



# GEF-6 REQUEST FOR PROJECT ENDORSEMENT/APPROVAL

PROJECT TYPE: Full-sized Project

TYPE OF TRUST FUND: GEF Trust Fund

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## PART I: PROJECT INFORMATION

Project Title: <b>Sustainable use of biomass to assist the development of Turkey's economy towards green growth</b>			
Country(ies):	Republic of Turkey	GEF Project ID: <sup>1</sup>	9218
GEF Agency(ies):	UNIDO	GEF Agency Project ID:	140325
Other Executing Partner(s):	Ministry of Food, Agriculture and Livestock (MoFAL/TAGEM); Ministry of Energy and Natural Resources (MoENR/YEGM)	Submission Date:	11/17/2017
		Resubmission:	12/11/2017 12/21/2017
GEF Focal Area (s):	Climate Change	Project Duration (Months)	60
Integrated Approach Pilot	IAP-Cities <input type="checkbox"/> IAP-Commodities <input type="checkbox"/> IAP-Food Security <input type="checkbox"/>	Corporate Program: SGP	<input type="checkbox"/>
Name of Parent Program	n/a	Agency Fee (\$)	419,540

### A. FOCAL AREA STRATEGY FRAMEWORK AND OTHER PROGRAM STRATEGIES<sup>2</sup>

Focal Area Objectives/Programs	Focal Area Outcomes	Trust Fund	(in \$)	
			GEF Project Financing	Co-financing
CC-1 / Program 1	Outcome A. Accelerated adoption of innovative technologies and management practices for GHG emission reduction and carbon sequestration	GEF TF	4,416,210	29,598,880
<b>Total project costs</b>			<b>4,416,210</b>	<b>29,598,880</b>

### B. PROJECT DESCRIPTION SUMMARY

Project Objective: Trigger sectoral transformation through application of modern bio-energy technologies to improve overall energetic performance, increase competitiveness and reduce greenhouse gas emissions in agro-industry						
Project Components	Financing Type <sup>3</sup>	Project Outcomes	Project Outputs	Trust Fund	(in \$)	
					GEF Project Financing	Confirmed Co-financing
1. Demonstration of modern bio-energy technologies and energy efficiency measures in the agro-industrial sector	TA	1.1 Modern bio-energy technologies demonstrated and ready for scale-up	1.1.1 Twenty business plans for sustainable supply chain management of agricultural residues prepared based on a call for applications and supported pre-assessment	GEF TF	800,000	5,000,000
	TA		1.1.2 Twenty-five feasibility studies for modern bio-energy technology applications with focus on process heat applications are prepared based on a call for projects and supported pre-			

<sup>1</sup> Project ID number remains the same as the assigned PIF number.

<sup>2</sup> When completing Table A, refer to the excerpts on [GEF 6 Results Frameworks for GETF, LDCF and SCCF](#) and [CBIT programming directions](#).

<sup>3</sup> Financing type can be either investment or technical assistance.

			assessment  1.1.3 Ten supply chain and twelve bio-energy technology projects made bankable and linked with existing financing instruments for an accelerated scale-up across agro-industrial subsectors			
	INV		1.1.4 Five sustainable bio-energy supply chains and five innovative and highly replicable technology applications with an estimated total capacity of 10 MW <sub>th</sub> are realized and monitored for economic and energetic performance	GEF TF	2,400,000	17,000,000
2. Refined policy and regulatory framework to enable transformation across sub-sectors	TA	2.1 Policy and regulatory environment is fine-tuned to enable scale-up of bio-energy plants	2.1.1 Sustainable crop management – Regulations concerning the use of agricultural resources  2.1.2 Policies and programs to integrate heat from biomass  2.1.3 Incentive programs and financing schemes for bio-energy promotion	GEF TF	350,000	2,750,000
3. Capacity base strengthened and awareness raising increased	TA	3.1 Capacities of key players strengthened and information made available to market enablers and major stakeholders	3.1.1 Awareness on biomass technologies increased through development of tailored knowledge products to facilitate technology transfer in the agro-industry  3.1.2 Capacity and knowledge of 50 decision makers in government and private sector are improved through 5 tailored workshops  3.1.3 Capacity building mechanism for O&M, technical and service roles is established to develop and retain skilled workforce for innovative bio-energy technologies in industry through training of 20 trainers and 550 engineers, technicians, governmental and financial stakeholders, in cooperation with technical	GEF TF	555,914	3,297,400

			partners through 15 workshops			
4. Monitoring and evaluation.	TA	4.1 Project's progress towards objectives continuously monitored and evaluated	4.1.1 A monitoring and evaluation plan will be prepared and carried out. 4.1.2 Technical performance of demonstration projects will be monitored and publicized	GEF TF	100,000	500,000
Subtotal					4,205,914	28,547,400
Project Management Cost (PMC) <sup>4</sup>				GEF TF	210,296	1,051,480
<b>Total Project Cost</b>					<b>4,416,210</b>	<b>29,598,880</b>

**C. CONFIRMED SOURCES OF [Co-financing](#) FOR THE PROJECT BY NAME AND BY TYPE**

Please include evidence for [co-financing](#) for the project with this form.

Sources of Co-financing	Name of Co-financier	Type of Cofinancing	Amount (\$)
National Government	Ministry of Food Agriculture and Livestock (MoFAL) /TAGEM	Grants	5,255,045
National Government	Ministry of Food Agriculture and Livestock (MoFAL) /TAGEM	In-kind	14,106,280
National Government	Ministry of Energy and Natural Resources (MoENR)	Grants	19,185
National Government	Ministry of Energy and Natural Resources (MoENR)	In-kind	38,370
Private Sector	Local Banks	Loans	10,000,000
GEF Agency	UNIDO	Grants	90,000
GEF Agency	UNIDO	In-kind	90,000
<b>Total Co-financing</b>			<b>29,598,880</b>

**D. TRUST FUND RESOURCES REQUESTED BY AGENCY(IES), COUNTRY(IES), FOCAL AREA AND THE PROGRAMMING OF FUNDS**

GEF Agency	Trust Fund	Country Name/Global	Focal Area	Programming of Funds	(in \$)		
					GEF Project Financing (a)	Agency Fee <sup>a)</sup> (b) <sup>2</sup>	Total (c)=a+b
UNIDO	GEF TF	Republic of Turkey	Climate Change	Program 1	4,416,210	419,540	4,835,750
<b>Total Grant Resources</b>					4,416,210	419,540	4,835,750

a ) Refer to the [Fee Policy for GEF Partner Agencies](#) (up to \$10 million = 9.5%)

<sup>4</sup> For GEF Project Financing up to \$2 million, PMC could be up to 10% of the subtotal; above \$2 million, PMC could be up to 5% of the subtotal. PMC should be charged proportionately to focal areas based on focal area project financing amount in Table D above.

## E. PROJECT'S TARGET CONTRIBUTIONS TO GLOBAL ENVIRONMENTAL BENEFITS<sup>5</sup>

Provide the expected project targets as appropriate.

Corporate Results	Replenishment Targets	Project Targets
1. Maintain globally significant biodiversity and the ecosystem goods and services that it provides to society	Improved management of landscapes and seascapes covering 300 million hectares	<i>hectares</i>
2. Sustainable land management in production systems (agriculture, rangelands, and forest landscapes)	120 million hectares under sustainable land management	<i>hectares</i>
3. Promotion of collective management of transboundary water systems and implementation of the full range of policy, legal, and institutional reforms and investments contributing to sustainable use and maintenance of ecosystem services	Water-food-ecosystems security and conjunctive management of surface and groundwater in at least 10 freshwater basins;	<i>Number of freshwater basins</i>
	20% of globally over-exploited fisheries (by volume) moved to more sustainable levels	<i>Percent of fisheries, by volume</i>
<b>4. Support to transformational shifts towards a low-emission and resilient development path</b>	<b>750 million tons of CO<sub>2e</sub> mitigated (include both direct and indirect)</b>	<b>4,280,000 metric tons (440,000 direct and 3,840,000 indirect)</b>
5. Increase in phase-out, disposal and reduction of releases of POPs, ODS, mercury and other chemicals of global concern	Disposal of 80,000 tons of POPs (PCB, obsolete pesticides)	<i>metric tons</i>
	Reduction of 1000 tons of Mercury	<i>metric tons</i>
	Phase-out of 303.44 tons of ODP (HCFC)	<i>ODP tons</i>
6. Enhance capacity of countries to implement MEAs (multilateral environmental agreements) and mainstream into national and sub-national policy, planning financial and legal frameworks	Development and sectoral planning frameworks integrate measurable targets drawn from the MEAs in at least 10 countries	<i>Number of Countries:</i>
	Functional environmental information systems are established to support decision-making in at least 10 countries	<i>Number of Countries:</i>

## F. DOES THE PROJECT INCLUDE A “non-grant” instrument? (Select)

(If non-grant instruments are used, provide an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF/CBIT Trust Fund) in Annex D

**NO**

<sup>5</sup> Update of the applicable indicators provided at PIF stage. Progress in programming against these targets for the projects per the *Corporate Results Framework* in the [GEF-6 Programming Directions](#), will be aggregated and reported during mid-term and at the conclusion of the replenishment period.

## PART II: PROJECT JUSTIFICATION

### A. DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN WITH THE ORIGINAL PIF

The key changes in alignment with the project design with the original PIF are explained below;

- **Project title change:** The title is changed from “Sustainable use of biomass to assist the development of Turkey’s economy towards a low-carbon development path” to “Sustainable use of biomass to assist the development of Turkey’s economy towards green growth”. The request came from MoD to adapt the terminology (‘green growth’) in line with the national policies stated in the 10<sup>th</sup> National Development Plan of government of Turkey.
- **Focus on solid biofuels:** PPG activities confirmed that the penetration of solid agricultural residue utilization for energy production in industry is very low compared to the other biomass applications (e.g. anaerobic digestion, landfill gas) in Turkey. Therefore the project prioritizes the collection and the use of solid agricultural residues over animal manure, sludge and other wastes.
- **Focus on thermal use of bioenergy:** The priority is given further to generation and the use of heat/cooling from bio-energy in industrial applications over the production of only-electricity along with improving relevant policies and regulations. Even though applications in the industry are usually designed as CHP, investors in Turkey mostly focus only on electricity production without considering the use of the waste heat, which is usually even the bigger part of produced energy. Since there are yet no major best-practice projects available in Turkey to showcase thermal applications of bioenergy or heat distribution infrastructure such as industrial heat networks. Also the current support mechanism does not include thermal energy production from renewable sources (biomass included).
- **Necessity of supply chain demonstration and policy improvement:** PPG activities showed that biomass supply chain is yet underdeveloped in the country and needs special focus to enable farmers and agricultural companies to build up a local biomass fuel market. It has also seen that biomass producers have lack of technical information concerning the biomass supply chain practices. Also there are no support mechanisms for supply chain investments in place. Therefore, demonstration of supply chain projects and relevant policy activities are included to project under Component 1 (to see related activities please refer to Output 1.1.1 and Output 1.1.3).
- **Increased demonstration plant capacity:** The capacity of 10 MW of demonstration plant is calculated as the outcome capacity (which was 2.3 MW in PIF) based on specific investment costs and capacity factors extracted from baseline projects, site visits and stakeholders consultation during PPG.
- **Deviations of GHG emission reduction values:** The reasoning for deviations of values stated in the PIF is due to not only increased capacity but also more detailed information on the type of demonstration projects and activities. In addition, the calculations of the now presented values have used as a basis not only investments in energy generation, but also the results of bio-energy supply chain developments and hence availability of more carbon neutral fuel on the Turkish market has been included. The effects of the supply-chain developments build up 60 % of the direct and 75 % of the indirect GHG emission reductions calculated, which most likely have not been included earlier at the PIF level (for detailed information please refer to section A.1.5. Global environmental benefits and Annex E).
- **Sustainable crop management:** The project will focus to secure the soil quality, hence the sustainability of crop production, through regulations, legal provisions, and recommendations available for Turkish farmers and agro-food SMEs (e.g. the amount of residues should be left in the field during the collection of the residues for energy utilization -for detailed information please refer to the section ‘2.1.1 Sustainable crop management – Regulations concerning the use of agricultural resources’).
- **Deviations of the budgets of Component 2 and Component 3:** The GEF financing amount of USD 150,000 is transferred from Component 2’s budget to Component 3’s budget.
  - o Reduced budget of Component 2: Upon consultation with national counterparts; some of the planned policy and strategy activities (such as legislation on low-carbon heat supply) were noticed to be already under implementation, therefore GEF financing budget of the Component 2 is reduced from USD 500,000 to USD 350,000.
  - o Increased budget of Component 3: Through discussions with TAGEM, the need of additional awareness raising and capacity building activities are foreseen (e.g. organizing at least 2 symposia) in order to achieve effective awareness raising on bioenergy technologies and also on sustainable crop management nationwide. To finance these activities, the GEF financing budget of the Component 2 is increased from USD 405,914 to USD 555,914.

The changes on the project outputs and project outcomes with the original PIF are shown side by side in the comparison table in the **Annex F**.

## A.1. Project Description

### A.1.1 The global environmental problems, root causes and barriers that need to be addressed

The world's population is expected to grow to almost 10 billion by 2050, boosting agricultural demand – in a scenario of modest economic growth – by some 50 percent compared to 2013. Income growth in low- and middle-income countries would hasten a dietary transition towards higher consumption of meat, fruits and vegetables, relative to that of cereals, requiring commensurate shifts in output and adding pressure on natural resources. Satisfying increased demands on agriculture with existing farming practices is likely to lead to more intense competition for natural resources, increased greenhouse gas emissions, and further deforestation and land degradation. Over the past 50 years, greenhouse gas (GHG) emissions resulting from 'Agriculture, Forestry and Other Land Use' (AFOLU) have nearly doubled, and projections suggest a further increase by 2050 (FAO, 2014)<sup>6</sup>.

Developing countries and emerging economies are increasing their energy consumption for their economic and industrial development. A carbon-intensive industrialization, as observed especially in economies with a large dependency on imported fossil fuels, presents a particular challenge in taking measures against climate change. Turkey's energy consumption has rapidly increased due to industrialization and economic development, urbanization and population increase. The impacts of climate change have been becoming more pronounced in recent years; in the country (for instance, severe drought during the summer of 2014, the floods in Istanbul in July 2017).

Turkey is responsible for 0.94% of total global GHG emissions. The reported GHG emissions increased from 208 million tons (Mt) CO<sub>2</sub>-eq in 1990 to 475.1 Mt CO<sub>2</sub>-eq in 2015<sup>7</sup>. This increase makes Turkey one of the top 20 emitters in the world. The country has one of the fastest growing economies, and globally ranks second in natural gas and electricity demand growth after China. Projections show that this demand growth trend will continue to rise<sup>8</sup>.

In overall 2015<sup>9</sup> emissions, the energy sector had the largest portion with 72 %, followed by the industrial processes and product use with 13 %, the agricultural activities with 12 % and the waste with 3.5 % (TUIK-Turkish Statistical Institute, 2016). Emissions from field burning of agricultural residues are estimated based on wheat, barley and maize, but do not include other residues such as sunflower, cotton, pruning residues and others. Their share in the total national emissions is less than 0.1 %.

It is critical for Turkey to activate its domestic energy potential in order to ensure its energy supply with respect to environmental sustainability, most notably its large unutilized bio-energy potential in the agriculture sector (56 million MWh). An increase of energy production from biomass sources will show how the trend of increasing GHG emissions can be reversed.

Despite a decrease in the relative share of the agriculture sector in the national economy, it still contributes more to the economy than any other industry through its raw material production and accompanying agro-processing industry – as can be seen from the table below.

**Table 1. Key indicators of Turkey (2002- most recent)<sup>10</sup>**

Key Indicators	2002			2011			2016 <sup>11</sup>		
	TURKEY	AGRI-CULTURE	Share of Agriculture (%)	TURKEY	AGRI-CULTURE	Share of Agriculture (%)	TURKEY	AGRI-CULTURE	Share of Agriculture (%)
Population (Million)	69.3	23.7	34.2	74.7	17.3	23.2	79.81	20.7	26
Employment (Million)	21.3	7.4	34.9	24.1	6.1	25.5	28.75	6	20.9
National Income (GDP) (Billion USD)	230.5	23.7	10.3	772.3	62.7	8.1	718	43.8	6.2

<sup>6</sup> <http://www.fao.org/3/a-i6583e.pdf>

<sup>7</sup> TURKSTAT (TUIK-Turkish Statistical Institute), 2016

<sup>8</sup> <http://climatescorecard.org/2016/08/30/turkey-emission-reduction-challenges/>

<sup>9</sup> Republic of Turkey Ministry of Environment and Urbanisation (MoEU)

<sup>10</sup> TURKSTAT; Ministry of Food, Agriculture and Livestock, 2013; World Bank; The Global Economy;

<sup>11</sup> Most recent data available

Income Per Capita (USD)	3,492	1,064	28.6	10,444	3,653	35.0	11,523	n/a	n/a
CO <sub>2</sub> emissions (t/cap)	3.2			4.4			6.07		

The key barriers to the development of bio-energy projects from agricultural residues and the proposed mitigation activities have been summarized in the table below.

**Table 2. Key barriers**

Primary barriers	Detail	Mitigation activities
<b>Policy and regulation barriers</b>		
<ul style="list-style-type: none"> <li>Lack of national bio-energy target:</li> </ul>	<p>The National Renewable Energy Action Plan (NREAP) 2014 mentions that bio-energy would contribute for reaching Turkey's national energy targets. The biomass energy installed capacity target mentioned in the Renewable Energy Action Plan is not yet included to the official documents. In addition, the targeted installed capacity of bio-energy refers to electricity only; no reference is made to heating and cooling applications.</p>	<p>The project will develop a strategic roadmap that will form the basis of a National Bio-energy Action Plan, to complement the objectives and targets defined for bio-energy within the NREAP 2014 and elaborate on the policy and regulatory environment to scale-up bio-energy technologies.</p>
<ul style="list-style-type: none"> <li>Lack of legal provisions/guidelines for sustainable agricultural land and crop management</li> </ul>	<p>Considering the sustainable agricultural practices, there are neither legal provisions nor recommendations available for Turkish farmers to observe in terms of soil quality and waste/residue management. Organic waste management practices are not strongly developed but could enhance the overall supply chain and allow that plant/crop residues are holistically addressed (e.g. for energetic purposes and as fertilizer). Guidelines for certain % of residues to remain in the fields can improve soil fertility, but provides a potential competition on energetic uses.</p>	<p>The Project will elaborate on the environmental policies and specifications, including revising the definition of biological wastes versus resources/residues (based on agricultural residues) and develop/update sustainability indicators and recommendations concerning the amount of residues that should be left on the fields.</p>
<b>Institutional &amp; capacity barriers</b>		
<ul style="list-style-type: none"> <li>Inadequate national capacity to explore biomass resources</li> </ul>	<p>Even though Turkey has vast resources of renewable energy and the national policies framework such as NREAP are in place, the promotion of bio-energy is not in the expected level yet. The renewable energy market is at developing stage and the comprehensive information on bioenergy technologies is moderately low especially in private sector.</p>	<p>This project aims to address these issues by capacity building of government as well as private sector stakeholders.</p>
<ul style="list-style-type: none"> <li>Limited awareness about modern bio-energy technologies</li> </ul>	<p>New technologies (e.g. cogeneration or tri-generation from biomass) and business models to engage in fuel preparation (e.g. briquettes, pellets) and energy plant operation are not fully available or not practiced so far.</p>	<p>Within component 3 of the project, the capacity of various stakeholders (incl. farmers) will be strengthened in regard to agricultural practices, technology and financial support mechanisms becoming available.</p>
<ul style="list-style-type: none"> <li>Lack of bio-energy applications in SME/industries</li> </ul>	<p>Potential assessment studies to evaluate the heating/cooling demand across different economic sectors are required.</p>	<p>The project will demonstrate various business cases that focus on building a bio-energy supply chain from agricultural residues and energy applications in</p>
<ul style="list-style-type: none"> <li>Limited demonstration</li> </ul>	<p>There are only few projects available in the</p>	



Primary barriers	Detail	Mitigation activities
examples and experience with bio-energy-to-heat/cooling	country to showcase thermal applications of biomass energy. Furthermore, there is limited notion in enterprises about multiple benefits that modern bio-energy applications provide.	various industrial sectors (heating, cooling and electricity production).
<b>Technological &amp; market barriers</b>		
o Lack of a modern biomass supply chain	Traditional farming methods are applied to large extent in Turkey. Due to the relatively small size of farms, the individual potential for farmers to become “energy farmers” is limited.	The project will explore business models and demonstrate the setup of fuel supply chains in regions that could be linked to energy users (e.g. industrial facilities), based on regional potentials of agricultural residues.
o Lack of technical experience and technology providers for bio-energy heating and cooling applications in SME/industry	Technical support services for the operation and maintenance of heating/cooling facilities using bio-energy are weak, which lead to poor design and inadequate performance of energy plants (e.g. in case of cogeneration facilities, only electricity is being utilized, not the waste heat component).	SME/industrial facility energy managers and local engineers will be capacitated and provided with awareness and trainings measures throughout the design and selection of demonstration projects and their implementation.
<b>Financial barriers</b>		
<b>For industry</b>		
o Long term collateral need	Industry is required to secure loans with collateral for the full tenure of the loan.	Outsourcing of supply of heat to an ESCO. Feasibility and advice to be developed under the project. Loan guarantee provided under a dedicated guarantee product.  (Due to the wide variety of possible project types targeted by the project, it is not yet clear if all biomass projects that need credit support will be eligible under the guarantee products currently provided by KGF (Credit Guarantee Fund). Therefore, within the scope of the project, applicability of these KGF guarantee products for the pilot project applications will need to be assessed. Depending on the outcome of this assessment the project might need to propose to the relevant governmental organizations, including KGF, to either: (i) adjust current guarantee products; or (ii) propose a separate dedicated guarantee product, so that these projects can be eligible.)
o Lack of solid long term supply contracts	It is very difficult for project sponsors to secure supply of biomass on long term basis, while this is a requirement for financing.	Develop standard contracts and market for biomass Promotion to supply biomass to the local industry and matchmaking activities
<b>For supply chain</b>		
o Creditworthiness of possible supply chain project sponsor	Possible supply chain project sponsors often have limited borrowing capacity	Loan guarantee provided under a dedicated guarantee product. Feasibility and advice to be developed under the

Primary barriers	Detail	Mitigation activities
(company or other organization)		project.
○ Offtake agreements	Project sponsor will need to show that offtake is secured, by providing offtake agreements for the biomass produced	Develop standard contracts and include measures for supporting a regional market for biomass

## A.1.2 The baseline scenario or any associated baseline projects

### A.1.2.1. Context / background information

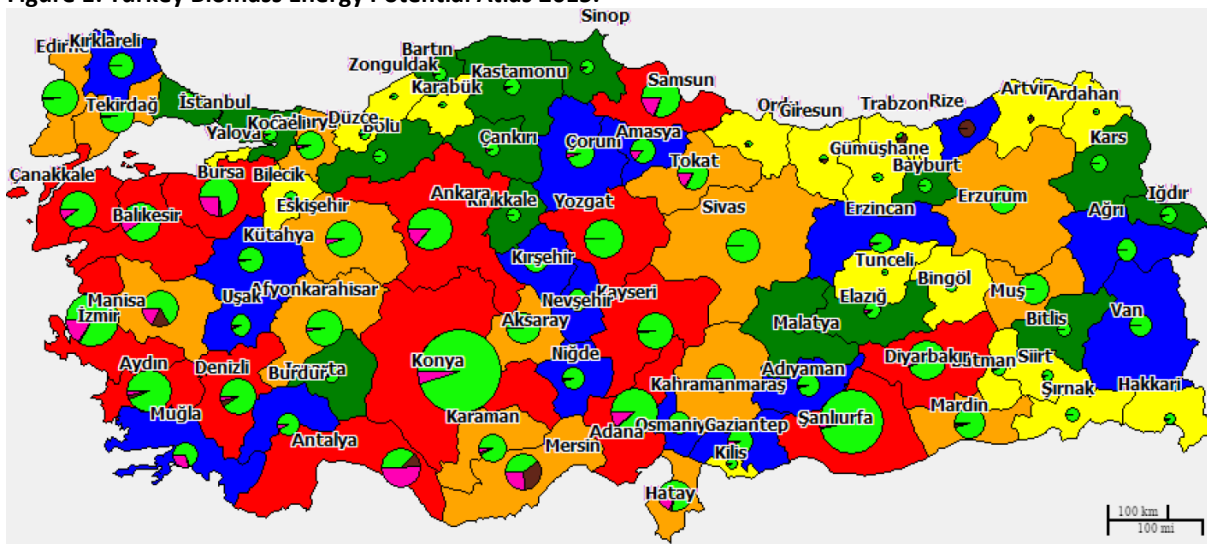
Turkey's energy consumption is increasing steadily over the past years and it relies heavily on fossil fuels to meet its domestic energy demand. The imports cover approximately 76 % of its primary energy sources. Fossil fuels make up approximately 89 % of the total primary energy supply. To decrease its dependency on imported coal, oil and natural gas, the country encourages electricity generation from renewable sources, which includes biomass (incl. landfill gas), hydropower, wind power, geothermal, and solar. More detailed analysis of the energy sector can be found in the Sixth National Communication of Turkey in 2016.

Turkey is the seventh largest agricultural producer in the world<sup>12</sup>. Given the size and diversity of agricultural production, a large amount of residues are generated by the agriculture sector. Therefore, the potential of using agricultural residues in a sustainable manner for energy generation purposes, apart from the existing uses (e.g. feedstock) is assumed to about 4 % of the total primary energy supply (56 out of 1,400 TWh in 2013).

#### TURKEY'S BIOMASS POTENTIAL

The main types of potential agricultural residues available for bio-energy production have been assessed within the PPG phase, including their geographical distribution, availability, current agricultural practices, residue collection costs and harvesting behaviors of farmers within Turkey. Figure 1 shows the Turkey Biomass Energy Potential Atlas presenting the amount of agricultural waste produced annually, divided into all 81 provinces for 2015.

Figure 1: Turkey Biomass Energy Potential Atlas 2015.<sup>13</sup>



The Turkey Biomass Energy Potential Atlas (Figure 1) divides the agricultural products into three categories:

1. vegetable plants (presented as green inside the pie charts of Figure 1)
2. products that can be collected from trees (hazelnut, citrus fruits etc. presented as brown inside the pie charts)
3. field crops (presented as pink color inside the pie charts) that require planting seeds (wheat, sunflowers etc.) and vegetables are excluded from this group.

The following table provides a summary of the assessment of the bio-energy potential from agricultural residues in Turkey. The data is based on TURKSTAT<sup>14</sup> information, and further the FAO/EBRD 2016<sup>15</sup> assessment, but has been refined during the PPG phase. The most critical variables used are "Residues-to-Crop Ratio" and "Availability for bioenergy". Since statistical data provide

<sup>12</sup> Evaluation of agricultural policy reforms in Turkey. OECD Publishing. (Available at: <http://dx.doi.org/10.1787/9789264113220-en>).

<sup>13</sup> Source: <http://bepa.yegm.gov.tr/>

<sup>14</sup> Turkish Statistical Institute (Government Agency): [http://www.turkstat.gov.tr/PreTablo.do?alt\\_id=1001](http://www.turkstat.gov.tr/PreTablo.do?alt_id=1001)

<sup>15</sup> I. Malsoglou, L. Rincon, A. Kojakovic, E. D. Yaylaci and M. Puri, "BEFS Assessment for Turkey," FAO - Food and Agriculture Organization of the United Nations, Rome, 2016.

only amounts of areas and total mass of crops harvested, the residues-to-crop-ratio transform the amount of crop into the mass of residues. This data is provided by FAO and was fit to national circumstances. The availability for bioenergy considers two main parameters: 1) current use of residues (e.g. other than energy), e.g. for fodder; and 2) limits for sustainable soil management, for which FAO recommends that at least 25 % of the residues should be left on the field to improve the soil.

Although the most produced crops are wheat and sugar beet in Turkey, their residues are almost not available at all as bio-energy feedstock.

**Table 3: Assessment of bio-energy potential from agricultural residues in Turkey<sup>16</sup>**

Crop	Residue	Production (average 2010-2014), t	Residue -to- Crop Ratio	Availability for bio-energy, %	Residues Quantity, t/y	Current use	Type	LHV, MW h/t	Energy, MWh
Wheat	straw	16,929,800	1.1	5%	931,139	fodder, bedding	spread	4.58	4,267,720
Sugar beet	tops	16,409,984		0%	0	fodder			
Mandarin	pruning	8,619,163	0.2	50%	751,817		spread	4.89	3,675,548
Barley	straw	6,657,800	1.1	5%	366,179	fodder, bedding	spread	4.86	1,780,037
Maize / Corn	stover/stalk	4,992,753	1.41	75%	5,279,836	fodder, bedding	spread	4.78	5,540,641
	cob	4,992,753	0.18	75%	674,022		spread	4.92	727,878
	husk	4,992,753	0.1	50%	249,638		collected	4.83	198,761
Cotton	stalk	2,330,013	7.18	25%	4,182,373		spread	5.03	21,028,044
	ginning residues	2,330,013	0.299	80%	557,339		collected	4.72	0
Olive	pruning	1,496,630	0.29	50%	220,627		spread	4.58	1,011,207
Sunflower	stalk	1,438,120	1.29	75%	1,391,381		spread	3.78	1,315,694
	head	1,438,120	1.17	75%	1,261,950		spread	4.03	1,269,165
Olive	kernel	1,239,200	0.5	100%	619,600		collected	4.64	595,327
Oranges	pruning	1,180,851	0.2	50%	118,843		spread	4.89	581,010
Grapefruit	pruning	894,293	0.1	50%	50,665		spread	4.89	247,695
Rice	straw	877,756	1	75%	658,317		spread	4.14	1,767,066
Apricots	shell/kernel	585,974		N/A				3.67	0
	pruning	585,974	0.19	50%	54,454		spread	5.36	291,935
Hazelnut	pruning	530,200	2.67	75%	1,061,363		spread	5.28	5,601,638
	husk	530,200	0.4	80%	169,664		collected	4.17	216,725
	shell	530,200	0.48	20%	50,899	furniture	collected	5.53	71,883
Lemons	pruning	475,159	0.2	50%	44,233		spread	4.89	216,248
Peach	pruning	360,263	2.5	50%	452,130		spread	5.39	2,436,478
Rye	straw	353,671	1.1	5%	19,452	fodder, bedding	spread	4.86	94,558
Oats	straw	215,737	1.1	0%	0	fodder, bedding	spread	4.83	0
Soybean	stalk	130,501	0.85	75%	83,194		spread	4.64	245,323
	straw	130,501	0.85	75%	83,194		spread	5.39	448,325
	husk	130,501	0.1	75%	9,788		spread	4.31	35,719
Groundnut	shell	111,883	0.33	30%	11,076		collected	5.76	0
	husk	111,883	0.33	30%	11,076		collected	5.17	29,796
Pistachio	shell	111,723	0.55	80%	49,158		collected	4.92	85,083
	pruning	111,723	4.88	50%	272,776		spread	5.28	1,439,651
Triticale	straw	108,424	1.1	0%	0	fodder, bedding	spread	0.00	0
Almonds	shell	72,597	0.43	100%	31,217		collected	4.72	17,349
	pruning	72,597	0.61	80%	35,443		spread	5.11	181,152
Tobacco	stalk	68,138	1.5	75%	76,655		spread	4.50	96,890

Collected residues (those residues that are either collected in the field after harvest or at the processing plant after the processing and packaging of the final product) that show larger availability include rice husks, hazelnut shells and olive kernels.

FAO/EBRD/TAGEM completed a biomass potential assessment in 2016 concluding that there are more than 3.5 million tons of

<sup>16</sup> TURKSTAT, FAO/EBRD 2016, PPG Consultants

collected residues available in the country per year. During the PPG these data have been refined (some residues collected turned out to be spread) and the potential is recalculated to 1.7 million tons, or 1.5 TWh.

Residues that are *spread in the fields* that show larger availability are cotton stalks, maize and sunflower residues but also clippings from the regular pruning of hazelnut, olive and citrus trees or wine yards. During PPG this data has been recalculated (based on the FAO/EBRD/TAGEM 2016 data) resulting to 18 million tons of available biomass that would lead to 54 TWh of energy per year in Turkey. Şanlıurfa (Southeast Anatolia Region), Adana (Mediterranean Region), Aydın (Aegean Region), Hatay (Mediterranean Region), Samsun and Giresun (Black Sea) provinces have the largest amount of spread residues, with cotton and maize stalk and hazelnut pruning having the largest shares in total.

Hence the total quantity of residues that are spread in the field is considerably larger than the collected residues in Turkey as a whole, and the overall energetic potential amounts to approximately 55.5 TWh.

The agricultural residues of the key sectors listed below are prioritized by TAGEM due to their high energy potentials and availability for sustainable collection for bioenergy utilization:

- **Cotton**
- **Hazelnut**
- **Rice**
- **Sunflower**

Even though these 4 sectors are chosen to be main focus for the project, other feedstocks which have energy potential and availability would be evaluated as well during the project.

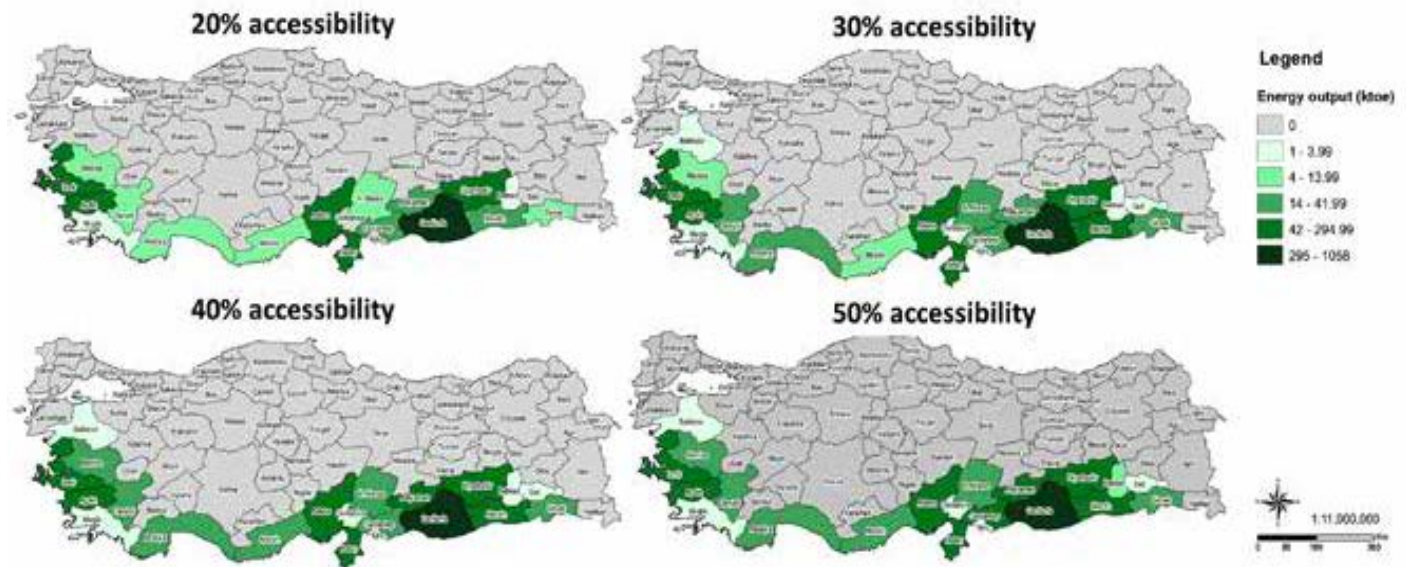
The chosen main sectors are explained further in the respective subsections below.

### Cotton

As an important world cotton grower, Turkey ranked seventh in the world production of cotton with around 738,000 tons in 2015/16 term. The most important regions for cotton are the southern provinces of the country such as Southeast Anatolia, Aegean, Çukurova and Mediterranean.

According to FAO/EBRD<sup>17</sup>, the production average (2010-2014) was 2.3 million tons on a harvested area of 485,755 ha.

**Figure 2: Total national potential energy output (ktoe) from cotton stalk at different accessibility levels (Source: FAO/EBRD<sup>18</sup>)**



<sup>17</sup> I. Malsoglou, L. Rincon, A. Kojakovic, E. D. Yaylaci and M. Puri, "BEFS Assessment for Turkey," FAO - Food and Agriculture Organization of the United Nations, Rome, 2016.

<sup>18</sup> I. Malsoglou, L. Rincon, A. Kojakovic, E. D. Yaylaci and M. Puri, "BEFS Assessment for Turkey," FAO - Food and Agriculture Organization of the United Nations, Rome, 2016.

After years of reduction, for the marketing year 2016 USDA<sup>19</sup> projected Turkish cotton area and production to increase about 15 % accordingly; further planting area was expected to be 425,000 hectares and production is forecast at 650,000 tons. In 2004, Turkish researchers<sup>20</sup> estimated the maximum amount of cotton stalks available in Turkey to be 4.41 million tons annually, and that a net energy of 39,028 MJ/ha (10.84 kWh/ha) may be produced from a cotton field every year. FAO/EBRD<sup>11</sup> estimated that the total energy available from cotton stalk is 25.7 million MWh per year. Critical is the rate of accessibility for residues: if 20 % of cotton stalk were to be accessed, this would result in producing 1,033 ktce (12 TWh) of energy.

### Cotton processing

**Figure 3: Bundles (left) and heaps (right) of cotton stalk** <sup>21, 22</sup>



Following machine harvesting (90 %) or hand harvesting (10 %) in September-October, the cotton stalks are usually left in the fields. Some of these straws are picked by agricultural workers living in the South East Anatolia to be further used as fuel. A majority of the stalks are chopped into pieces on the field before the following cropping season (in April to March). The completion of chopping of residues until 31<sup>st</sup> March is legally mandatory<sup>23</sup> to prevent spread of pest (caterpillars, larva). Farmers usually mix the chopped residues with the soil or burn it on the field.

Farms in Adana use the same machine for chopping of cotton residues as for corn, sunflower – so no new machines have been bought. The cost of chopping is about 20 TL<sup>24</sup>/da (which roughly equals to 18 TL (cost of 4 liters of diesel/da) plus 3-4 TL/labor). Burning of residues on the field is in general forbidden but depending on the area, some do it at night, or it is the general practice (as in Adana, where the fields need to be prepared quickly for the second season).

The Turkish grower typically sells seed cotton to either the cooperative gin or a private ginner for further processing (ginning = separation of fibers and seeds, and carding process). There are about 15 ginning factories in Turkey but also some other 127 cotton processing companies in Adana region alone. Private sector ginners typically act alone in that they are independent firms with no umbrella organization. The cooperative gin, in contrast, is acting as a part of a larger organization, and typically has access to substantial financial resources. Livestock farmers use the residues from cottonseed oil production as fodder. Ginning and carding residues could be used for briquetting or direct combustion.

Current constraints in using cotton stalks:

- Bulky material
- Collection and transportation
- Absence of supply chain mechanisms
- very small number of techno economic feasibility reports
- almost no practical country experience
- Lack of awareness

<sup>19</sup> United States Department of Agriculture, "Turkey: Cotton and Products Annual," USDA - Foreign Agricultural Service, 28 March 2016. [Online]. Available: <https://www.fas.usda.gov/data/turkey-cotton-and-products-annual-0>. [Accessed 24 04 2017].

<sup>20</sup> C. R. Akdeniz, M. Acaroglu and A. Hepbasli, "Cotton Stalk as a Potential Energy Source," *Energy Sources*, p. 26:65–75, 2004.

<sup>21</sup> Allplan, CAIConsulting, "Osh District Heating Project Feasibility Study," EBRD, 2016.

<sup>22</sup> Zhengzhou Azeus Machinery Co.,Ltd, "How to make cotton stalk pellets," [Online]. Available: <http://www.biopelletmachine.com/biopellets-making-guidance/how-to-make-cotton-stalk-pellets.html>. [Accessed 20 03 2017].

<sup>23</sup> Official Gazette of the Republic of Turkey 05.08.2003, Regulation Number 25190, Article 11

<sup>24</sup> 20 Turkish Liras (TL) is equivalent of 5.60 USD (1 USD ≈ 3.5 TL)

Cotton stalks have a higher content of alkali, which results in a lower melting temperature of its ashes. This results in the same problems as with the straw: higher temperatures above 800°C result in slag deposits in the boilers. Slag deposits at the heat exchanger act as a kind of insulation and lower its efficiency. The lignin content is high enough to gain solid and durable briquettes. The macromolecule lignin has an effect like glue and keeps the particles in the pressed briquettes together.

### Hazelnut

Hazelnut is the principal nut in Turkey with an average annual production of around 550,000 tons. Hazelnut production was 646,000 tons in harvesting year 2015-2016 (TUIK, Turkish Statistical Institute, 2016). Turkey is the most important nut exporter with 72.2 % in the world in 2013. In 2014, it held 68 % of the global hazelnut market (Hazelnut Report, Chamber of Agricultural Engineers, 2016).

**Figure 4: Hazelnuts in different states: Ripe with dried leaves, opened with broken shells, and dried** <sup>25</sup>



Hazelnut is not only one of the most important export crop of Turkey, but also the main economic activity of nearly 400,000 households under the form of family farming in the Black Sea Region. Hazelnut production is the single income source of 61 % of the families in the Black Sea Region. Monoculture is a dominant character in hazelnut and tea production activities. These aspects of hazelnut production, which fall within the framework of multi-functionality, are seen as being the key factors in maintaining social, economic and environmental sustainability in the rural parts of the region, as well as urban areas due to the employment and trade benefits created by hazelnut processing industry. The hazelnut economy directly and indirectly supports 4 million people.

**Figure 5: Hazelnut growing regions in Turkey** <sup>26</sup>



The production volume follows a cyclical pattern with production peaking every second year. Over the last 10 years, it has remained above 500,000 tons, except in 2011 and 2014 when it dropped to 430,000 and 412,000 tons, respectively, due to adverse weather conditions. Production is mainly located along the Black Sea coast, with the plantation area being around 712,000 ha. The annual yields vary from 700 to 800 kg/ha, depending on the slope and therefore density as well as the age of plantations. Ordu, Sakarya and Giresun have more trees than other provinces and were the major contributors to the country level production.

<sup>25</sup> Source: Simon A. Eugster/ Wikipedia

<sup>26</sup> M. P. Louis Werner, "The Hazelnuts of Trabzon," *Aramco World*, Sept/Oct 2014. [Online]. Available: <http://archive.aramcoworld.com/issue/201405/the.hazelnuts.of.trabzon.htm>. [Accessed 04 2017].

## Hazelnut processing

Hazelnut farming and processing leads to the following main residues:

- husks (green leaves directly covering the nuts)
- clippings of branches and twigs during regular pruning
- shells (separation of the hard shell enclosing the nut)

Turkish hazelnut generally grows ripe between the beginning and the end of August, depending on the altitude of the field. Timely harvest is done by picking up the hazelnuts with leaves that fall to ground when the branches are shaken off. Another method of harvesting is where the hazelnuts are picked one by one from the branches.

After being collected from the fields, hazelnuts are blended on the same day or a few days later depending on the field status and laid to be pre-dried under the sun until their leaves turn a crisp brown. After drying, hazelnuts are separated from their leaves using harvesting machines (vacuum-fed threshers) and laid over canopies in thin layers to be dried under the sun (average 15-20 days).

**Figure 6: Vacuum-fed thresher separates the leaves (husks) from the nuts** <sup>27</sup>



Dried nuts and the removed leaves are separately packed and removed from the fields. While the nuts are sold at an average of 10,000-12,000 TL/ton (approx. 2,700 USD/ton) and transported to the nut processing factories, the dried leaves are used by farmers as fuel in their homes or bedding material for animal farms. Dried leaves and other biomass from pruning (e.g. branches or twigs) do not have a market value so far. The calorific value of dried leaves of hazelnut is 4226 kcal/kg (Source: Black Sea Energy Research Center).

The major step in hazelnut processing is breaking and separating the shells. Currently, there are about 180 breaking plants with an internal capacity of 1.8 million tons per annum and about 40 processing plants with an internal capacity of 350,000 tons per annum in Turkey. The market price (depending on the harvest and world market price) of processed hazelnuts is about 80,000-90,000 TL/ton (22,000-24,000 USD/ton).

Shells are currently used as fuel source in different large scale and smaller applications in industry (co-firing), homes (fuel replacing other wood biomass or coal), even one apartment block in Ordu (7 flats, 28 houses) is being fueled with a central heating system 100 % based on hazelnut shells (previously used coal). The market price of hazelnut shells is about 250 TL/ton (up to 70 USD/ton). Further they are used as raw material for fiber and composite boards and further furniture.

<sup>27</sup> M. P. Louis Werner, "The Hazelnuts of Trabzon," *Aramco World*, Sept/Oct 2014. [Online]. Available: <http://archive.aramcoworld.com/issue/201405/the.hazelnuts.of.trabzon.htm>. [Accessed in April.2017].



**Figure 7: Example of hazelnut pruning residues (hazelnut farms in Italy)<sup>28</sup>**

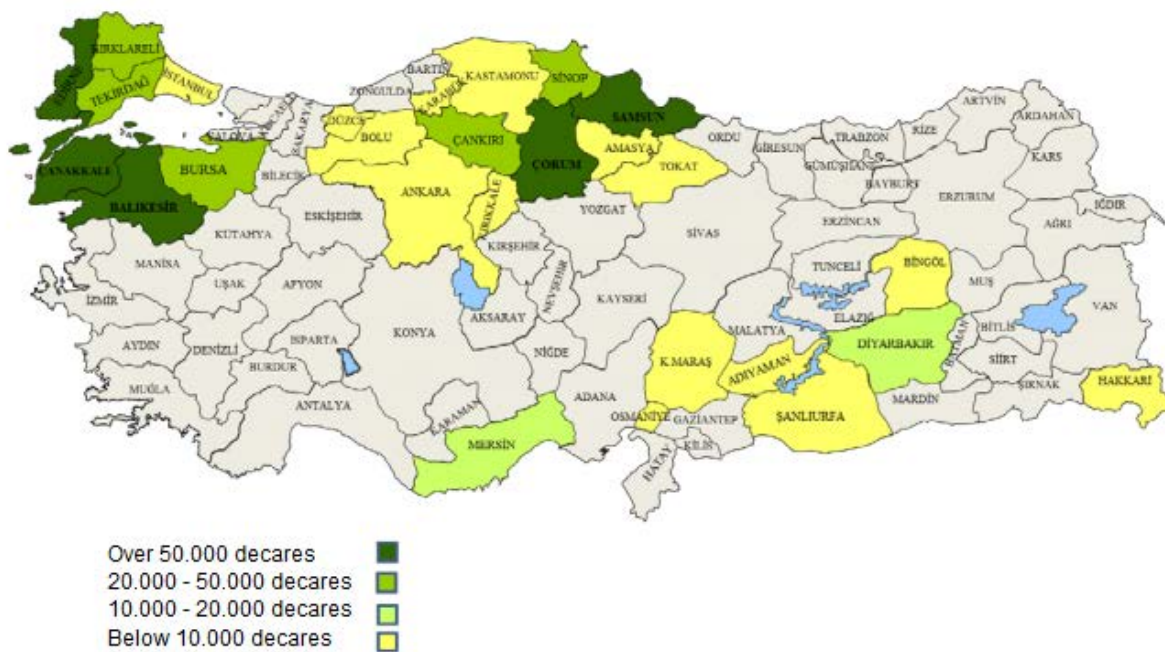


Much more relevant than husks in terms of residues are the pruning residues. Studies in Italy on the specific yield of pruning showed values of 1.67 kg/plant, equal to 446 kg/ha, up to 1950 kg/ha for the biomass harvested, which lead to the average value of biomass at 900 kg/ha. According to Ozturk<sup>29</sup> the residue to crop ratio for actual available pruning residues is 2.67 kg/kg Hazelnuts, which would lead to ~1500 kg/ha of residues.

### Rice

Rice production in Turkey has risen sharply since the mid-1990s and rice is now the fifth most widely grown cereal, behind wheat, barley, maize, and rye. The country now meets more than 90 % of its domestic demand for rice. With roughly 100,000 ha the area of rice grown is less than 1/60 of that for wheat; thus, rice is still not a major crop in. Meanwhile, rice yield has followed a generally upward trajectory, from 3.4 t/ha in 1962 to about 7.5 t/ha (including rice husk). This gives Turkey the third-highest average rice yield in the world (behind Australia and Egypt). In 2016, some 920,000 t of paddy were produced from 116,056 ha - an average yield of 7.93 t/ha (Turkey Wheat Report, TMO (GD Soil Crops Office), 2017). All of Turkey's regions produce rice, but the western and northern regions of Marmara and Black Sea, which have the best climate and water availability, account for over 92 % of total area and production.

**Figure 8: Paddy Production Area in Turkey<sup>30</sup>**



<sup>28</sup> M. De Franchi and K. Boubaker, "Valorization of Hazelnut Biomass Framework in Turkey: Support and Model Guidelines from the Italian Experience in the Field of Renewable energy," in *International Journal of Sustainable Energy and Environmental Research*, 2014.

<sup>29</sup> H. Ozturk, "Utilization of Agricultural Residues for Bioenergy in Turkey," in *Cereals straw and agricultural residues for bioenergy in New Member States and Candidate Countries*, 2014.

<sup>30</sup> TMO (2016)

### *Rice processing*

The rice harvesting is conducted usually in October with harvesting machines. Rice has a 30-35 cm stalk whereof approx. 10 cm of stalk remain on the field and are often burnt. Average rice yield (with husk) in Turkey is around 7.50 t/ha while stalk yield is 3.50 t (100 bales)/ha. The harvested product is sent to the rice factories. The de-husking process is done in the factory.

**Figure 9: Close up of rice husks**



The poultry sector purchases the husks (average price 35-40 USD/t) for further use as a poultry litter. After their use in the poultry sector, the husk and the poultry manure are used as fertilizers; some are used in biogas plants or are disposed as wastes. Rice straw is sometimes collected in bales that may cost 50 USD/t or more.

For bio-energy use, the rice straw/stalk left on the field after harvest would be directly available, as it has no current use. The yearly potential of 660,000 t/y has the energy content of 1.7 million MWh/y.

### **Sunflower**

The Government of Turkey has supported the production of edible oils since more than 10 years, hence production from oil plants increased steadily in the recent years. In 2016 the financial support was in the range of 400 TL/ton (110 USD) for sunflower to 750 TL/ton (210 USD) for cotton. Share of production is in the range of 40 % for sunflower, 16 % olive, 35 % cotton, 6 % soy and 4 % canola, 2 % safflower and others. Sunflower oil production was 500,000 tons in 2006, and 875,000 tons in 2013, 1.250,000 tons in 2016. In 2012 Turkish sunflower oil seeds farmers produced about 1.2 million tons of seeds that delivered 0.7 million tons of crude oil. According to FAO/EBRD the average for 2010-2014 was 1.44 million tons on 633,478 ha area. Accordingly, the residues quantity is 1.85 million tons per year, leading to 2.58 million MWh of energy content.

The most relevant regions are Trakya (350 ha), Central Anatolia (170 ha), Black Sea (75 ha) and Çukurova (75 ha). The most important provinces are Tekirdağ (93 ha), Edirne (78 ha), Konya (67 ha), Kirklareli (59 ha) and Adana (34 ha) [20].

### *Sunflower processing*

Machine harvesting is conducted in August-September. While FAO/EBRD [9] refers to the sunflower heads (buds) as *collected*, the actual feedback by farmers is that the heads/buds are spread in the field. During harvesting with combine harvesters the sunflower heads/buds and straw are crushed by the internal straw chopper and scattered on the fields. Farmers in Tekirdağ value the chopped residues as soil improvement by keeping the organic material and nutrients. Farmers during interviews mentioned that 3 tons of animal fertilizer per decare (1000 m<sup>2</sup>) (at a cost of 100 TL (25 USD)) provide the same fertilizer as the biomass of sunflowers left in the field. Farmers around Bursa also leave the stalks on the field, and chop and mix them with the soil. Contrary to the farmers in Tekirdağ, they do this only to get rid of the stalks; the reason could be that they have irrigation in the region. The residues from the oil production (pomace) are used as animal feed.

### As a result

The amount of untapped agricultural biomass potential available in Turkey is enormous and these sectors of cotton, hazelnut, rice, and sunflower are assessed as the 4 key focus sectors of the project, the alternative sectors includes olive, fruit and vegetable pruning, maize and other crops.

### **LEGAL STRUCTURE FOR RENEWABLES IN TURKEY**

Turkey's current national energy regulation is articulated in the following laws with secondary regulations for renewable energy:

- New Electricity Market Law (Law No. 6446, 2013)
- The Law on the Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy (Law No: 5346, 2005)
- Law Amending the Law on the Utilization of Renewable Energy Resources in Electricity Generation (Law No: 6094, 2011)

- Energy Efficiency Law (Law No: 5627, 2007)
- Environmental Law (Law No: 2872, 1983))

Law 6446 introduces some important changes in the current electricity market system, including amendments to license types, framing its provisions around each type of market activity, specific provisions for certain license types (generation, transmission, distribution, wholesale, retail, auto-producer and auto-producer group), the introduction of a preliminary licensing mechanism and investment incentives, such as extended deadlines and grace periods for environmental compliance. In reference to the renewable energy sector, it establishes:

- The maximum installed capacity for a renewable energy plant to operate without a license has been raised from 500 kW to 1 MW, with the ease of increasing it up to 2 times (5 MW) by a decree of the Council of Ministers without a change in the Law. Furthermore, with the new Law, there is no limit for renewable energy facilities that serve for self-consumption without feeding into the grid.
- Renewable generation facilities that extend over more than one premise can be considered one single generation entity if they are connected to the system from the same point.
- The Law reasserts the exemptions and discounts in land use rights as described in the Renewable Energy Law.
- The pre-licensing step is defined in the licensing process and all M&A activities at this stage are restricted.
- For wind and solar power plants that would compete for the grid access rights, the tendering process has been modified to reduce the 20 years payment period of contribution fees to the Transmission System Operator to 3 years. The contribution fee that was paid according to generated kWh was modified to be paid for unit installed capacity (per MW).

The Act on Incentivizing project-Based Investments and Amending Certain Acts and Decrees was published in the Official Gazette. This Act, also known as the omnibus bill, lays down regulations and amendments on several domains. By virtue of this Act, an Article has also been added to the Electricity Market Act no. 6446. Article 2 (20) of the Electricity Market Act has accordingly been reorganized (7 September 2016, 29824).

The amendment in the Act tasks the Turkish Electricity Transmission Corporation (TEIAS) with the development of capacity mechanisms in granting a priority to local resources. Article 75 of the Omnibus Bill reads as:

*ARTICLE 75 – Article 20 (2) of the Electricity Market Act dated 14.3.2013 and no. 6446 has been amended as:*

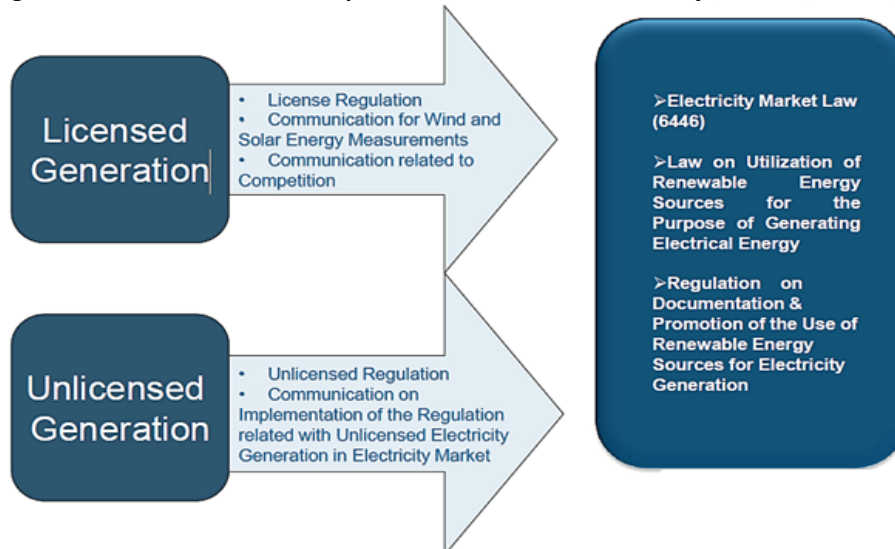
*“Capacity mechanisms prioritizing local resources shall be created with a view to maintain the reliable installed power capacity for the creation of adequate installed power capacity and/or ensuring the reliability of the system, including the reserve capacity required for the supply security. The payments to be made by TEIAS within the context of these mechanisms shall be considered while calculating the transmission tariff. Rules and procedures regarding the creation of capacity mechanisms shall be laid down by the Authority after receiving the relevant view of the Ministry”.*

The Law 6094 introduces significant amendments to improve the incentive mechanism under the Renewable Energy Law and encourage renewable energy investment opportunities. According to the Law 6094,

- Each supplier who sells electrical energy to consumers has an obligation to pay a renewable energy fee proportional to the amount of electricity that the supplier has sold to its consumers divided by the total electric energy that all suppliers have sold to all consumers in the country. In other words, they are indirectly obliged to purchase electricity that is generated from renewable resources.
- A new feed-in tariff plan, categorizing the different levels of feed-in tariff for different technologies is introduced. In addition, the local equipment bonus is to be added to the feed-in tariff plan.
- The scope of time for the support mechanism of 5-years is extended for facilities that are commissioned before the December 31, 2020 by a Board Decision in 2013. Feed-in tariffs are based on the USD (United States Dollar) and not subject to any escalation.
- Land Usage Fee Incentives: Until 2020, a discount of 85% for permission, lease, easement rights and servitude right fees for generation facilities based on renewable energy resources will be applicable for the first 10 years, including the period of investment and operation.

According to regulations, project development procedures for licensed or unlicensed projects are as follows.

**Figure 10: Procedures to Develop Licensed or Unlicensed RE Projects**<sup>31</sup>



The new era, which will affect the Renewable Energy production very much, has already initiated with a new regulation issued in Official Gazette No. 29662, by March 23, 2016 about unlicensed production of electricity.

It also gives opportunities to cooperatives and associations to play a role in energy production by removing the requirement of the common port necessity. The production in MWh will be directly proportional to the number of partners, 7-100 partnerships will be allowed to produce up to 1 MW, 100-500 partner cooperatives will be allowed up to 2 MW, 500 to 1000 partner cooperatives will be allowed to build up to 3 MW installed power. Cooperatives with more than 1000 partners will be allowed to build up to 5 MW.

**Incentives:**

There are various incentive schemes existing to support RE in Turkey.

**Feed In Tariff (FIT):**

In recent years the Renewable Energy Resources Support Mechanism (YEKDEM) gives the choice between direct marketing and resource- and technology-specific feed-in tariffs (with local content) under the Law Amending the Utilization of RES in Electricity Generation (Law No. 6094). Thus renewable electricity production is mainly promoted through a guaranteed feed-in tariff mechanism between 7.3 – 13.3 USD Cent per kWh for the first 10 years of operation.

Before Law No: 6094, the feed-in tariff was 5 – 5.5 €/kWh for all renewable energies (Law No: 5346) which was insufficient to achieve targets. Increased FITs included as part of 2010 law to provide more comprehensive RE support mechanism. Now FITs are differentiated on a source basis for instance FIT for wind energy and hydropower is 7.3 USD Cent /kWh and for solar and biomass is 13.3 USD Cent/kWh. Detailed information can be found in the Figure 11 below. Additional FIT is provided for using local content for 5 years for plants to be commissioned by December 2020 and also incentive tariffs apply for the first ten years of commercial operation of plants commissioned by December 2020. Subsequent FIT levels are established by the Cabinet of Ministers.

<sup>31</sup> MENR

Figure 12: Feed-in Tariffs & Premiums<sup>32</sup>

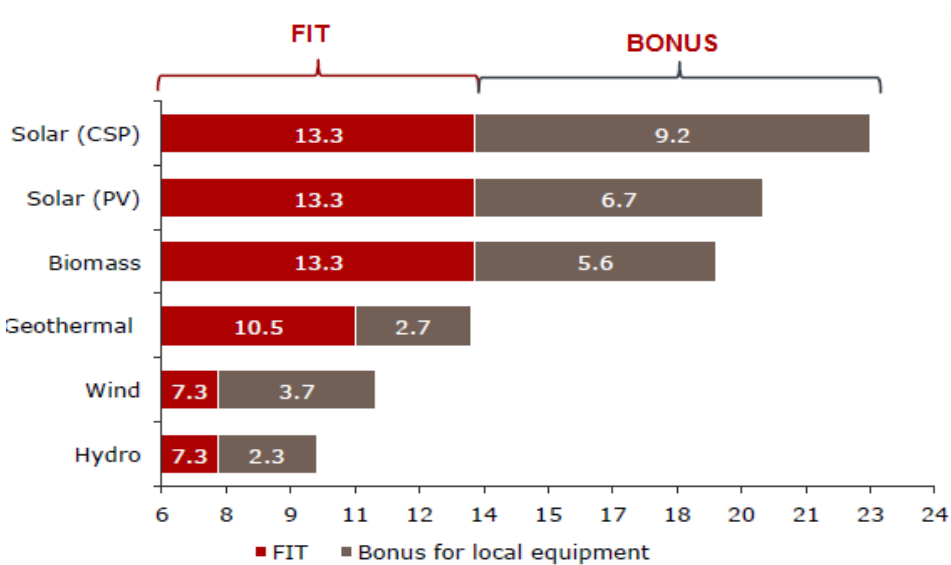


Table 4: FIT Schedule II for the local equipment bonus<sup>33</sup>

Schedule II (Provision of the law dated 29/12/2010 and numbered 6094)		
Type of Facility	Domestic Production	Domestic Contribution (US Dollar cent/kWh)
E- Biomass power based production facility	1- Fluid bed steam tank	0,8
	2- Liquid or gas fuel steam tank	0,4
	3- Gasification and gas cleaning group	0,6
	4- Steam or gas turbine	2,0
	5- Internal combustion engine or Stirling engine	0,9
	6- Generator and power electronics	0,5
	7- Cogeneration system	0,4

**Other Incentives:**

- Incentives within the Renewable Energy Law (5346)
  - Assigning land belonging to the Treasury and “land at the disposal of state” to renewable energy projects. 85 % discount in easement, usufruct, permit or lease fees for the first 10 years of operation.
  - Use of national parks, nature parks, natural protection areas, preservation forests, wildlife cultivation areas and special nature preservation areas with necessary permits
- Exemption from the compulsory 1 % turnover payment for operating business on immovable assets of the Treasury
- Incentive within the Electricity Market Licensing (24836)
  - 99% exemption from license fees for the first 8 years of operation
  - Priority in system connection
- Tax Incentives within the Cabinet Decree on State Aid Investment (No.2009/15199)
  - VAT exemption for domestic equipment for investment support certificate holders
  - VAT, Customs Tax, Resource Support Utilization Fund payment exemptions in imports for Investments in imports for Investment Support Certificate holders
- Payment of only 10% of the total licensing fee

<sup>32</sup> Source: Law on Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy; <http://www.emra.org.tr/en/documents/electricitymarket/Legislation>

<sup>33</sup> Law on Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy; <http://www.emra.org.tr/en/documents/electricitymarket/Legislation> - accessed on: 18.07.2017

- Exemption from being a balancing mechanism unit
- Purchasing option from the market up to 100% of the quantity inserted in the relevant license

Despite of this attractive support mechanism, there are still challenges in the policy level for the investors during licensing and grid integration of renewable energy at the transmission and distribution levels. Additionally, the processes of system operation management and network rules and location planning/permitting are lengthy.<sup>34</sup>

## FINANCING BIOMASS PROJECTS

Turkey's renewable energy market has been expanding and developing since the Renewable Energy Law was enacted in 2005, which marked a huge step towards meeting the country's growing demand for energy. Since then, a series of new regulations have demonstrated Turkish interest in making its renewable energy market a priority in the national energy agenda. The biomass sector in Turkey presents opportunities to generate heat and electricity from agricultural waste. Although these opportunities appear attractive, there remains a lot of uncertainty around feedstock in terms of costs, supply and aggregation, technology and off-take contracts. This limits and often restricts the financing potential for these projects.

Turkish banks have historically been reluctant to offer renewable energy financing product lines, since banks typically had limited internal capacity to properly assess, develop, and market financing instruments for these types of investments. However, since 2009, the government of Turkey together with a number of development banks and organizations collaborated to mobilize significant amount of private sector funds for the purposes of reducing GHG emissions while driving sustainable economic growth in Turkey. As part of this effort, the European Bank for Reconstruction and Development (EBRD) extended dedicated credit lines to a number of local banks dedicated for on lending to renewable energy investments, for example the Turkey Private Sector Sustainable Energy Finance Facility or TurSEFF<sup>35</sup>. The local banks use these credit lines to provide commercial loans, at their own risk, to borrowers with eligible investment opportunities, which include bio-energy projects.

**Debt finance** - Many of the financial products available to project sponsors for financing renewable energy investments in Turkey are accessed on a voluntary basis provided they are able to meet collateral and liquidity requirements of the lenders. In Turkey, lenders have the loan securitized with collateral that typically covers 150% or more of the loan amount which provides the lenders recourse to the assets of the company. Although this structure is widely applied and relatively easy to structure, it is also very restrictive. Not all companies have sufficient value (collateral) available to carry such guarantee, or are unwilling to restrict the company's finances (collateral can only be used once). Therefore, although corporate finance is relatively straightforward, it does not unlock the potential.

An alternative is project finance. With this method of funding, the lender primarily looks to the revenues generated by the project, both as the source of repayment and as security for the exposure. Risk can then be shared and therefore extends debt capacity. In Turkey project finance is typically only applied once the renewable energy project has proven that it is able to generate a steady income stream. The construction period and first years of generation is sufficient for wind-power, solar-power or hydro-power projects to secure refinancing based on project finance basis (and thereby releasing the locked collateral). However, due to on-going risk to source sufficient biomass (competition and weather situations might easily limit the availability), banks require on going collateral to secure their loan.

**Credit Guarantee** - Government credit guarantees could be used to help fund biomass projects by lowering the demand for collateral. Such a dedicated facility could provide guarantees on loans to borrowers by covering a share of the default risk of the loan. In case of default by the borrower, the lender recovers the value of the guarantee. Dedicated guarantee facilities are used around the world to support biomass to energy projects. For example, the United States Department of Agriculture provides business and industry loan guarantees, which can be used to finance biomass projects<sup>36</sup>. Under this program a farmer or producer can attract financing using a guarantee that covers 60 per cent to 85 per cent of the loan amount depending on the size of the loan.

In Turkey, the KGF<sup>37</sup> with support from the Turkish Treasury provides guarantees to SMEs. This guarantee is provided to certain Turkish financial institutions and covers borrowers default. The typical guarantee is limited to SMEs, up to a loan amount of 2.5

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<sup>34</sup> IEA Fatih Birol

<sup>35</sup> <http://www.turseff.org/>

<sup>36</sup> <https://www.rd.usda.gov/programs-services/business-industry-loan-guarantees>

<sup>37</sup> <http://www.kgf.com.tr/index.php/en/>

million TL ( $\approx$ USD 715,000) and 80% of the credit risk. 24,600 SMEs utilize the program between 1994 and 2015 to access more than USD 4.72 billion in bank loans with guarantees for USD 3.42 billion<sup>38</sup>

**Energy Service Companies** - Outsourcing the supply of heat and energy to Energy Service Companies (ESCOs) could in theory also be a solution to address the high need for collateral. In this case the ESCO would provide energy solution projects on energy performance-based contracts (EPCs). For example: taking over the supply of heat to the plant and replacing the old system with a new energy generating system on biomass. The ESCO guarantees performance (i.e. delivery of heat). Their remuneration is directly linked to - and lower than - the cost of energy of the old system. The ESCO assumes the technical and performance risks associated with the project, while securing the needed financing themselves. If the ESCO is not able to generate heat cheaper than before, the ESCO runs at a loss.

In many developing countries, ESCOs undertake more traditional fixed-fee energy solution contracts. These contracts do not include guarantees, arranging finance, undertaking monitoring or performance-based remuneration element. These companies are technically not ESCOs, although they are still referred to as ESCOs leading to much confusion. This is also the case with Turkish ESCOs or EVDs as they are called in Turkey. According to the ESCO Association of Turkey, there are a few EVDs operating in Turkey, many with side businesses other than providing ESCO services. There are few if any ESCOs with industrial clients given the difficulties and variances in determining industrial SME energy demand baselines. Most of these EVDs do not have sufficient experience to act as a full ESCO that would include finance measures and executing energy performance contracts. It is also true that nearly all EVDs do not have collateral and thus have limited borrowing capacity.

#### ***A.1.2.2. Baseline scenario (i.e. situation in the country should no intervention of GEF take place)***

Turkey lacks large heat distribution infrastructure such as district heating or industrial heat networks. Hence combined-heat-and-power (CHP) is hardly used in Turkey (except e.g. in the sugar industry). The use of biomass residues to produce *power-only* in a combustion or gasification process is currently deemed a prosperous business for some investors. Although usually designed as CHP, , the focus of investors and operators is only on electricity production without considering the use of the waste heat of the co-generation process, which is usually even the bigger part of total energy. Several such development projects have been set up in recent years, with a total of approximately 75 plants, 383 MW<sub>el</sub> installed and 265 MW<sub>el</sub> operated<sup>39</sup>.

The baseline scenario is best described by the following assumptions;

1. Financially strong investors will continue to invest in power plants using biomass (mostly biogas with animal manure, municipal sewage sludge (considered biomass by law) and some other residues as feedstock) based on the attractive feed-in-tariff for electricity. The plants will not make any use of the heat, as they see no market for the heat and have optimized their plant design for maximum electricity production. Table 5 shows the current list of such plants under consideration and development in Turkey.
2. Some innovative investors in power plants will start to make use of agricultural residues like from cotton or sunflowers, but will have problems in guaranteeing their supply chains. Hence the very few existing harvesting companies that also have the technical capacity to collect other residues will start to develop their side business for collection of residues and probably start processing them into pellets or briquettes.
3. Food processing industries like cheese factories, dairies or seed oil production require significant amounts of heat, yet they are mostly unaware of the potential of biomass and will probably continue to generate heat by burning domestic coal. To make use of the direct residues of these production facilities (e.g. waste water treatment sludge, oil residues, etc.) and also use the residues of their suppliers (manure from livestock farms) and hence increase continuity of the supply chain, biogas systems seem to be the most appropriate technologies for CHP in industries related to agriculture. It is assumed that at least 2 reasonable-size combined heat and power biogas plants will be established in the next 5 years with no intervention of this GEF project.
4. Some agro-industry (e.g. hazelnut) will develop small scale supply chain projects for biomass to be used for heating of private or public buildings. Yet, central heating systems are very uncommon and hence the potential is very low as of now.

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<sup>38</sup> KGF Activity Report 2015- <http://www.kgf.com.tr/wp-content/uploads/2016/03/2015-faaliyet-raporu.pdf>

<sup>39</sup> Source: EMRA, 10 July 2017

5. With only the current FIT system in place and without support of a revised biomass energy strategy, the existing bioenergy plants would have problems sustaining the feasible energy production beyond the availability of the feed-in-tariff as stated by the investors during discussions. (e.g. PAKMIL Adana, please refer to respective case study section).
6. Overall, these activities will be uncoordinated individual struggles facing lots of barriers, further they will not be linked to any networking or awareness campaigns and will stay unknown for a considerable period of time.

**Table 5: Biomass power plants under development** <sup>40</sup>

Plant	Capacity (electricity)	Location	Feedstocks	Information
EKTON Enerji	10 MW	Ceyhan	Agricultural residues (cotton stalks, maize straw, pruning)	see case study below
Tire Biogas	4.8 MW	İzmir/Tire	Cows manure, maize	
Mases Energy (Biomass burning)	13.6 MW	İzmir/Bergama	Pomace, sunflower stalk, cotton stalk, corn cob, cone	27 million TL, 42,1 MWt
Afyon Biogas	1.2 MW	Afyon	Municipality waste	Increasing Capacity. Total capacity 8,428 MW
Albe Biogas	1.87 MW	Ankara/ Cubuk	Chicken manure, cows manure, waste of agriculture	Increasing Capacity. Total capacity 3,11 MW
Korpinar Biogas	6 MW	Kirsehir	Cows and chicken manure	Investment cost: 12,350,000 €
Eman Energy	275 ton/day	Mersin/ Silifke	Municipality waste	Investment cost: 27,697,248 TL
Abak Energy	6 MW	Ankara/ Elmadağ	Cows, chicken, turkey manures, waste of vegetables and fruits	Investment cost: 54,810,980 TL
Kaycev Energy	4 MW	Kayseri/ Kocasinan	Cows and chicken manures,	Investment Cost: 8 Million €
Diyarbakir Municipality	3 MW	Diyarbakir/Bağlar	Municipality waste	n/a
ITC-KA	25 MW	Ankara/ Ayaş	Municipality waste	n/a
Serir Energy	4 MW	İzmir/ Kirazli	Cows manure, turkey manure, cheese plant waste, paste of olive	n/a
Balikesir Energy	95 t/d waste	Balikesir	n/a	8,750,000 TL
Bioyen Energy	5 MW	Balikesir/Susurluk	Chicken manure, cows manure, stalks of cotton, rice, corn,	Direct Burning. Investment cost: 15 million TL
TRK Enerji A.S.	50 MW	Kadirli/Osmaniye	Cotton waste, maize, sunflower, wheat, rye, soybean, peanut, forest and forest product	Investment cost: approx. 300 million TL
Mavi Bayrak	12 MW	Soke/Aydin	Stalks of Cotton (however plant is suitable for waste of maize, forest and forest products)	14,5 million USD

### A.1.2.3. Baseline project

Despite the significant potential Turkey has for biomass, currently only about 79 facilities are using biomass resources. Thirty two of these facilities produce electricity by collecting and burning the gas from the municipal landfills. There are also seven wastewater treatment plants that produce electric energy from sludge. Other biogas and burning facilities mainly use waste of agriculture and animal wastes as feedstock. The majority of these plants are using household and municipal waste, and hardly any demonstration project using bio-energy from agricultural residues is being valorized. The total installed (electric) capacity and total capacity in operation are about 408 MW and 295 MW respectively, and an additional 800 MW are under construction. However, when considering the significant biomass potential in the agriculture sector, the actual utilization remains yet very low.

- **Associated baseline projects: governmental projects and initiatives that the project will build on**

**Turkey's Renewable Energy Action Plan (REAP)**, which was created in alignment with 'the Renewable Energy Directive' of the European Parliament and of the Council, has set a target for renewable energy sources to contribute 20% of total general energy consumption by 2023 (Ministry of Energy and Natural Resources, 2014).

<sup>40</sup> YEGM and other energy publications



Turkey's ambitious vision for 2023, the centennial foundation of the Republic, envisages important targets for the energy sector in Turkey. These targets include:

- Raising the total installed power capacity to 120 GW
- Increasing the share of renewables to 30 percent
- Maximizing the use of hydropower
- 1,000 MW biomass energy<sup>41</sup>
- Increasing the installed capacity based on wind power to 20,000 MW
- Installing power plants that will provide 1,000 MW of geothermal and 5,000 MW of solar energy
- Extending the length of transmission lines to 60,717 km
- Reaching a power distribution unit capacity of 158,460 MVA
- Extending the use of smart grids
- Raising the natural gas storage capacity to more than 5 billion m<sup>3</sup>
- Establishing an energy stock exchange
- Commissioning nuclear power plants (two operational nuclear power plants, with a third under construction)
- Increasing the coal-fired installed capacity from the current level of 15.9 GW to 30 GW

While the Government has been making initial efforts to improve the use of biomass and stimulate private sector participation, the development of more detailed regulations is required, capacities are missing at several levels (policy, finance, technical), and there is a need for demonstration projects to showcase the applicability of modern bio-energy technologies. This UNIDO-GEF project therefore aims to contribute to the Government's efforts for fine-tuning the regulatory framework which can encourage investors and project developers, and demonstrate the use of bio-energy – with a focus on thermal applications. Based on the observation that political willingness, initial private sector interest and demand for electricity are all present, the project aims to play a triggering and facilitating role to reduce the risks for private sector.

The policy component of the project will address the institutional and policy-related gaps. It will support the development of a national strategy and roadmap for the promotion of efficient utilization of bio-energy, in line with the Renewable Energy Action Plan of Turkey, through inclusive stakeholder participation within the framework of the national sustainable energy policy. Turkey has no specific policy for the promotion of heating technologies neither for SME and industries nor for residential buildings. The expected outcome from this project component is that the policy and regulatory environment is fine-tuned to enable scale-up and replication of bio-energy plants. In addition, it will also support the elaboration of special guidelines and indicators for the sustainable use of biomass from agricultural residues, including introducing best international practices to crop residue management.

Component 1 of the project (refer to chapter A.1.3) will showcase latest technology and best practice through highly replicable technology applications using agricultural residues. The project prioritizes the collection of solid agricultural residues over animal manure, sludge and other wastes. Priorities are given further to generation and use of heat from bio-energy for industrial and other applications, over the production of electricity. The target technologies and sub-sectors have been selected during the PPG phase based on regional, geographical and socio-economic distribution of the key sub-sectors and potential of agricultural residues being available.

**The project will build on the existing legal and regulatory framework in Turkey** which has been presenting several policies and measures for the fight against climate change particularly in development plans and also national plans, programs and strategy documents, especially in energy, agriculture, forestry, transportation, industry and waste sectors. Turkey's main goal in the fight against climate change is the mitigation of GHG emissions. According to 2015 figures of GHG emissions, the energy sector ranks first among sectors emitting greenhouse gases (at 72%). Turkey's strategy and policy is focused on providing energy security of supply through diversification in energy resources. An enhanced use of domestic and renewable energy resources is essential to achieve this goal. The project will strengthen the existing incentives which the Government of Turkey has been preparing and implementing in order to accelerate the use of biomass resources with modern technology application.

**Specific laws and regulations are in place to give incentives to private sector** to enter into the sector of renewable energy in general, and bio-energy in particular. Energy generation from renewable energy sources is regulated by the following laws and regulations: Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy (Law No. 5346, enacted in 2005). Renewable producers also benefit from an 85% discount on transmission cost for a period of 10 years. "Regulation for Production of Electricity without a License" of December 2010 (Official Gazette no. 27774), update in 2013 with the "New Electricity Market Law" (Law No. 6446), eliminates the requirement for a license from EMRA (Energy Market Regulatory

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<sup>41</sup> The 1000 MW refer to electricity production only. No indicative target for heat from biomass has been defined so far.

Authority) for the production of electricity through renewable sources at facilities with less than 1 MW of installed capacity with the ease of increasing it up to 2 times (5 MW) by a decree of the Council of Ministers without a change in the Law. Furthermore, with the new Law, there is no limit for renewable energy facilities that serve for self-consumption without feeding into the grid.

**Turkey Biomass Energy Potential Atlas (BEPA)**<sup>42</sup> is a web application developed by Renewable Energy General Directorate of Turkey (YEGM) which can dynamically present of how much electricity and biofuels are generated from the biomass source in Turkey through graphical and numerical representations and where these resources are concentrated in the country on the map. Potential analysis of biomass energy can be done with BEPA on both province and district level.

**KGF (Credit Guarantee Fund)** provides guarantees to SMEs which cannot benefit from bank loans due to insufficient collateral. This guarantee is provided to certain Turkish financial institutions and covers borrowers default. The typical guarantee is limited to SMEs, up to a loan amount of 2.5 million TL (USD 715,000) and 80% of the credit risk. 24,600 SMEs utilize the program between 1994 and 2015 to access more than USD 4.72 billion in bank loans with guarantees for USD 3.42 billion. The majority of KGF's shares are owned by several governmental organizations, such as KOSGEB and TOBB, while the minority is owned by Turkish banks. The main guarantee product is capitalized with TRY 2 billion provided to KGF by Treasury. Under this product the maximum guarantee limit per SME is restricted to TRY 1.5 million and can have a tenor of 6 months to 8 years. KGF provides a portfolio of different guarantee products. Each of these products has a dedicated aim or target and accompanying eligibility criteria, which restrict use to only those targeted. For instance the guarantee can only be provided to SMEs and other dedicated groups, such as young and women entrepreneurs. Depending on the guarantee product, the maximum credit that can be guaranteed is also limited. Due to the wide variety of possible project types targeted by the project, including those applying for pilot project support, it is not clear if all biomass projects that need credit support, will be eligible under the guarantee products currently provided by KGF. Therefore, within the scope of the project, applicability of these KGF guarantee products for the pilot project applications will need to be assessed. Depending on the outcome of this assessment the project might need to propose to the relevant governmental organizations, including KGF, to either: (i) adjust current guarantee products; or (ii) propose a separate dedicated guarantee product, so that these projects can be eligible. Although it could be possible that no changes to the current guarantee products are needed to fully support the target companies of the project.

**Regional Development Agencies** (countrywide 26 RDAs exist, organized under the Ministry of Development) also have special support programs for renewable energies as grant of investment for small scale projects.

- **Associated baseline projects: private sector enterprises and entrepreneurs**

Three examples of case studies which are conducted during PPG phase through site visits are explained below:

#### ***Baseline Case Project 1: PAKMIL, Adana***

Full plant name: Pakmil Enerji Ve Elektrik Üretim Tic. Ltd. Sti., 1.84 MW<sub>m</sub>, 1.763 MW<sub>el</sub>)

PAKMIL is a cotton ginning and oil factory producing about 5,000 t/year of ginning waste. They produce 300 t/day of ginned cotton for 45-60 days/year, and 250 t/day of hot pressed oil during 5-6 months/year. During peak production, about 150 people work in the factory.

In 2015, a biomass power plant went operational with a 60 bar steam boiler producing 8 t/h steam and further 1.763 MW<sub>el</sub>. (For the energy requirements of the cotton factory, the factory has another 5 bar steam boiler and buys electricity for 0.08 USD/kWh from the grid.) It is a licensed biomass power plant with a granted feed in tariff of 0.133 USD/kWh (which is net of grid fees 0.125 USD/kWh) for 10 years. The investor would close the power plant if the feed-in-tariff stops after 10 years. Investment was about 5 million USD and payback is expected to be 8 years. Three banks provided the loan (İş Bank (national), Yapı Kredi Bank, Ziraat Bank). Financing was not a major issue as the banks had the collateral of the big cotton factory as a guarantee. Licensing took 1 year, where the main issues were about power generation, environmental concerns were easy to solve.

The power plant consumes about 18,000 tons/y of biomass, thereof are 5,000 tons of own waste from ginning and oil pressing. The plant buys cotton stalk, corn straw, soya straw in September/October from one company that provides rectangular and round bales at a current rate of USD 37/t, which the owner considers as expensive. Farmers do not earn anything on the residues, yet the plant owner has plans to reduce the fuel cost by 40 %.

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<sup>42</sup> Official website: <http://bepa.yegm.gov.tr/>

### **Baseline Case Project 2: EKTON Enerji, Ceyhan**

Full plant name: Ekton Energy Electricity Production and Trade Co.

Ekton is basically a construction & logistics company with about 200 employees. In 2014 they received the first license for bio-energy for a 14 MW<sub>el</sub> plant in which they wanted to use a feedstock comprising of 30 % water treatment sludge and the remainder should be agricultural residues, mainly corn straw, cotton stalk, tree clippings (citrus, olives) and some energy crops.

The original concept would have required an investment of 58 million EUR and provided an IRR of 16 % (20 y) and a ROI of 8.2 years and included a plan to purchase 400 ha of land. Their main problems in developing the project were:

1. Licensing
2. Collection of biomass residues
3. Financing
4. Construction and finding the contractors and technology suppliers

Licensing was mainly an issue because the technology they proposed in the first concept was different and the Ministry of Energy had some issues. The concept was revised and now features a 10 MW<sub>e</sub> direct combustion plant with an investment of 24.5 million EUR and a payback of 4.7 years. For this size the share of waste water treatment sludge increases to 50 %, collection of the remaining should not be a problem as they have already purchased 10 baling machines, some tractors and 10 bale collection trailers. The baling machines (at a cost of 120,000 USD per unit) requires a shaft power of 200 hp and hence a tractor with at least 230 hp. As a result from some field testing they have currently 5,000 t of different residues (corn, olive and citrus clippings, cotton, etc.) on site. They currently consider a demand of 100,000 t/year for supply of the 10 MW<sub>el</sub> plant. Since the plant would be built on a green field with no users for heat nearby, 60 % of the energy input will be wasted. After 4 years of development the investors are still facing problems on financing, technical design and suppliers.

### **Baseline Case Project 3: apartment house heated with hazelnut shells**

An apartment house with 28 apartments, each ca. 150 m<sup>2</sup> area (4,200 m<sup>2</sup>) that is equipped with a central heating system (for heating only, hot water by electricity) with boiler house in the basement. 3 years ago, the former coal boiler was reconfigured for hazelnut shells. The current fuel demand is about 100 t of hazelnut shells per year. The operator considers it a good experience, but since it was a prototype it needs a separate person to operate the boiler and refill the fuel supply.

Price variations in natural gas or oil are less likely to influence the economic feasibility of bio-energy for industries, as industries largely depend on coal for heat generation, since it is cheaper and so bio-energy has to compete with the cheapest source. The biomass supply chain, starting from the farmers, depends on oil, (i.e. diesel), for most of its energy intensive activities. So there will be a higher dependency on oil prices as for instance in the supply chain of coal, since biomass supply chains are in general more energy demanding due to the lower energy density of biomass in comparison to coal.

#### • **Associated baseline projects: financial institutions and other donor-funded initiatives**

In the last 4-5 years, close to USD 5 billion have been poured into the Turkish market for financing renewable energy and energy efficiency projects (mainly renewable) by International Financial Institutions (IFIs). These financing programs implemented by IFIs via local banks.

There are several loans and funding opportunities on renewable energy for different types of investors (SMEs, medium and large companies) available in Turkey. These are (selection):

- **The World Bank:** Loans for Renewable Energy and Energy Efficiency Projects; RE plants and energy efficiency projects including good service and construction activities implemented by private sector would be financed. Max. limit 50 million USD per project.
- **Islamic Development Bank:** Loans for Renewable Energy and Energy Efficiency Projects; private sector firms investing in power plants based on renewable resources and energy efficiency projects are eligible to finance.
- **KfW (German Development Bank):** Loans for Renewable Energy and Energy Efficiency Project; Private sector firms investing in power plants based on renewable resource and energy efficiency projects are eligible to finance. Max. loan size 15 million EUR per project.
- **European Investment Bank (EIB):** Loan schemes to the total value of €300 million with the EIB provide support for small and medium-sized investments in environment and energy with the Industrial Development Bank of Turkey (TSKB) and the Development Bank of Turkey (TKB).

- **European Bank for Reconstruction and Development (EBRD)** is running a 500 million EUR framework operation (MidSEFF III) for on-lending to several participating financial institutions' in Turkey to finance private sector borrowers for mid-size renewable energy and resource efficiency, including energy, water and waste minimization, investments.
  - **TurSEFF:** The Turkish Sustainable Energy Financing Facility, TurSEFF, launched in 2010 is a credit line designed for industrial and commercial SMEs to be used on their energy efficiency and renewable energy investments. The facility has been developed by the EBRD and is supported by the European Union. TurSEFF III provides another 400 million EUR framework loans for on-lending to finance private and public sector sub-borrowers investing in small scale renewable energy and resource efficiency projects.
  - **BEFs Assessment for Turkey 'Sustainable bioenergy options from crop and livestock residues'** was developed under the collaborative agreement between European Bank for Reconstruction and Development (EBRD) and Food and Agriculture Organization of the United Nations (FAO), as part of the Sustainable Resource Initiative of the EBRD and building on the Bioenergy and Food Security (BEFS) Approach of FAO. The scope of the report is to assess the availability of agriculture residues for energy production covering pathways from agriculture residues to heat, power and combined heat and power. The results provide an overview of which bioenergy pathways can be viable and the locations of the bioenergy potential, given the overarching existing policy framework.
- **GIZ (German International Cooperation):** Promotion of Grid-connected Renewable Energy in Turkey: the project implemented between 2013 and 2017 is targeted to empower the Turkish government to establish an improved environment for energy policy, promote the greater use of renewable energies and sustainably implement Turkey's goals of expanding power generation from renewable energy (incl. solar, wind, small-hydro, biogas and geothermal).

Other financial support provided:

- **TÜBİTAK (Scientific and Technological Research Council of Turkey)** compensates or grants R&D related expenses and capital loans for R&D projects. Projects eligible for TUBITAK incentives cover concept development, technological research and feasibilities, laboratory studies, design studies, prototype production, pilot and testing facilities as well as patent/license studies. Demonstration projects within component 1 may apply and benefit from TÜBİTAK's support.
- **TKDK (Agricultural and Rural Development Institution of Turkey):** this agency under the Ministry of Food, Agriculture and Livestock is providing financial support by means of the EU IPA Rural Development (IPARD) program for projects that contribute to the modernization of the agricultural sector (including processing) through targeted investments while at the same time encouraging the improvement of EU acquis related food safety, veterinary, phytosanitary, environmental or other standards, as well as projects that contribute to the sustainable development of rural areas. Unlicensed renewable energy projects (< 1 MW), also bio-energy projects, can receive 50-65 % grant for eligible investments of max. 500,000 EUR, whereby project funding is to be applied through regular calls.

During the implementation phase of the project, efforts will be made to create linkages with the most appropriate financing schemes currently available in the country. The project will also consult the Turkish financial sector stakeholders on policy and regulatory interventions concerning new financing schemes by organizing a Financial Sector Roundtable (please refer to chapter A.1.3 – component 2).

### **A.1.3. The proposed alternative scenario, GEF focal area strategies, with a brief description of expected outcomes and components of the project**

This project seeks to facilitate and promote private sector participation and the development of a market for bio-energy and create new economic opportunities for the agro-industry. Modern bio-energy technologies will be applied in SMEs and industrial facilities from various sectors across the country (preferably those with high demand for heating and cooling). This alternative scenario will use the realization of highly replicable innovation projects as a trigger for increased interest and awareness from the sector and market enablers and accumulators (e.g. biomass fuel production and development of a supply chain). In parallel, this project will introduce interlinked interventions focused at the policy and regulatory level, and capacity building for market players and other key stakeholders. By addressing systemic barriers related to policy and regulation, the project will create an environment conducive for private sector led investment activities in this sector. The project will also create a critical mass of

capacity for both market enablers and players so as to support the nascent industry with relevant skills. To kick start investments in this sector, the project will implement carefully selected pilot projects that would serve as best practice projects.

The major focus sector for this project will be the agro-industry; the agricultural sub-sectors of field crops (cotton, sunflower, rice) and horticulture (hazelnut). The sustainable biomass supply of these agricultural sub-sectors will not face the risk of competing uses of biomass due to the development of sustainability indicators and recommendations concerning the amount of residues that should be left on the fields and a local level monitoring system.

The project and its associated delivery of services are expected to contribute to the GEF Focal Area Strategy CC 1 through (i) promoting innovative bioenergy technologies, (ii) supporting relevant national policies and strategies (iii) reducing GHG emissions by replacing fossil fuels to lead to significant global environmental benefits (iv) generating social and economic benefits at local levels, including increased productivity, innovation and competitiveness, job creation, gender mainstreaming in the agro-industry.

The project is structured around four key components, as outlined below.

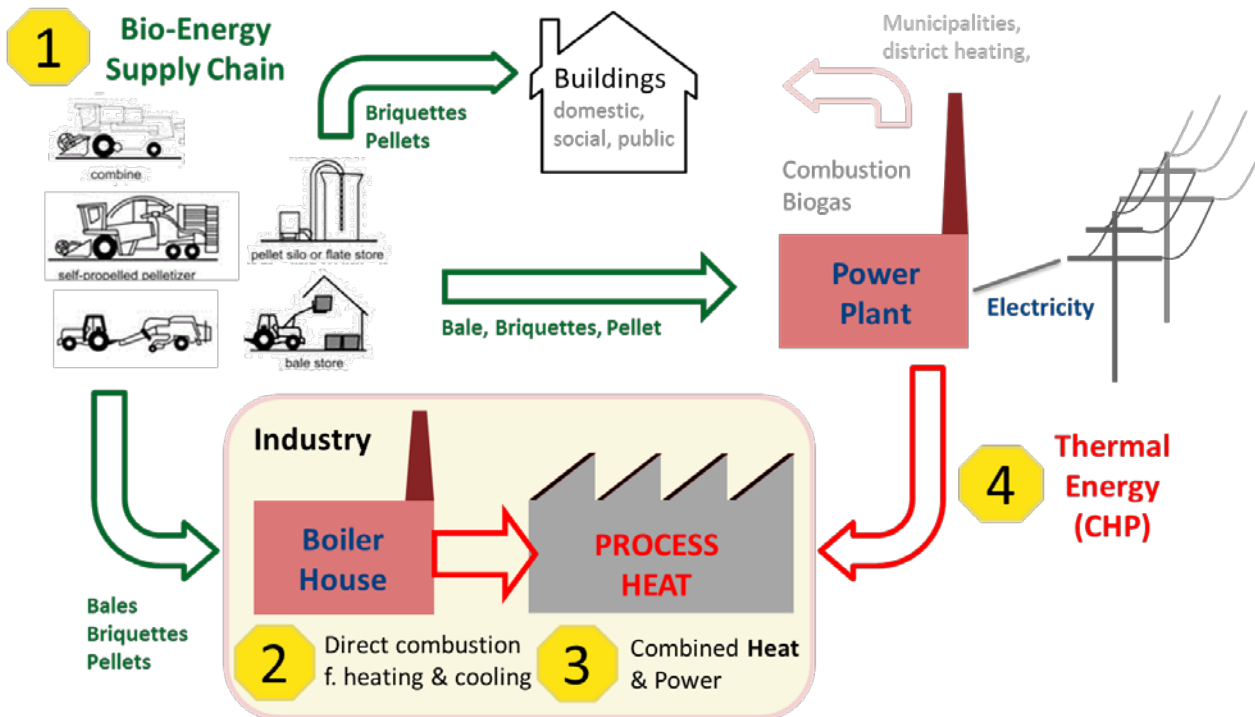
**COMPONENT 1: Demonstration of modern bio-energy technologies and energy efficiency measures in the agro-industrial sector**

This component will address the practical barriers from the supply chain of bio-energy to heat integration into new and existing industries and SMEs.

The aim of this component is to bring state-of-the-art technology and best practices to the country in the form of highly replicable innovative technology applications using agricultural residues. The penetration of solid agricultural residues utilization for heat generation in industry is very low compared to other biomass applications in Turkey. The project therefore **prioritizes: (i) the collection of solid agricultural residues over animal manure, sludge and other wastes; and (ii) the generation and use of heat from bio-energy for industrial and other applications, over the production of electricity.**

The project and specifically this component, focuses on four business cases that are best described by the following illustration and table. These are (1) biomass supply chains; (2) direct combustion of agricultural residues in existing boilers for thermal energy production; (3) generation of heat and electricity from agricultural residues in industry with new installations; and (4) heat use integration from power generation by industry.

**Figure 13: Illustration of the four business cases and their linkages**



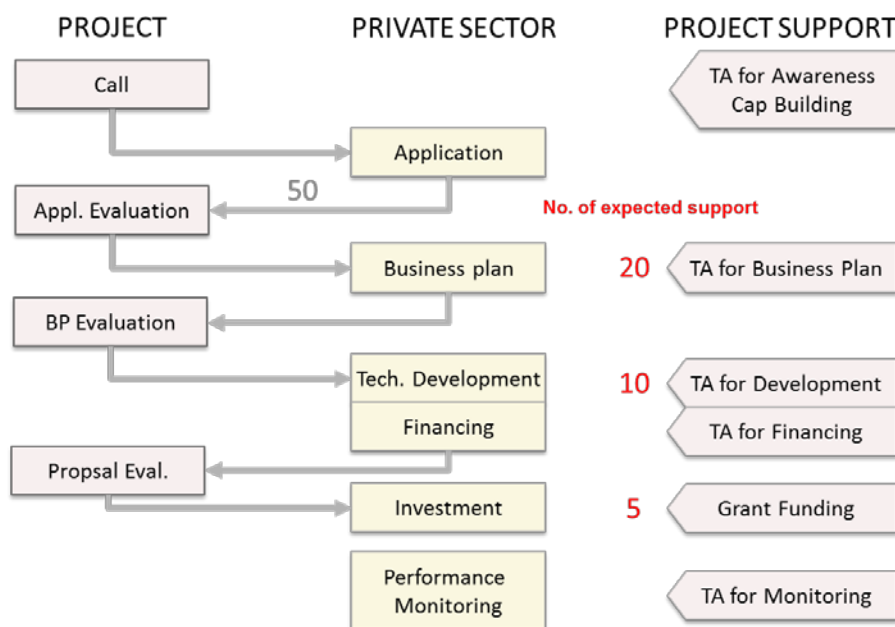
**Table 6: Description of the four business cases that will be developed by the project**

Business case	1. Setup of a Biomass Supply Chain	2. Direct combustion	3. On-site co-generation in industry	4. Heat integration from power generation
<b>Input:</b>	spread residues (e.g. cotton stalk, straw, husks, pruning)	raw and processed agricultural residues	agricultural residues (field, collected, greenhouses) manure (cow, chicken) food processing residues (milk, cheese) food processing wastes (sludge)	raw and processed agricultural residues
<b>Output:</b>	briquettes, pellets, chippings or bales	heat	biogas / heat / cooling / power fertilizer	heat (process, district) / cooling / (power)
<b>Target stakeholders:</b>	farmers, private alliances, SMEs	all	agro & food processing industry	independent power suppliers
<b>Production capacity:</b>	10,000 to 100,000 t/y	up to 1 MW <sub>th</sub>	up to 5 MW <sub>th</sub>	2 – 20 MW <sub>th</sub>
<b>Typical investment costs:</b>	USD 50,000 to 300,000 for special machines (baling, pelleting, briquetting)	USD 50,000 to 500,000 for adaptation of heat supply system, typically USD 1000/kW <sub>th</sub>	USD 100,000 to 1,000,000 for integration of heat into processes, typically USD 500/kW <sub>th</sub>	USD 100,000 to 1,000,000 for connecting the heat off-takers with the power plant, typically USD 300/kW <sub>th</sub>
<b>Financing sources:</b>	loan from commercial banks (under dedicated RE/EE credit lines) guarantee (KGF)	loan from commercial banks (under dedicated RE/EE credit lines) guarantee (KGF)	loan from commercial banks (under dedicated RE/EE credit lines) guarantee (KGF)	loan from commercial banks (under dedicated RE/EE credit lines) no guarantee available (loan size too large)
<b>Interventions by project:</b>	development of supply chain model and business case contracting of farmers sustainability of biomass development of market and distribution scheme financing of expensive equipment secure off-take agreements explore new dedicated loan guaranty product for application to this business case	sufficient & guaranteed supply of biomass centralized heat supply systems are not common technical adaptation of boilers technical and financial feasibility secure supply agreements biomass feedstock will need to be cheaper than coal explore application of ESCO for public	sufficient & guaranteed supply of biomass assessment of thermal needs and available waste streams design of process heat integration technical and financial feasibility licensing secure supply agreements explore new dedicated loan guarantee product for application to this business case explore application of SCO	assessment of thermal needs of potential clients technical design of heat link to clients and off-take agreements technical and financial feasibility secure supply agreements explore new dedicated loan guaranty product for application to this business case

Business case	1. Setup of a Biomass Supply Chain	2. Direct combustion	3. On-site co-generation in industry	4. Heat integration from power generation
		heat needs explore new dedicated loan guaranty product for application to this business case	for public heat needs	
<b>GEF/UNIDO contribution:</b>	TA + investment grant support for equipment purchase  e.g. 100 % TA, up to 50 % investment	TA + investment grant support for heat utilization  e.g. 100 % TA + 30 % investment	TA + investment grant support for heat utilization  e.g. 50 % TA + 30 % investment	TA + investment grant support for heat utilization  e.g. 30 % TA + 20-30 % investment
<b>Target of supported investments:</b>	5	2	1	2

The following activities and outputs are designed to identify, develop and focus the support into investments in highly replicable business cases. The activities will start with two separate calls for application. One is for the development and support of supply chains, business case 1. The other call will be for applications in the business cases 2, 3 and 4, on modern bio-energy technology applications with focus on process heat applications. The criteria threshold for application will allow for more applications, and from all over the country. Yet, **as a guideline, at least 50 % of the energy generated and used needs to be thermal energy and at least 50 % of the feed-stock needs to be from solid agricultural residues, such as among others straw, stalks, leaves, husks, twigs, branches, shells, kernels, ginning wastes.** Through a stepped approach (See Figure 14 and Figure 15) the number of applicants will be narrowed down, while at the same time the support and assistance provided by the project will intensify from step to step. A special team under the PMU (*PMU Special Team*) consisting of members from TAGEM (2<sup>43</sup>), YEGM (1), UNIDO (1) and national (2) and international (1) experts will conduct the evaluation of applications and procure and arrange support by the project.

Figure 14: Scheme of the project development process for supply chain projects.



<sup>43</sup> Numbers in brackets show indicative numbers of members

On the call for supply chain development proposals/ideas, about 30-50 applications are expected. Out of these, the most suitable 20 applications will be supported with the preparation of a business plan. This support will be provided as technical assistance (TA) provided under the project. The 10 best (most fitting applications to criteria mentioned below) will receive further support with technical, financial and legal development. Based on all the project documents that have been developed under the project support, the *PMU Special Team* will select a minimum of 5 projects (ideally 8). These projects will be supported with financing and subsequent implementation. GEF grant funding from the project will be utilized to kick start these pilot projects and leveraged with traditional finance. It is expected that the grant funding level will be up to 50 % of the total cost for establishment of a biomass supply chain model, which includes all kinds of required up-front investments for collection (e.g. special baling machines or harvesters), processing (e.g. pelletizers or briquette machines), logistics (e.g. storage, weighbridge, special transport equipment), and qualification and certification (e.g. lab tests) of products.

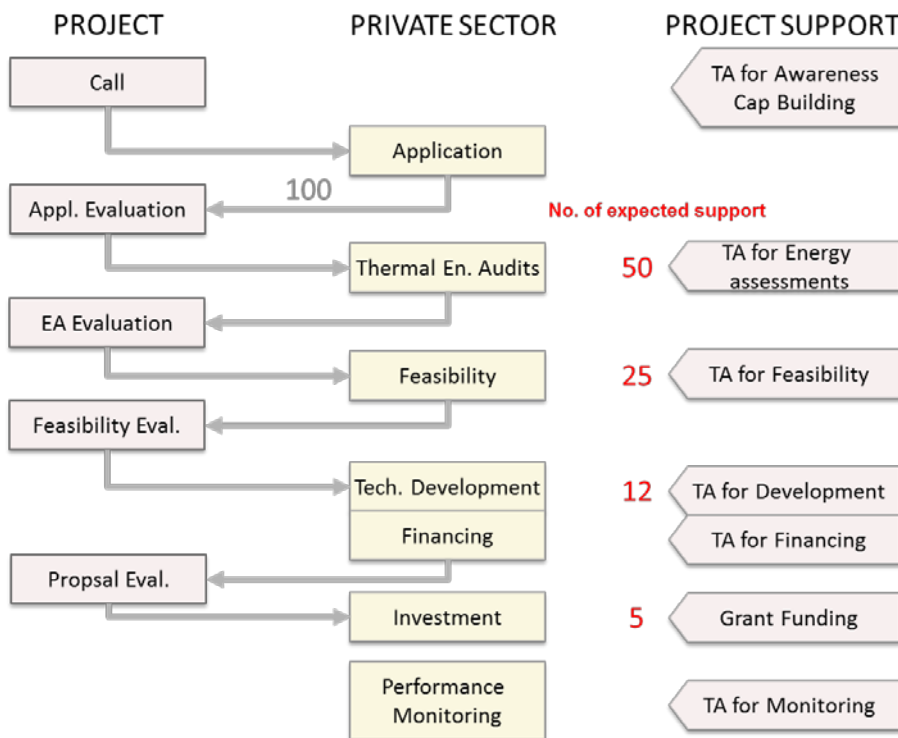
The *PMU Special Team* will decide on the funding levels depending on project needs and funds available. The evaluation of the applications in each step will be based on a point system. The following list of possible evaluation criteria is a draft and will be finalized during design of the call by the PMU Special Team supported by TA.

- diversity, availability and sustainability of agricultural residues to be used as feedstock
- replicability of the intervention; the selected regions will be favored automatically due to their high potential of residues (shown in the map in Figure 15)
- share of residues spread on the field and require innovative or special collection technologies
- quality of the implementation scheme for sustainable biomass management at the farmers
- size of applying enterprise (small and medium will be favored)
- gender mainstreaming action plan (e.g. number of foreseen women employees, women benefitted) and related targets to enhance gender equality environmental policies implemented

Based on economic data received from the farmers in Adana and Tekirdag, the economics of collection and transport for agricultural residues has been calculated and resulted to be a feasible investment. The analysis includes an estimated price of 50 to TL 70/ton paid to the farmers, further expenditures for collection machines and their operation and maintenance, transport for a radius of 20 to 30 km and labor cost and profit margins. For different collection technologies (small bales up to large round bales and pellets) the final cost of energy (LCOE) is USD 12 to 21 /MWh (~ USD 2 ct/kWh, TL 47 to 80/MWh). Imported hard coal was found to be USD 14/MWh and domestic lignite to be USD 22/MWh.



**Figure 15: Scheme of the project development process for bio-energy applications**



On the call for bio-energy technology projects proposals/ideas, about 100 to 150 applications are expected. Out of these, 50 applications will be granted TA support, which includes a special energy assessment focusing on the thermal energy demand and supply and the potential for heat integration into heating and cooling processes and advice on further development. The energy assessment reports will be the basis on which 25 applications will be selected for further support with the preparation of a feasibility study. Based on an evaluation of the feasibilities the project will grant support in form of TA to 12 proponents to prepare a business plan, which includes technical, financial and legal aspects. Based on this business plan the PMU will approve at least 5 projects (ideally 6) for grant funding using the GEF funding. It is expected that the grant funding level will be up to 30 % of the total cost for making use of bio-heat from agricultural residues, which includes all kinds of required up-front investments for adaptation of existing boilers and steam generators; the extra cost of upgrading on-site power generation to combined heat-and-power plants; new thermal distribution systems (heat exchangers, pipes, instruments, controllers, absorption chillers, etc.); long distance piping for connecting power plants with heat off-takers; energy and performance monitoring equipment (e.g. heat meters, remote logging devices).

The *PMU Special Team* will decide on the funding levels depending on project needs and funds available. The evaluation of the applications in each step will be based on a points system. The following list of possible evaluation criteria is a draft and will be finalized during design of the call by the *PMU Special Team* supported by TA.

- share of renewable energy generated and consumed out of total energy demand
- share of feedstock from solid agricultural residues
- replicability of the intervention; the selected regions will be favored automatically due to their high potential of residues (shown in the map in Figure 15)
- weighted average distance from which the agricultural residues are sourced (the shorter, the better)
- use of thermal-driven cooling processes
- energy policy implemented and energy monitoring system already in place
- proven track of implemented energy efficiency measures or management systems, incl. e.g. ISO 50001 or energy audits
- size of enterprise (small and medium will be favored)
- gender mainstreaming action plan (e.g. number of foreseen women employees, women benefitted) and related targets to enhance gender equality
- environmental policies implemented

The support provided under the project to the applications includes support with obtaining finance. This support is most effective if it is lined up with the partner banks. The project will therefore consult the partner banks at least twice during the pilot project selection phase. At the first consultation the national and international consultant will seek feedback from the partner banks on the basis of project fiches prepared for the 20 selected supply chain applications and 25 bio-energy applications at the start of the business plan development phase. Feedback received from the partner banks will help with the further development of the project and business plan. The second consultation will be on the basis of the selected business plans, i.e. 10 business plans for the supply chain projects and 12 business plans for the bio-energy projects. The project will directly seek interest of any of the partner banks. Those that receive interest by these partner banks will be introduced and supported to financial close.

The consultations will need to be bilateral and separate with partner banks, due to the sensitive, competitive and confidential nature, which might limit constructive feedback. Purpose of this consultation is to improve the bankability by involving the partner banks directly in the selection and structuring of the pilot projects. The partner banks will then be able to provide direct feedback about the risks and concerns of the project and will be allowed to directly engage with these projects to discuss and close the financing for these projects. Their feedback is valuable for the project. In return, these banks would have access to an additional sourcing route for biomass projects, which would (possibly) receive technical support from the project. Conditions will need to be clarified at the start of the project.

The scale-up of the exemplary technology applications will be facilitated and accelerated by the creation of a linkage with existing funding and financing schemes. To support greater replication of these pilot projects, the project will explore the development of a loan guarantee product to SMEs, similar to the current loan guarantee provided by KGF since it is not clear if supply chain biomass projects that need credit support would be eligible for KGF's criteria. The project will also explore setting up an ESCO. This is to be considered as a combination of grant-based technical assistance using GEF and other national or international sources of funding and is to be applied to leverage the existing funding and financing schemes. This will unlock agro-processing industries or private investors to access the initial capital to finance and operate/maintain their installations.

After successful implementation or construction of the projects, the projects will be monitored for their performance, analyzed and evaluated as a basis for replication. The monitoring equipment will be part of the investments under component 1, the accompanying technical assistance for extracting lessons learned and developing case studies is part of component 3.

The demonstration project sites will be selected through the call for proposal. Yet, as a consequence of the focus on agricultural residues (spread and collected) and that agricultural activities are concentrated in certain areas of the country (see Figure 16), the potential sites for the demonstration plants will be most likely in Central Anatolia, Eastern Mediterranean and Southeastern Anatolia, Aegean, Central Black Sea and Thrace (Marmara) regions. While wheat, maize, sunflower and further rice, grapes, citrus, vegetables are cultivated basically in all the regions, there is a given focus on hazelnuts (pruning residues, husks, shells) in Black Sea region, and for cotton (stalk, ginning waste) from the Aegean over the Mediterranean region to Southeast Anatolia. Local municipalities and relevant agricultural cooperatives will be invited to participate to planning and executing of the activities for developing biomass supply chains.

Project will take into consideration of the estimations of expected investment costs of demonstration projects. If investment costs of any demonstration plants (i.e. large scale biogas, co-generation, tri-generation) are expected to be too high thus not feasible even with the grant support due to conditions in the energy market, the project will seek cooperation possibilities with national financial institutions (such as KOSGEB, TKDK) and benefit from their experiences in the country.

**Figure 16: Map of the regions with the highest bio-energy potential.**



The expected outputs that will contribute to the realization of the overall outcome of Component 1 are the following:

**Output 1.1.1:** Twenty business plans for sustainable supply chain management of agricultural residues prepared based on a call for applications and supported pre-assessment

Activities:

- Development of guidelines and procedures for the call and evaluation of applications.
- Publishing of call and featuring the call using established online-tools by the regional development agencies.
- Support for awareness creation about the call (see component 3)
- Evaluation of applications and selection of 20 applications for further support

Responsibility: TAGEM

**Output 1.1.2:** Twenty-five feasibility studies for modern bio-energy technology applications with focus on process heat applications are prepared based on a call for projects and supported pre-assessment

Activities:

- Development of guidelines and procedures for the call and evaluation of applications.
- Publishing of call and featuring the call using established online-tools by the regional development agencies.
- Support for awareness creation about the call (see component 3):
- National and international experts conduct 50 thermal energy assessments at the potential project sites with the focus on integration of heating and cooling including analysis of load profiles, Sankey diagrams, heat exchanger networks, heating and cooling composite curves (Pinch analysis).
- Review of the reports of the energy assessment and selection of 25 proponents for the next step (at least TA for business plan as in Output 1.3)
- Both the national and international experts of the *PMU Special Team* will discuss the 25 selected pilot project ideas with the partner banks – as part of the feasibility assessment – based on project fiches. These project fiches will be prepared by the PMU and describe the relevant pilot project components of the project with the partner banks. These banks are then invited to provide guidance for further development of the project to improve the bankability of the project. Their input will be provided back to all 25 proposed project ideas as input for next phase.
- National and international experts assist 25 proponents in preparing technical and financial feasibility studies for the integration of heating and cooling.
- Review of the reports of the feasibilities and selection of 12 proponents for the next step

Proposed Responsibility: TAGEM

**Output 1.1.3:** Ten supply chain and twelve bio-energy technology projects made bankable and linked with existing financing instruments for an accelerated scale-up across agro-industrial subsectors

Activities:

- The assistance provided to prepare 45 business plans, (20 supply chain, 25 bio-energy technology applications)
- Out of these 45 business plans, 10 supply chain and 12 bio-energy projects will be selected to seek financial closure and implementation.
- The national and international consultants will discuss the 22 pilot project proposals with the partner banks. The partner banks will be invited to provide direct feedback on the bankability of these pilot projects and propose measures for improvement.

Responsibility: TAGEM

**Output 1.1.4:** Five sustainable bio-energy supply chains and five innovative and highly replicable technology applications with an estimated total capacity of 10 MW<sub>th</sub> are realized and monitored for economic and energetic performance

Activities:

- Based on all the previous steps the special team under the PMU consisting of members from TAGEM (2), UNIDO (1) and national (2) and international (1) experts will select the projects with most promising results, sustainability and replicability for grant funding
- Administration of grant supports to beneficiaries through reimbursement modality.
- Regular collection and review of monitoring data and provision of data for further analysis in Component 4.

*Reimbursement Modality:*

- 1- Terms of References for purchasing equipment/services is prepared by experts based on the earlier feasibility studies and business models
- 2- A Protocol between the enterprise and UNIDO on GEF grant support is signed
- 3- The enterprise procures bioenergy equipment and services based on the ToR
- 4- Verification is done by PMU special team whether the equipment with required quality is purchased according to ToR
- 5- UNIDO reimburses the determined amount of grant support according to the Protocol, enterprise benefit from import tax exemption and TAGEM/UNIDO brand value

Responsibility: UNIDO and PMU Special Team

**COMPONENT 2: Refined policy and regulatory framework to enable transformation across sub-sectors**

This component will address the institutional and policy-related barriers to the development and utilization of bio-energy from agricultural resources using low-carbon energy technologies for heating and cooling purposes. It will support the development of a roadmap for the promotion of sustainable production, conversion and efficient utilization of bio-energy, in line with the Renewable Energy Action Plan of Turkey, through inclusive stakeholder participation and investments in low-carbon energy technologies, within the framework of the national sustainable energy policy. While renewable energy provides the ideal low-carbon solution for decentralized heat and power projects, Turkey has so far no specific policy for the promotion of heating technologies neither for SME and industries nor for residential buildings. The expected outcome from this project component is that the policy and regulatory environment is fine-tuned to enable scale-up and replication of bio-energy plants.

In addition, it will also support the elaboration of special guidelines and indicators for the sustainable use of biomass from agricultural residues, including introducing best international practices to crop residue management.

**Outcome 2.1 Policy and regulatory environment is fine-tuned to enable scale-up of bio-energy plants:**

The expected 3 outputs that will contribute to the realization of the overall outcome of Component 2 are the following:

### **Output 2.1.1 Sustainable crop management – Regulations concerning the use of agricultural resources for bioenergy**

Considering the sustainable agricultural practices, there are neither legal provisions nor recommendations available for Turkish farmers to observe in terms of soil quality and waste/residue management. Organic waste management practices are not strongly developed but could enhance the overall supply chain and allow that plant/crops remainings are holistically addressed (e.g. for energetic purposes and as fertilizer). On the topic of “sustainable biomass supply” the focus will be to ensure that by removing the residues from the field, the soil quality and hence sustainability of crop production will be ensured and potentially also improved as compared to burning on the field.

#### Activities:

- A national guideline and classification of agricultural sources/residues and types of biomass developed: the Project will elaborate on the environmental policies and specifications, including revising the definition of biological wastes versus resources/residues (based on agricultural residues).
- Development/update of a set of sustainability indicators and recommendations concerning the amount of residues that should be left on the fields: for Turkey and its regions and different crops and climates the specific percentage value together with regulations and local guidelines will be developed as part of the project, with reference to the Global Bioenergy Partnership that has published sustainability indicators concerning bio-energy use.
- Development of a monitoring system at a local level to measure the sustainability of biomass extraction, and monitoring of any adverse environmental effects, such as expansion of (surrounding) agricultural lands and impact on forests, protected areas and any restrictions to be enforced.
- Development of one practical guide that includes guidelines for proper management of bio-energy areas where on a yearly basis the harvesting for energy and the practice of mixing with the soil are alternated; requirements and tools for long term monitoring of soil quality & health; residue harvest protocols to set sustainable harvest rates and crop management practices.
- Developing sustainability guidelines materials (handbook, brochure) for farmers
- OPTIONAL: Developing and adapting a support mechanism for regional biomass supply chains development (for example; support mechanism for biomass fuel preparation, commercial supply models or engagement of energy cooperatives by cooperating with MoFAL. The supporting mechanism should include additional support option for social and gender-sensitive projects.

Responsibility: TAGEM

### **Output 2.1.2 Policies and programs to integrate heat from biomass**

Currently, MoENR/YEGM has a support mechanism for only electricity production from renewables (biomass included) in place and currently working on policies and strategies on low-carbon heat supply. However, from the sustainability point of view and for the sake of optimizing the use of biomass resources for energy production, the production and use of heat/cooling applications need to be promoted and demonstrated in the country. In case of cogeneration or tri-generation systems (combined production of power and heat or power/heat/cooling in biomass furnaces or biogas applications); a mandatory share of heating/cooling should be envisaged. Technical regulations and standards that enforce the heat usage within industrial facilities and buildings will be developed, together with the mechanism (elaborated under 2.1.3) to support future investments.

#### Activities:

- Develop a regulation for the utilization of thermal component (heating/cooling) in cogeneration and/or tri-generation systems, to eventually become mandatory. The project will provide suggestions and feasibility studies on national policy works based on a review of the best international policy examples tailored to Turkish energy market.
- Developing policy/regulation, on district heating and cooling from bioenergy in Organized Industrial Zones, agro-industry and farms and, on integration of district heating networks during planning of new settlements (residential areas, industrial zones) based on best international examples

Responsibility: YEGM

### **Output 2.1.3 Incentive programs and financing schemes for bio-energy promotion**

Although a number of renewable energy applications using organic wastes have been able to obtain finance, finance institutions in Turkey are generally reluctant to finance this kind of projects. As argued earlier, investments in biomass to energy are perceived as highly risky by the banking sector. This perception results in investments considered non-bankable (e.g. due to missing long-

term supply contracts) or require a high level of securitization for the full tenure of the loan. The project will need to explore and develop: (i) a dedicated credit support option to allow project sponsors to obtain loans, which could be similar to the current KGF guarantee for SMEs; and (ii) utilization of the ESCO model to kick start the ESCO market, which could be dedicated to heat supply to industry or public buildings. The guarantee product and/or ESCO will need to be operational by the end of year 2. Additional stimulating measures to reinforce the existing legislative framework (such as investment grants, tax breaks, tailored regulation for decentralized bio-energy applications, etc.) will be considered based on best practice and appropriateness for the national conditions.

The project will consult the Turkish financial sector stakeholders on policy and regulatory interventions by organizing a Financial Sector Roundtable. The stakeholders include: (i) the domestic banks, especially those banks that have issued co-financing letter in support of this project; (ii) bilateral and international financial institutions, such as EBRD, IFC, WB, KfW and others; (iii) the Credit Guarantee Fund (Kredi Garanti Fonu - KGF); and (iv) relevant governmental agencies and departments, including TAGEM, YEGM. Purpose of this consultation is to identify, discuss and address issues/barriers to support further development of biomass investments in Turkey.

Activities:

- Explore and develop closely with relevant stakeholders financial mechanisms and long term solutions – including social and gender sensitive additional grant support for e.g. thermal component, guarantee product and ESCO) to address (identified) financial barriers
- Developing feasibility studies/recommendations for national incentive programs based on the best international examples tailored to Turkish energy market
- Discuss solutions with financial sector roundtable
- Seek ownership and selection for support mechanisms for further replication of bio-energy projects.
- Consult stakeholders active in the Turkish financial sector on project interventions, progress and outcomes.

Responsibility: YEGM

***COMPONENT 3: Capacity base strengthened and awareness raising increased***

Key stakeholders currently are not aware and do not have sufficient knowledge on the commercial use of biomass. The competence of all parties on this topic will be enhanced, taking into account gender differentiated knowledge gaps. In order to achieve this, main stakeholders, both women and men, including biomass producers, concerned industries, banks, finance institutions, technology developers, local people influenced by organic waste disposal and public institutions will be provided with tailored initiatives to strengthen the capacities. Considering the targeted actors in the supply chain and hence biomass producers, it is seen that the lack of technical information concerning technological biomass practices is one of the barriers to the starting of technological investments. The dissemination material will include a set of business cases, developed based on the pilot projects. These business cases will be based on technical, operational and finance information from the pilot projects. The information will need to be generalized to function as project examples, or example business cases.

This component will deliver 3 main outputs that are closely interlinked and sequenced with the activities in Component 1 and 2.

**Output 3.1.1 Awareness on biomass technologies increased through the development of tailored knowledge products to facilitate technology transfer in the agro-industry**

To develop a specific package of tailored knowledge products, research institutes (both academic and non-academic) or consortia thereof with other partners will be invited to apply for implementation of the following tasks:

- Technical support (review of applications and feasibilities, provision of guidance and specific research) for pilot project development (1.1.2 & 1.1.3) including an energy monitoring concept
- Report on analysis of energy monitoring data from pilot installations (see 1.1.4)
- Support of 5 master students and 2 PhD candidates through co-financing from national stakeholders in the development of their theses about bio-energy potential from agricultural residues, supply chain development, heat integration into industrial processes, sustainable crop management, etc.
- Publication of 5 papers and active participation in 5 relevant conferences and symposia on the above topics
- Development of training curricula for a 5 days trainings in cooperation with the PMU and international TA
- Support in training of trainers by providing at least one senior expert for trainings

- Support in trainings during the 15 workshops by providing at least two trainers at academic level, thereof at least one female
- Development of training curricula for a specific training course at academic level
- Implementation of training course at academic level (at least 2 semesters)
- Technical support in development of a replication strategy

It is expected that the research institute will bring 100% of co-financing from their regular budget or from special funding schemes for any R&D activities. Potential candidates are universities, faculties, institutes and departments on agriculture, energy, science, and technology (e.g. TUBITAK, TOBB, Istanbul Technical University, Ege University Solar Energy Institute, Adana Science and Technology University), as well as energy foundations and clusters (e.g. Clean Energy Foundation, Cluster of Renewable Energy and Environmental Technologies) or business promotion institutes and chambers (e.g. KOSGEB<sup>44</sup>).

The PMU will further develop a project website, e-mail newsletter and social media channels that provide information about the project activities, the calls, events, trainings, research findings, pilot installations and other regular updates from the relevant sectors.

Responsibility: TAGEM

### **Output 3.1.2 Capacity and knowledge of 50 decision makers in government and private sector are improved through 5 tailored workshops**

To create awareness about the potential of bio-energy from agricultural residues for heat supply and specifically to create awareness about the support by the project and the call for applications (see component 1), the PMU will organize workshops in the main agricultural areas at the beginning of the project. The target group is opinion leaders and multipliers from industry and farmers associations, regional farmers and development agencies, officials from regional administration relevant to the sector of agriculture, industry, SMEs and energy.

Activities:

- Development of information package for awareness creation and basic training
- Advertisement through sector specific media channels and direct mailings
- 5 x 1 days of workshops

Responsibility: TAGEM

### **Output 3.1.3 Capacity building mechanism for O&M, technical and service roles is established to develop and retain skilled workforce for innovative bio-energy technologies in industry through training of 20 trainers and 550 engineers, technicians, governmental and financial stakeholders, in cooperation with technical partners through 15 workshops**

Towards the end of the project and based on the learnings of the pilot investments supported by the projects and the developments in the country in general, a training course will be developed that features the latest about bio-energy technology in Turkey. The participants will be trained in all the steps necessary to develop and operate bio-energy projects for heat in industrial environments from the initial energy assessment, over feasibility studies and financing to aspects of monitoring, operation & maintenance. This kind of training will be provided to project developers, national consultants, and the target enterprises where the technologies are being applied.

The training will be facilitated and implemented in partnering with knowledge organizations where this capacity can be institutionalized (such as universities, research organizations, industry associations, chamber of engineers, etc.). Training will be foreseen for 450 engineers and technicians in cooperation with technical partners (e.g. academic, industry associations etc.) through 9 workshops.

In 2 specially adapted training workshops for the governmental level 50 staff will be trained on bio-energy utilization and the aspects of supporting proponents, streamlining rules & regulations and removing barriers. For the stakeholders from the financial sector a special training will be tailored to improve the risk assessment and financial support for bio-energy investments.

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<sup>44</sup> Small and Medium Sized Industry Development Organisation

For the special farmers trade shows that are happening on agricultural land throughout the country, a special awareness package will be created and delivered at about 50 happenings, that include demonstration of collection technologies, videos with statements and printed material about technical, financial and organizational aspects of the supply chain business.

Activities:

- Development of training materials based on curricular developed under 3.1.1
- 2 x 2 days training of trainers workshop for 20 national trainers
- On-site training for trainers to gain knowledge and exposure to international best practice
- 9 x 2 days of training for about 450 engineers and technicians (50 participants for each training)
- 2 x 2 day of training for 50 government staff
- 2 x 2 days of training for 50 financial sector stakeholders and managers and executing officers from industry
- Development of supply chain awareness & knowledge dissemination package
- Active participation in over 50 farmers trade shows and exhibitions<sup>45</sup>, targeting over 5000 farmers.
- Organizing 2 symposia on national agricultural plants for bioenergy production and sustainable agriculture

Efforts will be taken to ensure that both women and men have equal opportunity to participate in and benefit from all capacity building activities. The goal is to ensure that women are able to participate in, benefit from and access all capacity building activities and build up technical knowledge.

Responsibility: TAGEM

#### **COMPONENT 4: Project Monitoring and Evaluation (M&E)**

The objective of this component is to facilitate a detailed and extensive M&E structure to be put in place under the project in compliance with UNIDO and GEF procedures. This will allow not only the monitoring of the project's progress in terms of the components and outcomes, including GHG emission reductions, to be achieved, but also the construction of an overall project impact assessment on a rolling periodic basis. The analysis of the M&E and impact assessment results of the different components will allow for periodic reviews of the project's 'Theory of Change' and subsequent implementation strategies and work plans. Beyond this tailor-made M&E and IA approach, the proposed GEF Project would also come under UNIDO's standard M&E approach for GEF funded projects.

##### **Output 4.1.1.: A monitoring and evaluation plan will be prepared and carried out.**

The activities included are the preparation of the M&E plan and its acceptance, semi-annual progress reports, annual project implementation reports (PIRs), mid-term and final evaluations, and the project terminal report.

Activities:

- Demonstration projects monitored throughout project cycle and independently evaluated
- Regular project reports submitted
- GHG emission reduction monitoring established and reported

Responsibility: UNIDO

##### **Output 4.1.2: Technical performance of demonstration projects will be monitored and publicized**

Assessment of the project results and preparation of learning, good practice and case studies for dissemination of the benefits of bio-energy projects and the productive applications achieved through this projects will be provided. Lessons learnt will be summarized and publicized towards the end of the project, using available distribution channels (website, social media).

Activities:

- Monitoring reports elaborated documenting the successful project implementation of demonstration projects
- Lessons learnt from the project drafted and published

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<sup>45</sup> e.g. <http://www.tarlagunleri.com/eng/>; <https://www.b2match.eu/b2konya-agri-2017>; <http://www.agroexpo.com.tr/>;  
<http://www.tarimteknolojigunleri.com/eng/>; <http://www.growtech.com.tr/>; <http://burtarim.com/>;



Project Component 4 activities will be carried out through well-defined responsibilities of project management unit (PMU) as described under the Section A.6 (Institutional arrangements and co-ordination) of this document. GEF resources will be used for technical assistance and hiring experts for independent evaluation of the project (refer to section C).

Responsibility: UNIDO

The tentative summary of tasks and responsibilities of project partners can be seen in the table below:

COMPONENT	TASK		RESPONSIBILITY
<b>COMPONENT 1: Technology demonstration</b>	<b>Output 1.1.1</b>	20 business plans for sustainable supply chain management of agricultural residues prepared based on a call for applications and supported pre-assessment	TAGEM
	<b>Output 1.1.2</b>	25 feasibility studies for modern bio-energy technology applications with focus on process heat applications are prepared based on a call for projects and supported pre-assessment.	TAGEM
	<b>Output 1.1.3</b>	10 supply chain and 12 bio-energy technology projects made bankable and linked with existing financing instruments for an accelerated scale-up across agro-industrial subsectors.	TAGEM
	<b>Output 1.1.4</b>	5 bio-energy supply chains and 5 innovative and highly replicable technology applications with an estimated total capacity of 10 MW <sub>th</sub> are realized and monitored for economic and energetic performance.	TAGEM and UNIDO
<b>COMPONENT 2: Refined policy and regulatory framework</b>	<b>Output 2.1.1</b>	Sustainable crop management – Regulations concerning the use of agricultural resources	TAGEM
	<b>Output 2.1.2</b>	Policies and programs to integrate heat from biomass	YEGM
	<b>Output 2.1.3</b>	Incentive programs and financing schemes for bio-energy promotion	YEGM
<b>COMPONENT 3: Capacity Building and Awareness Raising</b>	<b>Output 3.1.1</b>	Awareness on biomass technologies increased through the development of tailored knowledge products to facilitate technology transfer in the agro-industry	TAGEM
	<b>Output 3.1.2</b>	Capacity and knowledge of 50 decision makers in government and private sector are improved through 5 tailored workshops	TAGEM
	<b>Output 3.1.3</b>	Capacity building mechanism for O&M, technical and service roles is established to develop and retain skilled workforce for innovative bio-energy technologies in industry through training of 20 trainers and 550 engineers, technicians, governmental and financial stakeholders, in cooperation with technical partners through 15 workshops	TAGEM
<b>COMPONENT 4: Monitoring and Evaluation</b>	<b>Output 4.1.1</b>	Project monitoring and evaluation	UNIDO
	<b>Output 4.1.2</b>	Technical performance of demonstration projects monitored and publicized	UNIDO

#### **A.1.4. Incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, CBIT and co-financing**

The proposed project is structured under Program 1 (“promote timely development, demonstration and financing of low-carbon technologies and mitigation options”) to “promote innovation, technology transfer and supportive policies and strategies”, which is focal area strategy of GEF, in scope of “Climate Change Mitigation”.

By means of this project, global environment management indicators will be developed as a part of national energy and environment management systems of Turkey and practices under the international conventions to which Turkey is a party will be improved. Successes in two main thematic areas of the GEF, climate change and biodiversity, are directly related to capacity development and expansion of appropriate technological applications.

As a result of this project, the market environment for industrial applications of biomass will be improved and sustained, including through setting up the biomass supply chain from agriculture residues and by reducing the risk of biomass investments through an established linkage with development and commercial finance mechanisms.

In the absence of this GEF project, modern bio-energy applications will remain marginal in number and scope, and, at best, remain limited to a small number of applications in large-scale agricultural industries. The GEF budget will be used to kick-start the local fuel supply market and heating/cooling applications for small- and medium-scale agricultural industries, strengthen the local expertise on design, operation and maintenance of biomass facilities and improve the existing regulations/policies allowing introduction of biomass technologies in the SME and industry sectors. This will be done through a combination of technical assistance and investment support. The project will explore and develop a dedicated credit support option to allow project sponsors to obtain loans and public subsidies, and will aim for a maximum triggering effect for the type and size of most relevant modern bio-energy technology applications. The project is expected to leverage significant private sector investment through the Call for Proposals during the implementation phase. In addition, the project will consult the Turkish financial sector stakeholders on policy and regulatory interventions by organizing a Financial Sector Roundtable. Purpose of this consultation is to identify, discuss and address issues/barriers to support further development of biomass investments in Turkey. UNIDO's best practice suggests that a limited triggering financing support (for instance as grant mechanism), combined with tailored technical assistance typically yields the best results.

During PPG, project preparation team had difficulties to obtain co-financing letters from private sector due to hesitancy of the sector players to provide formal statements. Instead of private sector, letters of interest from the finance sector (TSKB and Garanti banks) can be found in attachment; these letters express the ability of national banks to use their existing credit lines to provide funding for bio-energy projects in Turkey. Co-financing for the investments in the pilot projects is expected to be received by the target enterprises, which will be facilitated by the financial sector through loans. Around 70% - 80% of the credit line amounts stated in the finance sector's co-financing letters are expected to be materialized by beneficiaries. Further co-financing will be obtained from the National Government's (TAGEM and YEGM) as well as UNIDO's cash and in-kind contributions from national activities on policy development, research, capacity building and awareness creation.

#### **A.1.5. Global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF):**

This GEF project will initiate a significant reduction of greenhouse gas emissions in a so far largely untapped area, i.e. thermal energy and heating in agro-food, agro-industry and SMEs. An increased use of biomass will substitute the use of fossil fuels for heat or power generation and thus greenhouse gas emissions arising from combustion of these fossil fuels will be prevented. In this way, Turkey will contribute to national targets as well as global targets to reduce GHG emissions.

Sustainable results will be obtained from this project through a cost-effective approach. The technical assistance and financial support from the GEF combined with the support of the government will function as an important leverage for biomass investments in agro-industries. Thus, besides indirect results such as creating extensive investment opportunities not only in the implementation period of this project but also after this period through planning and site researches and pilot facility applications to be conducted in scope of this project, the necessary substructure will also be created for introducing the service providers engaged in agriculture trade and agricultural industrial practices and commercializing biomass technologies. By all these means, the capacity needed by the country will be developed, a safe technical and financial ground will be set and finally new enterprises will be triggered and also longer term development and investment impacts will be created, which will bring national success to global environment management indicators in scope of GEF's focus areas. Based on initial assumptions, this project is expected to result in these numeric estimations of global environment benefits:

- Direct emission reductions of 440,000 tCO<sub>2eq</sub> through its demonstration activities
- The range of indirect CO<sub>2</sub> emission reductions is 3,840,000 to 10,000,000 tCO<sub>2eq</sub>.

#### ***Direct emission reductions***

Direct emission reductions within this project result from the investment in a minimum of 5 technical demonstration projects and 8 supply chain development projects and in direct assistance in further replication or scale-up projects. These projects will be installed and commissioned during the project's 5 year implementation phase resulting in direct GHG emission reductions. For each of these projects an economic lifetime of 15 years is assumed. For the 5 technical demonstration projects this results in total direct emission reductions of 320,000 tons of CO<sub>2</sub> equivalent (tCO<sub>2eq</sub>) over the lifetime of the investments, and net of considered baseline investments this is 80,000 tCO<sub>2eq</sub>. Direct emission reductions for the supply chain development projects are 960,000 tCO<sub>2eq</sub>, resulting to 360,000 tCO<sub>2eq</sub> after deduction of the considered baseline investments. Further details on the calculations can be found in Annex E.

The following numbers of installations have been assumed as the additional and baseline scenario of the calculation of GHG emission reductions according to the GEF methodology for demonstration and diffusion projects:

Project Case	Amount of new and additional investments	Amount of baseline projects that would happen without the GEF project	Net investments considered for GHG calculations
Direct combustion for heating and cooling	2	1	1
On-site co-generation of heat and power	2	1	1
Heat integration from power plants	1	1	0
Supply chain developments for heat	8	5	3

In the non-GEF base case the energy needs of each project would be met in a variety of ways. In all cases fossil fuels such as coal (local lignite) or gas would be used. A smaller amount of electricity would also be generated, which otherwise would be taken from the national grid with their natural gas and coal dependent generation. A conservative emission factor for the grid (0.519 tCO<sub>2</sub>/MWh) has been used and IPCC figures have been used for natural gas, coal (lignite), fuel oil, and diesel.

In addition there are emission reductions resulting from implementing rules and regulations for sustainable handling of biomass residues, and hence soil improvements, reduction in burning on the field and displacement of synthetic fertilizers. Further emission reductions are available from the avoidance of previous waste disposal methods. Again these differed between projects from open lagoons, open dumping, and landfill to disposal at sea. In reference to very low total shares in the national total emissions of agricultural soils (3.31 %) and field burning of agricultural residues (0.08 %) these potential emission reductions are not calculated separately.

The reasoning for deviations of values stated in the PIF is due to more detailed information on the type of demonstration projects and activities. In addition, the calculations of the now presented values have used as a basis not only investments in energy generation, but also the results of bio-energy supply chain developments and hence availability of more carbon neutral fuel on the Turkish market has been included.

#### ***Indirect emissions reductions***

The project is expected to catalyze significant further investment in biomass to energy technologies due to its policy, technical and capacity building activities that are designed to address the current barriers to investment. These are likely not only in the agricultural industry but also in other industries, resulting in indirect emissions reductions. Using the GEF bottom-up methodology, indirect emission reductions attributable to the project are expected to be 3,840,000 tCO<sub>2eq</sub>. This figure assumes a replication factor of 3 (GEF uses 3 for a market transformation initiative and 4 where a credit guarantee is introduced).

Using the GEF top-down methodology, indirect emission reductions attributable to the project are estimated at 10,000,000 tCO<sub>2eq</sub> (rounded figures). This figure assumes that total technological and economic potential for GHG emission reductions in this area over the post-project 15 years is 68,000,000 tCO<sub>2eq</sub> (rounded figures), with a project causality factor of 15 %.

The range of indirect CO<sub>2</sub> emission reductions is 3,840,000 to 10,000,000 tCO<sub>2eq</sub>.

Deviations to values stated in the PIF are due to the fact that for the top-down approach the sustainable biomass potential for Turkey has been refined, and the causality factor reduced. For the bottom-up approach the replication factor stayed the same, but the direct emission reductions have changed.

Assumptions to reach these figures include a grid emission factor of 0.519 tCO<sub>2</sub> / MWh. To simplify the calculation heat and power production only has been considered, even though the project will have emission reductions from improved agricultural practices as well.

#### **A.1.6. Innovativeness, sustainability and potential for scaling up**

##### ***Innovation***

Using biomass and specifically agricultural residues is not new in Turkey, but the utilization of the heat component (either from heat-only plants or as a waste heat from electric power generation) and the large scale collection and use of many different types of residues is very limited in number, even lower is the utilization of thermal driven cooling for processes and storages and hence tri-generation (electricity, heating and cooling). Specifically, the market development for a biomass supply chain for energy purposes, either by energy farmer cooperatives or other commercial business models, and using thermal energy (also via Energy Service Companies, (ESCOs)) within the productive industry are yet considered very innovative in Turkey. In line with these new activities, new regulations and recommendations will be introduced for sustainable management of agricultural residues and soils. Also the aspect of trading of heat and usage of waste heat from power plants will be discussed on regulatory levels for the first time.

### ***Sustainability***

The demonstration projects under component 1 are real investment projects where the owners would provide equity and secure debts/loans from commercial banks. As such, the owners (i.e. the industries) will have a vested interest that the sub-projects operate successfully for them to recover their investments and also repay the loans. As such, given the commercial interest in sustaining the operations of the projects, the different proponents will have an interest in keeping the projects running and hence sustain the global environmental benefits beyond the project lifetime. Furthermore, the providers of debt investments to these projects will provide continuous monitoring for the projects and provide support where required.

Specific technical training and general capacity building measures are included to improve the sustainability. The trainings will include train-the-trainers sessions ensuring that staff from various stakeholders will be in a position to mainstream heating and cooling from thermal bio-energy applications in their institutions and be in a position to provide similar training to more people. The project will also provide training to government agencies for creating conducive policies with incentive mechanisms to make the investment feasible to the end-user.

In addition, employment opportunities will be increased for both women and men in the agro-industry and thus local and national economy will be reinforced. Also social sustainability will be strengthened due to the systematic gender mainstreaming of the project during the whole project cycle.

### ***Replicability***

The replication potential is significant, based on the enormous, untapped agricultural residue potential, and the modern bio-energy applications are expected to unlock the large number of similar investment opportunities, and thus initiate a low-carbon transformation of the agro-industrial sector.

Replicability will be ensured through the documentation and widespread dissemination of the project demonstration results. The dissemination of the results of the sub-projects, including results from their energy performance monitoring, and barrier removal activities will also provide a better understanding of the success/failure factors and issues regarding such projects. Likewise, the pilot projects will showcase the ownership and management structures employed for consideration by the future projects. Guidelines, best practices, investment incentives, standardized heat purchase/supply agreements, tariffs & pricing mechanisms, risk management instruments etc. developed under this project can be used for future project development. The replication factor will also be enhanced through more informative exchange, awareness raising, public participation, demonstration and site visits.

Word of mouth is the most important factor for replication among Turkish entrepreneurs and investors, so it is crucial that the pilot installations show economic success in new markets with a large potential for growth – which is very likely for the anticipated demonstration projects. The modern bio-energy applications are expected to act as game changers which will be picked up by market enablers, finance sector and policy makers to further enable the environment for this type of investments. Through technical and financial feasibilities to be prepared, entrepreneurs will see other potential benefits (technology and business innovation; competitive power, socio-economic benefits) that will further boost demand for investments and related services.

***A.2. Child Project?*** If this is a child project under a program, describe how the components contribute to the overall program impact.

N/A

**A.3. Stakeholders.** Identify key stakeholders and elaborate on how the key stakeholders' engagement is incorporated in the preparation and implementation of the project. Do they include civil society organizations (yes  /no)? and indigenous peoples (yes  /no)? <sup>46</sup>

The project will be executed under the management of T.R. Food, Agriculture and Livestock Ministry (MoFAL)-General Directorate of Agricultural Research and Policy (TAGEM) as the primary counterpart of T.R. Ministry of Energy and Natural Resources (MoENR) will take part in the Steering Committee. For further coordination with other Ministries (Development, Environment, Finance) a special coordination group will be established. Therefore, the project will be carried out in cooperation with other national and local stakeholders and government agencies. (See A.5. and Figure 17 for more details).

During project development financial partners including EBRD, commercial banks, and funding agencies (please see A.1.2.1. and A.1.2.3.), research institutions like TUBITAK (The Scientific and Technological Research Council of Turkey) and Regional Development Agencies, TKDK (Supporting Institution of Rural Development), CSOs like the Clean Energy Foundation, the Bioenergy Association, Regional Agricultural Cooperatives and Unions, Chambers of Agriculture, Chambers of Agricultural Engineers, private sector stakeholders like investors, agro- and food-industries (See A.1.2.1.), technology clusters and business centers have been involved in the design of the project.

Stakeholders will also include a gender expert, gender focal points from involved stakeholders, local and international associations and/or agencies promoting gender equality and women's empowerment (e.g. KADiGER), in particular those focusing on energy needs and entrepreneurship.

Given the size and type of the bio-energy applications (i.e. in agro-industrial enterprises) to be supported under this project, it is not foreseen that indigenous communities will be involved.

Stakeholder	Information and Key Roles
United Nations Industrial Development Organization (UNIDO)	GEF implementing agency.
TAGEM (General Directorate of Agricultural Research and Policy) / MoFAL	<p>TAGEM is a general directorate under Ministry of Food, Agriculture and Livestock of Turkey (MoFAL). TAGEM will provide co-financing and act as main executing partner during the project.</p> <p>A number of activities are expected to be executed by TAGEM in line with UNIDO's rules and regulations such as:</p> <ul style="list-style-type: none"> <li>- call for proposals and feasibility/business model studies under the Component 1</li> <li>- all the activities under the Component 3</li> <li>- sustainable crop management policy activity (activity 2.1. 1) under the Component 2</li> </ul>
YEGM (General Directorate of Renewable Energy) / MoENR	YEGM is a general directorate under Ministry of Energy and Natural Resources of Turkey (MoENR). YEGM will provide co-financing and act as executing partner during the project. Two of the policy activities (2.1.2, 2.1.3) under the Component 2 are expected to be executed by YEGM in line with UNIDO's rules and regulations.
TKDK (Agricultural and Rural Development Institution of Turkey) / MoFAL	This agency under the Ministry of Food, Agriculture and Livestock (MoFAL) is providing financial support by means of the EU IPA Rural Development (IPARD) program for projects that contribute to the modernization of the agricultural sector (including processing) through targeted investments. Unlicensed renewable energy projects (< 1 MW), also bio-energy projects, can receive 50-65 % grant for eligible investments of max. 500,000 EUR, whereby project funding is to be applied through regular calls.
Ministry of Development	Ministry of Development of the Republic of Turkey is an expert based organization which plans and guides Turkey's development process in a macro approach and focuses on the coordination

<sup>46</sup> As per the GEF-6 Corporate Results Framework in the GEF Programming Directions and GEF-6 Gender Core Indicators in the Gender Equality Action Plan, provide information on these specific indicators on stakeholders (including civil society organization and indigenous peoples) and gender.

Stakeholder	Information and Key Roles
(MoD)	of policies and strategy development. MoD will be a member of the Steering Committee.
KOSGEB	KOSGEB is the national SME support directorate under the Ministry of Science, Industry and Technology. KOSGEB is expected to be a member of the Coordination Group.
Regional Development Agencies (RDA) under MoD	Countrywide there are 26 RDAs in Turkey, organized under the Ministry of Development (MoD) which have special support programs for renewable energies as grant of investment for small scale projects. Regional development agencies (e.g. TRAKYAKA, OKA, DOKA, ÇKA) will feature the call for proposal using established online-tools and will be included in regional capacity building activities by the PMU.
Ministry of Environment and Urbanisation (MoEU)	The Ministry of Environment and Urbanisation is a government ministry office of the Republic of Turkey, responsible for the environment, public works, and urban planning in Turkey. The Ministry of Environment and Urbanisation is expected to be a member of both Coordination Group and Steering Committee.
TÜBİTAK (The Scientific and Technological Research Council of Turkey)	TÜBİTAK compensates or provides grants for R&D related expenses for eligible projects. TÜBİTAK incentives cover concept development, technological research and feasibilities, laboratory studies, design studies, prototype production, pilot and testing facilities as well as patent/license studies. Demonstration projects within Component 1 may apply and benefit from TÜBİTAK's support.
Bioenergy Association	Bioenergy Association of Turkey will raise the awareness for call for proposals and will be consulted and/or involved whenever appropriate during project implementation.
KADİGER (Women Entrepreneurs Association of Turkey)	KADİGER will act as a special channel for communication and multiplication to invite women entrepreneurs and other relevant parties to participate trainings, workshops, call for proposals and other project activities. The association will be consulted and/or involved whenever needed/appropriate on the gender mainstreaming issues.
Bilateral and international financial institutions (IFIs) (EBRD, TurSEFF, EIB, IFC, WB, KfW, IDB)	IFIs via local banks provide several loans and funding opportunities on renewable energy for different types of investors (SMEs, medium and large companies) in Turkey.
Local banks	Local banks are expected to provide commercial loans to the beneficiary enterprises.
KGF (Credit Guarantee Fund)	KGF will provide guarantees to SMEs which cannot benefit from bank loans due to insufficient collateral.

#### A.4. Gender Equality and Women's Empowerment

Elaborate on how gender equality and women's empowerment issues are mainstreamed into the project implementation and monitoring, taking into account the differences, needs, roles and priorities of women and men. In addition, 1) did the project conduct a gender analysis during project preparation (yes  /no)?; 2) did the project incorporate a gender responsive project results framework, including sex-disaggregated indicators (yes  /no)?; and 3) what is the share of women and men direct beneficiaries? (women: 40 % or more, men: remaining)

The core beneficiaries of the project are SMEs, industry and investors in the field of energy. However the project design acknowledges the differences of clean energy access considering distribution of economic activities and social roles between women and men in Turkey, in line with GEF 6 Programming Strategy. A preliminary desk based gender analysis has been conducted to assure that gender dimensions can be integrated into the project document. Further detailed analysis is planned during project inception.

Gender inequalities in the Turkish agricultural sector take the form of unequal access to real estate, property, livestock, farming equipment, entrepreneurship opportunities and financial resources, all to the detriment of women. The predominant production model relies heavily on non-paid family labor and a seasonal, and often migratory, workforce. Women take on a large share of the agricultural labor but are largely unseen in national statistics, and the informal nature of their employment means that they miss out on critical social benefits, such as accruing pensions.<sup>47</sup> To counteract, Turkey has included gender sensitive regulations at different levels, e.g. the KOSGEB's SME support program provides women advantages during project selection and providing higher support ratios of 20 %.

The main counter action at project level will be as follows; during the call for proposals in Component 1, the gender mainstreaming action plan (incl. number of foreseen women employees, women benefitted, current information on sex and age disaggregated at different employment levels) and any other related targets to enhance gender equality (among them farmers or farmer associations) will be asked/gathered from applying candidates and these indicators will be included in the selection process in favor of women and youth employment.

The experience during the stakeholder consultations at PPG phase was that the share of women active in the relevant governmental and private sector organization was at least 30 % and sometimes more. During PPG phase, the inception workshop had 40 % share of female participants, the validation workshop 38 %. Based on this experience, further project related activities (workshops, trainings) will target to have at least 50 % share of female participants. To facilitate this, as a special channel for communication and multiplication, the Women Entrepreneurs Association of Turkey (KAGiDER)<sup>48</sup> will be addressed and invited to participate. The project will also explore the possibility of organizing a regular networking event for women entrepreneurs in Turkish energy sector.

The core team of implementation staff at the executing agency TAGEM is expected to consist of a female project director and otherwise will be gender balanced. Further it is a clear strategy that women participate equally with men as decision-makers in all decision making processes during the project.

In general, UNIDO recognizes that gender equality and the empowerment of women have a significant positive impact on sustained economic growth and inclusive industrial development, which are key drivers of poverty alleviation and social progress. Commitment of UNIDO towards gender equality and women's empowerment is demonstrated in its policy on Gender Equality and the Empowerment of Women (2015), which provides overall guidelines for establishing a gender mainstreaming strategy, UNIDO has also developed an operational energy-gender guide to support gender mainstreaming of its sustainable energy initiatives.

UNIDO recognizes that energy interventions are expected to have an impact on people and are, therefore, not gender-neutral<sup>49</sup>. In fact, due to diverging needs and rights regarding energy consumption and production, women and men are expected to be affected differently by the project (in terms of their rights, needs, roles, opportunities, etc.). The project aims to demonstrate good practices in mainstreaming gender aspects into promoting sustainable use of biomass to strengthen the economy in Turkey, wherever possible and avoid negative impacts on women or men due to their gender, ethnicity, social status or age. Consequently, it will be considered to systematically include the gender dimension during the whole project cycle.

A guiding principle of the project will be to ensure that both women and men are provided equal opportunities to access participate in and benefit from the project, without compromising the technical quality of the project results.

In practical terms:

- Under the second component, the project will ensure that the developed regulations are gender sensitive.
- Efforts will be made to promote participation of women in training activities, both at managerial and technical levels.

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<sup>47</sup> <http://www.fao.org/3/a-i6192e.pdf>

<sup>48</sup> <http://www.kagider.org/>

<sup>49</sup> ENERGIA "Turning Information into Empowerment: Strengthening Gender and Energy Networking in Africa. Leusden, 2008; Joy Clancy "Later Developers: Gender Mainstreaming in the Energy Sector", 2009

- Gender-sensitive recruitment will be practiced at all levels where possible, especially in selection of project staff. Gender responsive TORs will be used to mainstream gender in the activities of consultants and experts. In cases where the project does not have direct influence, gender-sensitive recruitment will be encouraged. Furthermore, whenever possible existing staff will be trained and their awareness will be raised on gender issues.
- All decision-making processes will consider gender dimensions. At project management level, Project Steering Committee meetings will invite observers to ensure that gender dimensions are represented. Also, at the level of project activity implementation, effort will be made to consult with stakeholders focusing on gender equality and women's empowerment issues. This is especially relevant in policy review and formulation.
- When data-collection or assessments are conducted as part of project implementation, gender dimensions will be considered. This can include sex-disaggregated data collection, performing gender analysis as part of ESIA's, etc.
- In sum, the project design will acknowledge the differences of energy access impacts considering distribution of economic activities and social roles between women and men in Turkey, in line with the GEF 6 Programming Directions.

The project does not explicitly address women's empowerment, but gender dimensions have been considered during project formulation and will be considered systematically throughout the whole project cycle.

#### A.5. Risks

The risk assessment and mitigation actions for achieving the desired GEF project results have been discussed in detail here. The following risk categories have been identified: (1) regulatory & institutional risks, (2) technology risks, (3) implementation risks, (4) financial and economic risks, (5) sustainability risks, (6) social and gender risks, and (7) climate change risks. All these risks have been evaluated against their risk level. The mitigation actions for these risks are presented in the table below.

**Table 7. Risks**

<b>Risk</b>	<b>Risk level</b>	<b>Risk mitigation measures</b>
<b>Regulatory &amp; Institutional risks</b>		
Uncertainty in the application of legislation that incentivize renewable energy production	M	The incentive given for energy to be obtained through biomass use is applied for ten years for those having production license subject to the Renewable Energy Law (REL) Support Mechanism (YEKDEM2) that have commenced or will commence operation until 31/12/2020. YEGM is currently working on a regulatory framework project on deployment of renewable energy to supply heating. A tailored set of recommendations will be given to relevant ministries to refine the existing framework for facilities using agricultural biomass for the generation of renewable electricity and heat.
<b>Technology risks</b>		
No demonstrated projects in the country for bio-energy applications to produce heating/cooling for industrial energy users	M	Biomass technologies are state-of-the-art in many developing countries and energy produced from agricultural residues in the form of electricity, heating and cooling is a major contribution to sustainable development and lowering the country's energy imports in the long term. Technology know-how and successful business models will be used while implementing the project.
Some bio-energy technologies and applications may not be technically/economically viable for energy generation.	L	The project focuses mainly on locally available resources and their use as a bio-energy fuel source within SME and industrial facilities. Assessments made during the PPG showed that the production of thermal energy would provide a major benefit for the predominantly fossil-fuel based industries, while additional income opportunities for local farmers utilizing their available residues would be generated.
Low awareness on biomass energy technologies may hinder the project development.	L	Building capacity and awareness raising among stakeholders on bio-energy technologies and their application has been already started during the PPG and will be further carried out as a special component (Component 3) during project implementation.
<b>Implementation risks</b>		
Entrepreneurs' lack of interest	M	Key stakeholders are currently not aware and do not have sufficient knowledge on the commercial use of biomass-to-energy. The competence of entrepreneurs as well as farmers and SME managers on bio-energy production and use will be enhanced by providing tailored awareness initiatives to



<b>Risk</b>	<b>Risk level</b>	<b>Risk mitigation measures</b>
		strengthen the capacities. Entrepreneurs will be provided with technical assistance in the project development and assessing technical, economical feasibilities and develop bankable projects.
Technology providers' lack of interest.	L	Considering the targeted actors in the supply chain and hence biomass producers, it is seen that the lack of technical information concerning technological biomass practices is one of the barriers to the starting of technological investments. This project seeks to facilitate and promote private sector participation and new technologies for bio-energy thermal utilization and thus create new economic opportunities for the agro-industry as well as local technology providers. Hence, their interest to participate within demonstration projects shall be ensured (e.g. via the already practiced premium grant in case local technologies are used).
<b>Financial risks</b>		
Financial/credit constraints and high capital cost that prevent the private sector from investing in bio-energy projects	M	The project focuses on productive uses where bio-energy use (mainly heating/cooling, in addition to electricity production) can demonstrate real economic benefits and new value chains to encourage private sector participation. Selected business cases and demonstration projects will provide technical assistance to properly design, finance, and bio-energy applications that will contribute to increased confidence in the technical reliability of the technologies. Creation of a linkage with relevant financing schemes currently existing in the country will be ensured throughout the project by organizing financing roundtables with relevant stakeholders from the banking sector, private entrepreneurs and government.
Insufficiency of available financial mechanisms	M	It is very difficult for project sponsors to secure supply of biomass on long term basis with contracts, while this is a requirement for financing. The project will develop standard contracts to enable the setup of a market for biomass and promote to supply biomass to the local industry through matchmaking activities UNIDO's best practice suggests that a limited triggering financing support (for instance as grant), combined with tailored technical assistance typically yields the best results. Loan Guarantee mechanism is going to be discussed under a dedicated Guarantee Facility as well as feasibility and advice to be developed under the project.
<b>Sustainability risks</b>		
The risk of raw material supply	M	Considering the large potential in existing biomass resources from agro-industrial waste streams, the partial use of these resources is not expected to have any impact on food production. Nevertheless, the biomass supply chain is so far in developing stage in the country and needs special focus and support mechanisms to enable farmers and agricultural companies to build up a local biomass fuel market. The project will promote the use of post-harvest agricultural wastes and byproducts and biomass residues generated in production processes in the agro-industry.
Competition between agricultural production and energy use	L	Sustainable use of modern biomass and development of a set of sustainability indicators and recommendations concerning the amount of residues that should be left on the fields will be developed as part of the project, with reference to the Global Bioenergy Partnership; relevant standards and certification schemes will be applied in line with best international practice where necessary.  Agricultural products for human consumption or animal feed will not be

<b>Risk</b>	<b>Risk level</b>	<b>Risk mitigation measures</b>
		included in the project to ensure food supply safety. The targeted biomass sources are agricultural residues which are not utilized for any consumption, such as harvest or pruning leftovers.
<b>Social and Gender Risk</b>		
There could be a risk of resistance against, or lack of interest in, the project activities from stakeholders, especially with regard to the active promotion of gender equality; or low participation rates of suitable female candidates due to lack of interest, inadequate project activity or missing qualified female population within engineering sector.	L	To mitigate this risk the project will pursue thorough and gender responsive communication and ensure stakeholder involvement at all levels, with special regard to involving women and men, as well as CSOs and NGOs promoting sustainable agriculture practices and energy use, and a gender expert. This shall mitigate social and gender related risks, promote gender equality, create a culture of mutual acceptance, and maximize the potential contribution of the project to improving gender equality in the energy field.
<b>Climate change risk</b>		
Climate change could affect Turkey's agricultural production	L	Increased drought periods (for instance in 2014) may affect the availability of biomass resources, both agriculture residues and livestock manure. During the project preparation phase, an assessment of the availability of resources based on different scenarios was carried out. As a result, it seems that the amount of untapped agricultural biomass potential available in the country is enormous and will not adversely affect the project implementation.

#### *A.6. Institutional Arrangements and Coordination*

A number of activities are expected to be executed by TAGEM in line with UNIDO's rules and regulations.

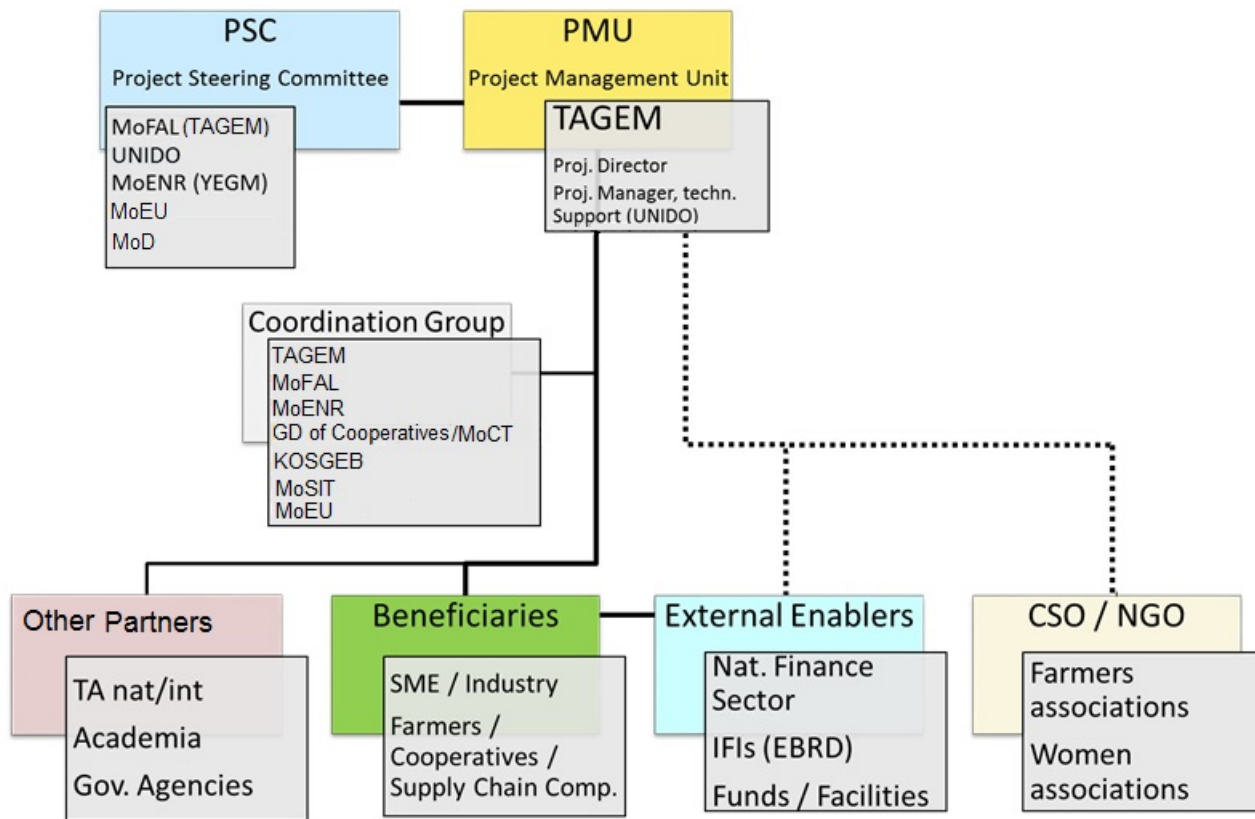
Equally; YEGM is going to be national executing partner, in relation with energy policy and financing scheme angle under the Component 2 in line with UNIDO's rules and regulations. Regular consultations with stakeholders and local beneficiaries will ensure that the project's impact on- and appropriation can be assessed throughout project implementation.

Full or partial title and ownership of equipment purchased under the project may be transferred to national counterparts and/or project beneficiaries during the project implementation as deemed appropriate by the UNIDO Project Manager in consultation with project stakeholders.

Project amendments will be done in accordance with the GEF Council Document GEF/C.39/Inf.03.

Figure 17 shows a diagram of the planned project implementation and execution arrangement.

Figure 17: Project steering and execution structure



- UNIDO:** As the GEF Implementing Agency, UNIDO holds the ultimate responsibility for the implementation of the project, the delivery of the planned outputs and the achievement of the expected outcomes. UNIDO will be responsible for supervision and monitoring of the project, and reporting on the project performance to the GEF. UNIDO has a country office in Ankara which has been instrumental in the preparation of the project and gathering support from key government and other stakeholders. It is clear that this office will be crucial also in the implementation phase. UNIDO currently has a number of projects ongoing in Turkey. The PMU will be supported by national and international experts (through TAGEM with support from UNIDO for specific technical assistance). Specifically for component 3 the project intends to engage (through TAGEM or otherwise) a national research institute (either academic or non-academic) or consortia thereof with other partners for the development of specific knowledge packages and training materials.

On request of the government of Turkey, UNIDO will provide limited technical and administrative execution support in the form of direct recruitment of consultants or procurement of equipment.

- Project Steering Committee (PSC):** The PSC will be established for regular reviewing and monitoring project execution progress, providing strategic advice, facilitating co-ordination between project partners, providing transparency and guidance, and ensuring ownership and sustainability of the project results. The Terms of Reference and the final composition of the Steering Committee will be defined during the project start-up phase and is expected to be chaired by TAGEM/MoFAL and include representation from UNIDO, MoENR MoEU, MoD and, specifically General Directorate of Renewable Energy (YEGM). YEGM will take part in PSC especially with regards to:

  - Feasibility/case studies and activities related to co/tri-generation from biomass and district heating utilization (in Organized Industrial Zones and agricultural areas) of biomass energy technologies.
  - Promotion of biomass technologies for the economical utilization of agricultural wastes and improvements of energy production, and case study development.
- Project Management Unit (PMU):** The PMU will be responsible for the day-to-day management and execution of project activities as in the agreed project work plan. The PMU will be hosted by TAGEM and headed by the Project Director (PD), a regular staff of TAGEM. Among other relevant experts such as an agricultural, technical and capacity building expert from TAGEM, UNIDO will contract a designated Project Manager for technical support.

- **PMU special team for call for demo-projects**<sup>50</sup>: A special team under the PMU consisting of members from TAGEM (2), UNIDO (1) and national (2) and international (1) experts will conduct the evaluation of applications and other reports and approval for granting further support by the project.
- **Coordination Group**: Since the activities on the refined policy and regulatory framework to enable transformation across sub-sectors requires changes in laws and regulations which are under the responsibility of different ministries, a special working group will be established to facilitate the exchange at the ministerial level and harmonize the rules and regulations. The group will be chaired by TAGEM and consist of representatives of MoFAL, YEGM, MoENR, General Directorate of Cooperatives /the Ministry of Customs and Trade (MoCT), KOSGEB, the Ministry of Science, Industry and Technology (MoSIT) and the Ministry of Environment and Urbanisation (MoEU).
- **Other Partners**: The regional development agencies (under the MoD) will be included in regional capacity building activities by the PMU.
- **Beneficiaries**: The direct beneficiaries will be the receivers of the project development support and grant financing for the demonstration projects (e.g. industry, SMEs, farmers, cooperations, and other users of heat (e.g. municipalities) and further the participants in the numerous trainings. Full or partial title and ownership of equipment purchased under the project may be transferred to national counterparts and/or project beneficiaries during the project implementation as deemed appropriate by the UNIDO Project Manager in consultation with project stakeholders.
- **External enablers**: An important role for the success of the project will have the national and international financing institutions and their funds and facilities (See section A.1.2.1 and A.1.2.3 for a description). Since most of them exist outside the direct GEF/UNIDO project already, their role will be mainly the one of external enablers. Yet they will be contributors and beneficiaries (e.g. trainings) in many cases and addressed by the PMU for specific activities.
- **CSOs and NGOs**: Potential CSOs and NGOs will be consulted and engaged, including the Bioenergy Association of Turkey, regional farmers associations and those focusing on gender equality issues and advocating women's empowerment, such as Women Entrepreneurs Association of Turkey (KAGiDER), will be consulted and/or involved whenever appropriate during project implementation.

UNIDO and other UN agencies are currently implementing several projects in Turkey which will have a synergetic relationship with this project. The on-going GEF/UNDP/UNIDO project on industrial energy efficiency improvement has a total GEF grant of US\$6 million and promotes energy efficiency in the Turkish industrial sector. UNIDO is also currently implementing the CleanTech Turkey project with a focus on innovation for startups and small businesses. This project will benefit from country specific lessons-learnt of Cleantech Turkey project and any recommendations from the project team specifically on the activities involving trainings and workshops.

#### Additional Information not well elaborated at PIF Stage:

##### *A.7. Benefits*

Through this GEF project, the following socio-economic and national environmental benefits are to be expected:

More farmers will be able to generate additional income from selling their residues to biomass plants or by getting directly involved in the supply chains and upgrading of biomass residues to tradeable fuels such as pellets or briquettes.

The introduction and enforcement of regulations for more sustainable residues management on agricultural land, will lead to a reduction of open combustion of residues on the field and hence to less local air pollution. This is also relevant for cities surrounded by intensive agriculture (e.g. Adana), where air quality is significantly reduced after harvest time due to massive burning of residues on the field. These regulations in more sustainable residues management will also lead to improved soil quality and hence less demand for artificial fertilizers as practical examples of innovative farmers in Turkey already prove. The improved management of agricultural residues will also lead to reduction in wild dump sites, smell of rotting biomass in open places and other nuisances.

The enhanced use of agricultural residues for heating and cooling purposes in industry and other sectors will result in a reduction in energy demand, hence leading to improved competitiveness and working environment in industry. The use of local biomass as an energy source will reduce the demand for fossil fuels and hence the demand for energy imports, which benefits the Turkish economy in general. The demonstration of waste heat usage from power plants and heat integration into industry and other

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<sup>50</sup> not shown in Figure 17 for simplicity and oversight

sectors will create awareness about the required reforms not only in the electrical power sector, but also in the thermal energy sector. This will spur the development of new know-how and suppliers for technical equipment, energy efficiency solutions and industrial production process improvements in general.

Job creation and community level benefits are expected through additional income generation particularly in the underdeveloped regions as well as gender mainstreaming benefits as stated in *A.4 Gender Equality and Women's Empowerment* section with details.

#### *A.8. Knowledge Management*

The project will work in collaboration with various stakeholders develop different knowledge tools (e.g. training tools, roadmaps, guidebooks etc.) that will be disseminated widely. A knowledge management plan will be elaborated during the project's initialization stage to define the specific knowledge creation and dissemination activities, the target groups and the time by when the materials will be made available and delivered.

Under component 1, successful business cases demonstrating the modern bio-energy applications will be widely disseminated choosing the most appropriate medium to reach a large number of actual and potential stakeholders. The business cases will be based on technical, operational and finance information from the pilot projects. The targets of this dissemination will be potential users of the technology, servicing and maintaining sectors, governmental stakeholders and decision-makers, as well representatives from financing institutions. After successful implementation or construction of the demonstration projects, the cases will be monitored for their performance, analyzed and evaluated as a basis for replication. The monitoring equipment will be part of the investments under component 1, the accompanying technical assistance for extracting lessons learned and developing case studies is part of Component 3.

Under component 2 on policy, the project will work with the relevant governmental agencies to develop the strategic biomass roadmap and action plan, as well as relevant standards and regulations for thermal application of bio-energy for a wide dissemination. In addition, a practical guide that includes guidelines for proper management of agricultural land and sustainable crop management will be developed in regard to harvesting practices and level of residues becoming available for energy use (extraction) and remaining in the soil (reuse).

As for the component 3 on capacity building, the project will develop specific packages of tailored knowledge products on improved biomass technologies and facilitating technology transfer within the agro-industry research institutes (both academic and non-academic). Training manuals will be readily available for use by different institutions like universities, research organization and industry associations. The project will also help local training institutions to adapt these training manuals into curricula for their institutions. Training programs will be provided for all steps necessary to develop and operate bio-energy projects for heat in industrial environments from the initial energy assessment, over feasibility studies and financing to aspects of monitoring, operation & maintenance. This kind of training will be provided to project developers, national consultants, and the target enterprises where the technologies are being applied.

This way, the knowledge generated from this project will be integrated into the education system. Altogether, a minimum of 100 decision makers in government and private sector are going to be capacitated in the potential and use of bio-energy within industrial applications, and the benefit biomass will provide to the national energy supply mix. 50 staff from governmental institutions will be additionally trained on bio-energy utilization and the aspects of supporting proponents, streamlining rules & regulations and removing barriers. At least 400 technicians will be trained on design and operational issues concerning bio-energy use, in cooperation with technical partners (e.g. academic, industry associations etc.) through 22 workshops. For the stakeholders from the financial sector a special training will be tailored to improve the risk assessment and financial support for bio-energy investments. For farmers, trade shows with a special awareness package will be created and delivered at about 50 happenings, which include demonstration of collection technologies, videos with statements and printed material about technical, financial and organizational aspects of the supply chain business.

All publications developed under this project will comply with GEF and UNIDO communication policies. A project website and the use of social media will propagate the materials and outputs produced under the project and act as main distribution channels for awareness creation in the country.

To ensure up-to-date know-how, UNIDO actively collaborates with a number of energy technology centers, networks and learning platforms worldwide, such as the International Centre for Science and High Technology in Trieste, the National Cleaner Production Centers (46 countries) and the Green Industry Platform to form strategic partnerships to promote knowledge management and best practices for technology transfer. UNIDO also already applies a strategy of establishing regional centers as centers of excellence and knowledge hubs (for instance the ECREEE center in Cape Verde for West-Africa, and similarly ongoing initiatives for

East- and Southern Africa, as well as for SIDS) as a way to institutionalize capacities and support regional coordination and information exchange. Depending on the timing for the creation of such a center covering the Europe / Central-Asia region, this same rationale will be pursued to ensure sustainability of the capacity gained under this project.

UNIDO is well-placed to implement this project with its global network of experts and will be able to draw upon its experience from its wider portfolio of relevant and mainly GEF funded projects on bio-energy, including in Ukraine (low-carbon technologies in bakery industry, biogas from organic farm waste to provide heat and electricity for on-farm needs), gasification in wood-processing sector, Uruguay (biogas and other low carbon waste utilization technologies), the Dominican Republic (biomass for electricity generation), Albania (bio-energy in olive oil sector) and Chile (biogas for agro-industries). Furthermore, UNIDO has carried out projects in Nigeria (rice husks for electricity), Thailand (bamboo waste from chopstick industry and rice husks for energy), Sri Lanka (bamboo waste processing into pellets).

All knowledge management activities will be gender mainstreamed. This includes integration of gender dimensions into publications, for instance, presenting sex-disaggregated data and gender-energy nexus theory; gender sensitive language in publications, photos showing both women and men and avoid presenting stereotypes; as well as assuring that women, men and the youth have access to and benefit from the knowledge created.

## **B. DESCRIPTION OF THE CONSISTENCY OF THE PROJECT WITH:**

### *B.1. Consistency with National Priorities*

In the 10th National Development Plan 2014-2018 (MoD, 2013)<sup>51</sup>, the energy development goal is explained as below:

Para 784: Based on, continuous, good quality, safe, with minimum costs energy supply to the final consumer, and source diversification in the supply of energy; the main goal is to reach a competitive energy system to strengthen the strategic position of the country in the international energy trade by; utilizing domestic and renewable energy sources to the highest possible levels, anticipating the use of nuclear technology for electricity production, supporting the reduction of the energy intensity in the economy, minimizing the inefficiencies and environmental impacts of energy.

The proposed project is fully consistent and well aligned with Turkey's 10<sup>th</sup> National Development Plan and international development objectives, priorities, strategies and targets. As a member to Organization for Economic Cooperation and Development, Turkey is included in both Annex-1 and Annex-2 lists of the United Nations Framework Convention on Climate Change, together with developed countries. In consequence of the 7th Conference of the Parties held in Marrakesh, Morocco in 2001, it was resolved that "Turkey's name would be removed from the Annex-2 and included in the Annex-1 under special conditions at a position different from other Annex-1 countries" and Turkey became a party to UNFCCC on May 24, 2004 and to Kyoto Protocol on August 26, 2009. As a party of the Annex-1 of the UNFCCC, Turkey is responsible for developing and implementing policies to fight against climate change and notify the UNFCCC of current greenhouse gas emissions and data regarding these emissions. On the other hand, Turkey has no obligation for mitigation greenhouse gas emission in the First (2008-2009) and Second (2013-2020) Commitment Period of Kyoto Protocol.

The Ministry of Environment and Urbanisation, national focus of which is climate change, fulfills its task of national coordination for all matters concerning climate change. Furthermore, a corporate structure was formed before becoming a party to UNFCCC and Coordination Board on Climate Change (CBCC) was established by a Prime Ministerial Circular no. 2001/2. CBCC was restructured in 2013 and its name was change to Coordination Board on Climate Change and Air Management (CBCCAM).

"Republic of Turkey National Climate Change Strategy Document" and "Turkey's Climate Change Adaptation Strategy and Action Plan", in which Turkey's short-, medium- and long-term plans concerning Climate Change Mitigation for the period 2010-2020 are included, were published.

The strategy documents (Agricultural Strategy, Agricultural Deduction Program, Rural Development Strategy and Action Plan, Energy Efficiency Strategy etc.), policies, long-term policy programs (Rural Development Program/IPARD, TUBITAK Vision 2023, etc.) and action plans (Waste Management Action Plan, Waste Water Treatment Action Plan etc.) contain various activities for emission mitigation as well as adaptation to the impacts of climate change for fighting against climate change.

Progress has been made in the field of renewable energy starting from 2005, after the publication of the new Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy (Renewable Energy Law, REL, Law No. 5346). Investments in renewable energy technologies remained limited between 2005 and 2010 due to the lack of secondary

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<sup>51</sup> (In Turkish) <http://www.kalkinma.gov.tr/Lists/Kalkinma%20Planlar/Attachments/12/Onuncu%20Kalk%C4%B1nma%20Plan%C4%B1.pdf>

legislation and relatively low feed-in tariff levels. Nevertheless, the Renewable Energy Law amendment in December 2010 introduced higher feed-in tariff rates for some technologies, and other various financial and other incentives. Therefore, the penetration of renewable energy technologies was accelerated as compared to the period 2005 - 2010. After feed-in tariff rates were revised, renewable energy investments attracted the attention of both local and international investors.

Besides the Renewable Energy Law (REL) there are a number of secondary national regulations consisted with the project;

- Electricity Market Licensing Regulation
- The Regulation For Unlicensed Generation Of Electrical Power In The Energy Market
- Technical Regulation For Evaluating License Applications Based On Wind Energy Generation
- Technical Regulation For Evaluating License Applications Based On Solar Energy Generation
- The Regulation On Competition For Grid Connection Rights For The Solar And Wind Power Generation Plants (Tender Regulation)
- Regulation For Pre-License Wind And Solar Measurements
- Communiqué On Measurement Standards For Wind And Solar Power Pre-License Applications
- Regulation Regarding Documentation And Support Of Renewable Energy Resources (Acronym: YEKDEM))
- Regulation Regarding Unlicensed Generation In The Electricity Market
- Regulation On Determination Of The Renewable Energy Zones
- Regulation Regarding The Use Of Domestic Mechanical Or Electro-Mechanical Equipment In Renewable Power Plants
- Regulation On The Project Approvals Of Electrical Plants
- Regulation On Solar Power Plants

Various policy documents are published in the recent years for Turkey's energy policy. The targets of completing privatization, improving market operation, initiating nuclear power plant construction, expediting local and renewable resources in order to reduce excessive dependency on natural gas, increasing energy efficiency in production and consumption, making Turkey a transit route and terminal country for transporting oil, natural gas and electricity resources are the targets that are included in these documents as a solution for the energy problem.

- Electricity Market and Supply Security Strategy Document (2009)
- 2015-2019 Strategic Plan of the Ministry of Energy and Natural Resources (2014)
- Medium Term Program (2016-2018)
- 10th Development Plan 2014-2018 (2013) and Energy Efficiency Improvement Program Action Plan and Production Based on Local Resources Program Action Plan (2014)
- Climate Change Strategy (2010-2023)
- Climate Change Action Plan (2011-2023)
- Energy Efficiency Strategy Paper 2012–2023
- National Renewable Energy Action Plan 2013–2023

Turkey's Renewable Energy Action Plan (REAP), which was created in alignment with 'the Renewable Energy Directive' of the European Parliament and of the Council, has set a target for renewable energy sources to contribute 20% of total general energy consumption by 2023 (Ministry of Energy and Natural Resources, 2014).

Turkey's ambitious vision for 2023, the centennial foundation of the Republic, envisages important targets for the energy sector in Turkey. These targets include:

- Raising the total installed power capacity to 120 GW
- Increasing the share of renewables to 30 percent
- Maximizing the use of hydropower
- 1,000 MW biomass energy<sup>52</sup>
- Increasing the installed capacity based on wind power to 20,000 MW
- Installing power plants that will provide 1,000 MW of geothermal and 5,000 MW of solar energy
- Extending the length of transmission lines to 60,717 km
- Reaching a power distribution unit capacity of 158,460 MVA
- Extending the use of smart grids
- Raising the natural gas storage capacity to more than 5 billion m<sup>3</sup>

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<sup>52</sup> The 1000 MW refer to electricity production only. No indicative target for heat from biomass has been defined so far.

- Establishing an energy stock exchange
- Commissioning nuclear power plants (two operational nuclear power plants, with a third under construction)
- Increasing the coal-fired installed capacity from the current level of 15.9 GW to 30 GW

According to the “*Republic Of Turkey Intended Nationally Determined Contribution*” report submitted in COP 21, some of the commitments given for “Energy” sector are

- Increasing capacity of production of electricity from solar power to 10 GW until 2030
- Increasing capacity of production of electricity from wind power to 16 GW until 2030
- Tapping the full hydroelectric potential
- Commissioning of a nuclear power plant until 2030
- Reducing electricity transmission and distribution losses to 15 percent to 2030
- Rehabilitation of public electricity generation power plants
- Establishment of micro-generation, co-generation systems and on-site electricity production

As to date, Turkey does not yet have specific policy framework on biomass utilization for heating and cooling. This GEF project will assist the development of the relevant framework conditions to promote the use of heat and demonstrate best practice. Thus the project will contribute to Turkey's general energy policy principles in the way that the necessary energy will be provided in order to support economic growth and social development in time, in a reliable and cost-effective manner, in reasonable prices and in an environmentally sensitive way.

The project also put in place sustainable crop management strategy and support mechanism for supply chain development. The practical guidelines will include proper management of agricultural land and sustainable crop management in regard to harvesting practices and amounts of residues.

The policy activities of this GEF project are in line with National Priorities of Republic of Turkey as mentioned above. Policy component of the project will contribute to these national policy objectives by filling the gaps and bringing international best examples.

### **C. DESCRIBE THE BUDGETED M & E PLAN**

Project monitoring and evaluation (M&E) will be conducted in accordance with established UNIDO and GEF procedures. The overall objective of the monitoring and evaluation process is to ensure successful and quality implementation of the project by:

- i) tracking and reviewing project activities execution and actual accomplishments;
- ii) providing visibility into progress as the project proceeds so that the implementation team can take early corrective action if performance deviates significantly from original plans;
- iii) adjusting and updating project strategy and implementation plan to reflect possible changes on the ground, results achieved and corrective actions taken.
- iv) Ensure linkages and harmonization of project activities with that of other related projects at national, regional and global levels.

According to the Monitoring and Evaluation policy of the GEF and UNIDO, follow-up studies like Country Portfolio Evaluations and Thematic Evaluations can be initiated and conducted. All project partners and contractors are obliged to (i) make available studies, reports and other documentation related to the project and (ii) facilitate interviews with staff involved in the project activities.

At the same time, M&E will comply with the rules and regulations governing the M&E of UNIDO technical cooperation projects, in particular the UNIDO Evaluation Policy and the Guidelines for Technical Cooperation, both in their respective current versions.

A detailed monitoring plan for tracking and reporting on project time-bound milestones and accomplishments will be prepared by UNIDO in collaboration with the PMU and project partners at the beginning of project implementation and then periodically updated. By making reference to the impact and performance indicators defined in the Project Results Framework, the monitoring plan will track, report on and review project activities and accomplishments in relation to:

- a. Renewable energy heat/power delivered and GHGs emission reductions directly generated by the UNIDO/GEF project. These will include the type and the number of projects developed and implemented.



- b. Renewable energy heat/power generation delivered and GHGs emission reductions in-directly generated by the UNIDO/GEF project. These will include type and the number of projects developed and implemented due to the increased capacity and conducive environment for the renewable energy projects.
- c. Renewable energy investment generated by the UNIDO/GEF project, directly and indirectly
- d. Development and amendments of policy, legislative and regulatory frameworks aimed to promote and support the bio-energy market
- e. Level of awareness and technical capacity for the use of agricultural residues for energy within relevant institutions, in the market and within enterprises.
- f. Overall and specific socio-economic impacts of the project, including the increase in productive capacities, access to modern energy services, job creation for women and men, and gender related aspects (such as gender balance of beneficiaries, budget spent on activities actively promoting GEEW).

The PMU will be responsible for day-to-day and local management of project activities execution, performance and the tracking of progress towards the achievement of milestones. However, monitoring and evaluation of the demonstration projects with respect to energy generation, technical performance, commercial viability and GHGs emission reduction will be integral part of the evaluation component of Project Component 4.

UNIDO will be responsible for oversight and tracking overall project milestones and progress towards the attainment of the set project outputs. UNIDO will be responsible for narrative reporting to the GEF. The UNIDO project manager will be responsible for the preparation of Annual Project Implementation Reviews (PIR).

Mid-term evaluations and terminal evaluation (TE) will be prepared by an independent evaluator as established in the M&E Plan.

One mid-term review will be carried out and a final external terminal evaluation at least one month before the completion of the project. UNIDO will make arrangements for the independent terminal evaluation of the project. The UNIDO project manager will inform UNIDO Evaluation Group at least 6 months before project completion about the expected timing for the Terminal Evaluation (TE). The UNIDO Evaluation Group will then manage the terminal evaluation in close consultation with the project manager.

All monitoring and evaluation documents, such as progress reports, final evaluation report, and thematic evaluations (e.g. capacity needs assessment), as well as publications reporting on the project, will include gender dimensions wherever adequate. Table 8 provides the tentative budget for monitoring and the two evaluations, which has been included in Output 4.1 of Project Component 4. UNIDO as the Implementing Agency will involve the GEF Operational Focal Point and project stakeholders in order to ensure the use of the evaluation results for further planning and implementation.

**Table 8: Project's Indicative Monitoring and Evaluation Work Plan**


Type of M&E Activity	Responsible Partner	Budget (USD)	Co-financing (USD) (to be distributed accordingly during execution)	Remarks	Timeframe
Inception Workshop (IW) and inception report	UNIDO Project Manager (PM); Project Management Unit (PMU)	N/A		It will be part of PMU activity	Within first two months of project start up
M&E design and tools to collect and record data (performance indicators) including a survey to confirm baseline values for industry, manufacturers, policy makers, gender, etc.	UNIDO PM, PMU and M&E specialists as required	20,000		Indicative cost	Within first two months of project start up and mid project
Regular monitoring and analysis of performance indicators (technical, social, policy, environmental, gender)	UNIDO Project Manager (PM); PMU and M&E specialists as required	N/A	30,000	It will be part of PMU activity	Regularly to feed into project management and Annual Project Review
Project Implementation Reviews (PIRs)	PMU to prepare prior to the annual project review PM UNIDO to validate	N/A		It will be part of PMU activity	Annually

Type of M&E Activity	Responsible Partner	Budget (USD)	Co-financing (USD) (to be distributed accordingly during execution)	Remarks	Timeframe
	and finalize to submit to GEF				
Annual Project Review to assess project progress and performance	PMU, PM UNIDO HQ and Project Steering Committee to review the project performance and make corrective decision	N/A	30,000	It will be part of PMU activity	Annually prior to the finalization of APR/PIR and to the definition of annual work plans
Steering Committee (SC) Meeting	PMU, PM UNIDO HQ and Project Steering Committee	N/A		It will be part of PMU activity	Annually to coincide with the Annual Project Review and ad hoc when urgent and important decisions need approval of SC
Mid-term evaluation including survey to measure progress against baseline for investments, trainings and policy makers	PMU, external consultants, UNIDO PM, UNIDO Quality Monitoring Division (EVQQUA) in advising on TOR and selection of evaluators, Steering Committee and M&E specialists as required	20,000		Indicative cost	Mid of project
Final survey to measure progress against baseline for projects	UNIDO PM; PMU and M&E specialists as required	N/A	24,000	It will be part of PMU activity	At least two months prior to end of the project
Project Terminal Evaluation	UNIDO Independent Evaluation Division (EVQ/IEV), PMU, PM UNIDO HQ and Project Steering Committee, independent external evaluators	30,000		Indicative cost	Evaluation at least one month before the end of the project; report at the end of project implementation
Lessons learned (in annual project review and PIRs)	PMU, external consultants, UNIDO PM	N/A	20,000	It will be part of PMU activity	By the end of project implementation; annual as part of PIR
Visits to field sites	UNIDO PM	N/A	10,000	It will be part of PMU activity	Annually and on project completion
<b>TOTAL indicative cost</b>		<b>70,000</b>	<b>114,000</b>		

### PART III: CERTIFICATION BY GEF PARTNER AGENCY(IES)

#### A. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF policies<sup>53</sup> and procedures and meets the GEF criteria for CEO endorsement under GEF-6.

<b>Agency Coordinator, Agency name</b>	<b>Signature</b>	<b>Date (MM/dd/yyyy)</b>	<b>Project Contact Person</b>	<b>Telephone</b>	<b>Email</b>
Philippe R. Scholtès, Managing Director, Programme Development and Technical Cooperation, UNIDO-GEF Focal Point		12/21/2017	Mark Draeck, Industrial Development Officer, Department of Energy, UNIDO	+431-260- 26-5317	<a href="mailto:m.draeck@unido.org">m.draeck@unido.org</a>

<sup>53</sup> GEF policies encompass all managed trust funds, namely: GEFTF, LDCF, SCCF and CBIT

**LIST OF ANNEXES:**

ANNEX A: PROJECT RESULTS FRAMEWORK

ANNEX B: RESPONSES TO PROJECT REVIEWS

ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES

ANNEX D: CALENDAR OF EXPECTED REFLOWS

ANNEX E: CALCULATIONS FOR GHG EMISSION REDUCTIONS

ANNEX F: CHANGES ON THE PROJECT OUTCOMES AND OUTCOMES IN ALIGNMENT WITH THE PROJECT DESIGN WITH THE ORIGINAL PIF

ANNEX G: WORKPLAN

ANNEX H: BUDGET SHEET

ANNEX I: LEGAL CONTEXT

SEPARATE DOCUMENTS

ANNEX J: CO-FINANCING LETTERS (see separate zip file)

ANNEX K: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (see separate docx file)

ANNEX L: TRACKING TOOL (see separate excel file)

## ANNEX A: PROJECT RESULTS FRAMEWORK

PROJECT STRATEGY	OBJECTIVELY VERIFIABLE INDICATORS	INDICATOR (QUANTIFIED AND TIME-BOUND)	BASELINE	TARGET	SOURCE OF VERIFICATION	ASSUMPTIONS/RISKS
<b>PROJECT OBJECTIVE:</b>	Trigger sectoral transformation through application of modern bio-energy technologies to improve overall energetic performance, increase competitiveness and reduce greenhouse gas emissions in agro-industry	CO <sub>2</sub> emission reduced (tons of CO <sub>2eq</sub> ) due to new bioenergy projects [direct and indirect]  Energy generated from bioenergy technologies supported or promoted by project (in MWh)  No. of new bioenergy projects	800,000 Direct CO <sub>2eq</sub> emission reductions associated with new projects  0 Indirect CO <sub>2eq</sub> emission reductions associated with new projects  8 new agro bio-energy projects	Cumulative direct reduction of GHG emissions by about 440,000 tCO <sub>2eq</sub> over the period 2018-2037  Indirect emission reduction greater than 3,840,000 million tCO <sub>2eq</sub>  1.2 TWh energy generated annually from bio-energy through projects installed over the period 2018-2037 related to project  13 new bio-energy projects at SMEs installed between 2015 and 2019	GEF project tracking tool  Project documents	The Government remains committed to the development of RE  Implementation of project activities will foster investment in bioenergy technologies  Adequate resources mobilized
<b>Project Component 1 - Demonstration of modern bio-energy technologies and energy efficiency measures in the agro-industrial sector</b>						
<b>OUTCOME 1.1</b>	Modern bio-energy technologies demonstrated and ready for scale-up	Increase the number of installed bio-energy capacity with focus on thermal applications and increase the number of private sector players taking part in such project.	N/A	State-of-the-art technology and best practices to the country in the form of highly replicable innovative technology applications using agricultural residues implemented	Responses counted to call for projects  Project concepts submitted  Feasibility studies  Business plans  Project commissioning reports	No. of applications received is sufficient expectations  Commitment of project sponsors and investors maintained throughout project approval and implementation stage  Timely approval of finances/funds and permissions available
<b>Output 1.1.1</b>	20 business plans for sustainable supply chain management of agricultural residues prepared based on a call for applications and supported pre-assessment	No. of project ideas submitted for supply chain development  No. of farmers/project investors interested in developing supply chain projects	N/A	30-50 applications expected by year 1. Out of these, 20 applications fitting to the criteria (incl. social and gender mainstreaming impact) most, will be supported with business plan preparation by year 1  Participation from or by women in the project teams will be given extra points in the evaluation	Responses counted to call for projects  Project concepts submitted	The call for project is issued within 1 <sup>st</sup> year of project duration, to allow sufficient time for development, implementation and monitoring of projects  No. of applications received is sufficient expectations [requires adaptation of selection criteria otherwise]

PROJECT STRATEGY	OBJECTIVELY VERIFIABLE INDICATORS	INDICATOR (QUANTIFIED AND TIME-BOUND)	BASELINE	TARGET	SOURCE OF VERIFICATION	ASSUMPTIONS/RISKS
<b>Output 1.1.2</b>	25 feasibility studies for modern bio-energy technology applications with focus on process heat applications are prepared based on a call for projects and supported pre-assessment.	No. of project ideas submitted for bio-energy project development  No. of project investors interested in developing bio-energy projects	N/A	100-150 applications expected by year 1.  Out of these, 50 applications to be supported with TA (special assessment with focus on thermal energy demand – by Q2, year 2.  Out of the 50, 25 applications to be selected for further support (preparation of detailed feasibility study) – by end year 2	Responses counted to call for projects  Project concepts submitted	The call for project is issued within 1 <sup>st</sup> year of project duration, to allow sufficient time for development, implementation and monitoring of projects  No. of applications received is sufficient expectations [requires adaptation of selection criteria otherwise]
<b>Output 1.1.3</b>	10 supply chain and 12 bio-energy technology projects made bankable and linked with existing financing instruments for an accelerated scale-up across agro-industrial subsectors.	No. of projects qualifying against the call criteria and becoming eligible for TA support provided	N/A	10 biomass supply chain projects to receive further technical, financial and business development support (by Q2, year 3)  12 bio-energy technology projects to be made bankable (by Q2, year 3)	10 Business plans developed.  12 projects checked against their bankability	No. of projects succeeding into the phase of project assessment is sufficient.  Commitment of project sponsors and investors maintained throughout project development
<b>Output 1.1.4</b>	5 bio-energy supply chains and 5 innovative and highly replicable technology applications with an estimated total capacity of 10 MW <sub>th</sub> are realized and monitored for economic and energetic performance.	No. of projects qualifying against the call criteria and becoming eligible for TA support provided	N/A	5 biomass supply chain projects implemented with TA support and external financing (equity/credits) – by end of year 4.  5 innovative and highly replicable bio-energy technology applications with TA support and external financing (equity/credits) implemented (min. capacity 10 MW) – by end of year 4.  Continuous monitoring of technical performance ensured – by end of year 5.	EPC contracts / project commissioning reports  Monitoring reports (at least 1 year of continuous project monitoring ensured by COP)	No. of projects succeeding into the phase of project approval and implementation is sufficient.  Commitment of project sponsors and investors maintained throughout project approval and implementation stage  Timely approval of finances/funds and permissions available  Local engineers get well trained for the O&M of plants by the time of plant commissioning
<b>Project Component 2 - Refined policy and regulatory framework to enable transformation across sub-sectors</b>						
<b>OUTCOME 2.1</b>	Policy and regulatory environment is fine-tuned to enable scale-up of bio-energy plants	Policy and regulatory framework for bio-energy projects from agricultural residues is developed / accepted among	The country has policy framework and support mechanism with some significant gaps (e.g. heat supply,	Policy and regulatory framework (incl. policies, roadmaps, databases), supporting mechanism and financial mechanism are elaborated	Policy and regulatory guidelines document	Government of Turkey remains committed to promote biomass to improve the energy scenario in the country.

PROJECT STRATEGY	OBJECTIVELY VERIFIABLE INDICATORS	INDICATOR (QUANTIFIED AND TIME-BOUND)	BASELINE	TARGET	SOURCE OF VERIFICATION	ASSUMPTIONS/RISKS
		governmental stakeholders and private sector able to implement projects under that framework	sustainable crop management)			
<b>Output 2.1.1</b>	Sustainable crop management – Regulations concerning the use of agricultural resources	Appropriate policy and regulatory framework for bio-energy development developed and enforced.  Guidelines for sustainable crop management are developed  OPTIONAL: Support mechanism for biomass supply chains put in place	Missing policy, guidelines for sustainable crop management (amount of residues to remain in fields)	Guidelines for sustainable crop management regulations and policies (amount of residues to remain in fields)  Developing sustainable crop management guidelines materials (handbook, brochure) for farmers  Support mechanism for development of biomass supply chains developed and adopted (by end year 5) by cooperating with MoFAL (higher support for the projects with higher social and gender mainstreaming impact)	Policy document on sustainable biomass extraction and utilization available  Guidelines for farmers and other relevant stakeholders  Guideline document for supporting mechanism of biomass supply chain	Ministry of Food Agriculture and Livestock agree on the need and importance of the policy on sustainability.
<b>Output 2.1.2</b>	Policies and programs to integrate heat from biomass	Guidelines, policy and regulatory framework for thermal utilization including district heating and cooling of biomass developed and adopted.	Turkey does have a general policy framework for renewable energy installations, including a funding scheme for electricity generation. But none for heat supply.	Policy and regulatory framework for the thermal component of bio-energy systems (including district heating and cooling) developed and adopted (by Q3 year 3)	Policy and regulatory guidelines document and its strategic implementation plan.	Relevant government agencies (specially the ministries responsible for agriculture, energy and environment) agree on the need and importance of the improved policy.
<b>Output 2.1.3</b>	Incentive programs and financing schemes for bio-energy promotion	Bioenergy financing mechanism developed	Funding scheme and support mechanism only for electricity production	Financial mechanism (incl. social and gender sensitive grant support, financial guarantee or ESCO) to replicate biomass energy projects in the future explored and developed (by end year 5)	Financing scheme and incentive program documents, guidelines, implementation plans	Finance sector remains interested in financing bio-energy projects, and financing support mechanisms continuously developed further.

Project Component 3 - Capacity base strengthened and awareness raising increased

PROJECT STRATEGY	OBJECTIVELY VERIFIABLE INDICATORS	INDICATOR (QUANTIFIED AND TIME-BOUND)	BASELINE	TARGET	SOURCE OF VERIFICATION	ASSUMPTIONS/RISKS
<b>OUTCOME 3.1</b>	Capacities of key players strengthened and information made available to market enablers and major stakeholders	Key stakeholders (government, private sector decision-makers, technical/operation staff) are capacitated and made aware of the vast potential biomass from agricultural resources has for energy uses.	Insufficient awareness, capacity and knowledge among key stakeholders	Capacities of main stakeholders strengthen and awareness raised	Project website Training materials Academic papers Promotional materials	Interest from the government, universities, research institutes and private stakeholders in giving/receiving tailor-made trainings and knowledge on bioenergy
<b>Output 3.1.1</b>	Awareness on biomass technologies increased through the development of tailored knowledge products to facilitate technology transfer in the agro-industry	Website hits and social media activities Number of training programs developed and organized Number of trained people at academic level Number of master and PhD thesis and academic papers Training course implemented Replication strategy developed	There are some technical universities and academic R&D institutions across the country, which focus on renewable energy technologies or agricultural resources research. However, specialized know-how for the development of specific business models on supply chain development and technical know-how on O&M, financing and implementation of bio-energy projects is lacking.	A project website developed and social media platforms integrated (e.g. Facebook, Twitter) – by Q2 year 1) Energy monitoring concept (by year 1) and analysis report developed (by year 5) Five master students (50% female) and 2 PhD (50% female) candidates accompanied in developing theses on bio-energy resources related topics (by end year 3) Publications of 5 papers (50% by female researchers) and participation in 5 relevant conferences and symposia on project related topics (by end year 4) Implementation of 1 training course (50% female participants) at academic level during at least 2 semesters (by end year 5) Developing of a replication strategy (by end year 5) Organizing 2 national symposia (50% female participants)	Project website Energy monitoring report Master/PhD thesis Papers and participation certificate of conferences Training curricula for academic courses Training materials Replication strategy document Outcome reports and participants lists of symposia	Research institutes to commit co-financing from their regular budget or from special funding schemes for R&D activities. Potential candidates from Universities, Faculties, Institutes and Departments on agriculture, energy, science, and technology interested in participation of awareness/capacity-building measures
<b>Output 3.1.2</b>	Capacity and knowledge of 50 decision makers in government and private sector are improved through 5	Number of public and private sector stakeholders participating in trainings Number of trainings	At present there is less awareness, confidence and linkages among various stakeholders for bio-energy development and its	Information package (gender-sensitive) on bio-energy development and benefits for awareness creation and basic training developed (by Q2, year 1) 5 x 2 days of decision makers awareness workshops (40% female participants)	Information material developed and disseminated Advertisement through sector	Public and private stakeholders maintain interest in the topic and participate in dedicated information and awareness workshops. All foreseen 5 workshops are



PROJECT STRATEGY	OBJECTIVELY VERIFIABLE INDICATORS	INDICATOR (QUANTIFIED AND TIME-BOUND)	BASELINE	TARGET	SOURCE OF VERIFICATION	ASSUMPTIONS/RISKS
	tailored workshops	organized Number of specific awareness materials disseminated	benefits. There are no funding/legal commitments for bio-energy projects so far.	delivered across the country (by end year 1)	specific media channels and direct mailings	delivered with sufficient participation (min. 50 participants).
<b>Output 3.1.3</b>	Capacity building mechanism for O&M, technical and service roles is established to develop and retain skilled workforce for innovative bio-energy technologies in industry through training of 20 trainers and 550 engineers, technicians, governmental and financial stakeholders, in cooperation with technical partners through 15 workshops	Number of trained engineers and technical staff Number of trained government staff to remove regulatory/implementation barriers Number of trained financial sector stakeholders and executive officers Number of farmers participating in roadshows	N/A	Training of 20 trainers (2x3 days) (40% female participants) An on-site training for trainers to gain knowledge and exposure to international best practice (3 days) (40% female participants) Training of 450 engineers, technical staff at SME/industries (9 workshops x 2 days) across the country on O&M and design/operational issues concerning bio-energy plants. (30% female participants) Training of 50 government staff (2x2 days) on bio-energy utilization and regulatory aspects/barrier removal. (50% female participants) Training for 50 financial sector stakeholders and executive officers from industry (2x2 days) on risk assessment and financial support (50% female participants) Active participation of over 50 farmers trade shows, targeting over 5000 farmers. (25% female participants)	Training materials developed (for ToT and trainees) and distributed among participants On-site training agenda Participants lists to the workshops Awareness & knowledge dissemination package for farmers (for roadshows) with focus on supply chain development Photographs of the on-site training, workshops and trade shows	Private sector representatives and other stakeholders are interested in participation in such fora. TR Government remains committed for development of biomass capacities/know-how through private sector participation.
<b>Project Component 4 - Monitoring and evaluation</b>						
<b>OUTCOME 4.1</b>	Project's progress towards objectives continuously monitored and evaluated	Timely implementation of the project and project targets and indicators properly monitored throughout the	N/A	Project progress and an overall project impact assessment periodically monitored and evaluated	Evaluation Reports Monitoring Reports Lessons learnt report	Capability and experience of project management unit Government and private sector are interested in the fact and figures

PROJECT STRATEGY	OBJECTIVELY VERIFIABLE INDICATORS	INDICATOR (QUANTIFIED AND TIME-BOUND)	BASELINE	TARGET	SOURCE OF VERIFICATION	ASSUMPTIONS/RISKS
		project duration				
<b>Output 4.1.1</b>	Project monitoring and evaluation	List of all progress reports prepared Mid-term and terminal evaluation conducted Number of project and steering committee meetings Number of dissemination materials	N/A	M&E Plan ready within 3 months of project start Mid-term evaluation completed by project mid-term Terminal evaluation completed by end of project closing time Project terminal report completed by end of project Dissemination materials ready by the end of project	Progress Reports Mid-term evaluation Report Terminal evaluation Report Project terminal report Copies of dissemination material	Appropriate capability of the Project Manager and Project Director exist for proper management and monitoring of the project. Project gets commissioned successfully and the expected outputs achieved sustainably.
<b>Output 4.1.2</b>	Technical performance of demonstration projects monitored and publicized	Monitoring reports of successfully implemented projects Report on lessons learnt	N/A	10 monitoring reports documenting successful project implementation of demonstrations Lessons learnt from the project drafted by Q2, year 5	Monitoring reports Lessons learnt report	Government and private sector accept the fact and figures produced from the projects' experiences.

## ANNEX B: RESPONSES TO PROJECT REVIEWS

(from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF).

### **GEF SECRETARIAT comments at PIF stage relevant for CEO Endorsement Request stage:**

none.

### **GEF STAP Comments received:**

1. The aim is to use biomass resources for process heat in the less developed regions of the country (although the concept can be just as effective in more developed areas as exemplified by large scale bioenergy uptake in Sweden and other Scandinavian countries for both heat and power).

*Response: the focus on less developed regions is no longer as strong as at PIF stage for the following reasons: a) the availability of agricultural residues and thus the basis for replication is of higher priority than other development indicators for the selection of regions; b) the sub-projects are to be co-financed by commercial finance institutions which also rate the risk higher in the less developed regions.*

2. The biomass resources in Turkey have been identified and quantified. Utilizing green waste streams for biogas is commendable and well understood in many countries, for example Germany and Denmark where community scale, municipal scale and farm scale systems have been operating successfully for decades. Maintenance of the plant is critical so including training in this regard is good.

*Response: besides training (which is included) it has been realized during PPG-phase, that also long term support for feed in tariffs or similar in a very sustainable manner is crucial, as otherwise the investments will be shut down by the end of the currently very attractive feed in tariff. Germany, Austria and others show similar experiences of shut-downs at the end of the feed-in-tariff.*

Capacity building is an important component as bioenergy is labor intensive compared with most other renewable energy systems. Where feasible, the co-generation of both electricity and useful heat (combined heat and power) should be encouraged to maximize the efficiency of the bioenergy conversion process.

*Response: Already at PIF stage the focus of the project was on heat use and heat integration from biomass. This focus on thermal energy use has been enhanced now due to the fact that electric power generation from biomass is financially attractive and beyond the phase of early adopters, and further because the concept of heat use, cogeneration and (waste) heat integration into industrial process is currently very unknown and has no market nor a regulatory framework therefore.*

4. The mitigation potential (section 1.5) is based on "initial assumptions" but it is not clear what these are to evaluate the figure quoted for the demonstration plants. Indirect emission reductions were based on GEF methodology so it is assumed that the direct emission calculations were too.

*Response: As described in Section A.1.5. and Annex E the assumptions have been further elaborated and the figures for direct emission calculations are based on planned investments and associated benchmarks for specific costs and energy output, hence very much detailed and in line with the GEF methodology.*

5. The risks are well outlined but there are two gaps in the proposal that should be addressed:

a. "Sustainable use of modern biomass will be promoted in the project; relevant standards and certification schemes will be applied where necessary". Although in the project title, the word "Sustainable" has not been defined in the proposal. Nor is it clear exactly what standards and certification schemes are to be used. The EU has spent much effort on ensuring any sources of biomass used for energy are produced in a sustainable way so much can be learned from their actions and policies. In addition, the Global Bioenergy Partnership (GBEP) has coordinated work in this area and produced a set of sustainability indicators that could be used in this project: <http://www.globalbioenergy.org/>

*Response: on the topic of "sustainable biomass" the focus will be to ensure that by removing the residues from the field, the soil quality and hence sustainability of crop production will be ensured and potentially also improved as compared to burning on the field. The project's output 2.2 (Component 2) targets the development of sustainability indicators and recommendations concerning the amount of residues that should be left on the fields (as for the beginning at least 25 %, which is the least recommendation by GBEP); further a monitoring system will be developed at a local level to monitor the sustainability of biomass extraction and to enforce restrictions if*

needed, and the development of guidelines for proper management of bio-energy areas where on a yearly basis the harvesting for energy and the practice of mixing with the soil are alternated. To back-up these new frameworks by localizing international know-how, technical support will come from TAGEM's Department of Soil and Water Resources Research.

b. "Lack of a modern biomass supply chain" is considered a barrier but no discussion is evident on exactly how the biomass resources are to be delivered to the bioenergy conversion plant. There is good literature on this, some which shows inefficient methods of transport and storage can cost several times more than other methods (see for example Chapter 4 in [http://www.amazon.com/The-Brilliance-Bioenergy-Business-1-Practice/dp/190291628X#reader\\_190291628X](http://www.amazon.com/The-Brilliance-Bioenergy-Business-1-Practice/dp/190291628X#reader_190291628X)), especially when relatively wet biomass is carted when, if to be combusted, it could first be left to dry naturally over a period. This transport and logistics aspect of biomass is often neglected when planning a bioenergy system and can be a costly omission.

Response: indeed the aspect of a supply chain was not a focus at PIF-stage, but is very prominently included now. Based on the findings from the PPG-phase (workshops, site visits and bilateral consultations) the priority of this aspect has been elevated and is now a major output (Output 1.1 and 1.4). The project intends to support at least 5 (ideally 8) sub-projects by providing financial support for investments into hardware for collection and transport of agricultural residues and in total 25 proponents with specific TA for the development of biomass-supply focused businesses and markets. It is expected that either farmers build cooperatives (energy cooperatives) or that larger individual farmers or custom harvesting companies enlarge their businesses for the collection and processing of biomass and become active players in the supply chain.

#### ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS<sup>54</sup>

PPG Grant Approved at PIF: <b>150,000</b>			
<i>Project Preparation Activities Implemented</i>	<i>GETF/LDCF/SCCF/CBIT Amount (\$)</i>		
	<i>Budgeted Amount</i>	<i>Amount Spent To date</i>	<i>Amount Committed</i>
Development of CEO Endorsement document – engagement of specialised contractor	99,935	99,935	0
Supporting activities (consultation and validation workshops; dissemination materials; detailed negotiation with governmental and private sector stakeholders; recruitment of national expert etc.)	50,065	19,880	30,185
<b>Total</b>	<b>150,000</b>	<b>119,815</b>	<b>30,185</b>

#### ANNEX D: CALENDAR OF EXPECTED REFLOWS (IF NON-GRANT INSTRUMENT IS USED)

No reflows are expected.

<sup>54</sup> If at CEO Endorsement, the PPG activities have not been completed and there is a balance of unspent fund, Agencies can continue to undertake the activities up to one year of project start. No later than one year from start of project implementation, Agencies should report this table to the GEF Secretariat on the completion of PPG activities and the amount spent for the activities. Agencies should also report closing of PPG to Trustee in its Quarterly Report.

## ANNEX E: CALCULATIONS FOR GHG EMISSION REDUCTIONS

The GHG emission reductions have been calculated using the GEF methodology for demonstration and diffusion projects. The summary of the results can be found in Table 9. The full table in MS Excel is part of the CEO Endorsement Request package.

**Table 9: Overall results of the GHG ER calculation using the GEF methodology for demonstration and diffusion projects (rounded values)**

All Components	Cumulative			Annual			
	Total	2018-2022	2023-2037	2018	2022	2025	2035
Direct Electricity Savings (MWh)	52,800	10,560	42,240	0	3,520	3,520	3,520
Direct Coal Lignite Savings (MWh)	1,133,259	255,985	877,275	0	75,551	75,551	31,665
Direct Diesel Savings (MWh)	0	0	0	0	0	0	0
Direct Natural Gas Savings (MWh)	0	0	0	0	0	0	0
Direct Total Energy Savings (MWh)	1,186,059	266,545	919,515	0	79,071	79,071	35,185
Direct GHG Emission Savings (tCO2)	439,456	98,557	340,900	0	29,297	29,297	13,340
Direct Post-project GHG Emission Savings (tCO2)	0		0	0	0	0	0
Indirect Bottom-up Emission Savings (tCO2)	<b>3,840,000</b>		<b>3,840,000</b>				
Indirect Top-down Emission Savings (tCO2)	<b>10,000,000</b>		<b>10,000,000</b>				

The main inputs to this methodology (energy savings) were calculated based on the available investment support and co-financing rate for the four case studies. Further specific investment costs and capacity factors for the different technologies have been assumed. Since these investments will use modern state-of-the-art technology into existing plants, an improvement of efficiency in combustion, control and distribution is further assumed.

**Table 10: Estimation of energy savings for the 4 case studies based on investment available and specific cost of investment and capacity factors**

Case	Grant Funding available	Share of grant funding	Total Investment	Spec. Investment cost	Installed Capacity / capacity factor	Operating hours per year	Efficiency improvements	Energy Savings Coal / Electricity
	USD	%	USD	USD/kW	MW	h/y	%	MWh/y
Direct combustion (heat)	366,667	30%	1,222,222	1000	1.22 / 0.7	6000	114%	5,867 / 0
On-Site co-generation (heat & power)	366,667	30%	1,222,222	500	2.44 / 0.9	8000	129%	13,577 / 7040
Heat integration from power generation	366,667	30%	1,222,222	300	4.07 / 0.8	8000	113%	29,333 / 0
				Harvesters / collectors	Annual Cap	Heat content of biomass	Efficiency improvements	Savings Coal
				#	t/y	MWh/t		
Supply Chain (heat) various	1,305,000	50%	2,610,000	8.7	40000 / 0.8	4.8	114%	175,543

The indirect-bottom-up savings are calculated with an assumed replication factor of 3.

For the indirect top-down approach the total market potential for bio-energy from sustainable agricultural residues was estimated and assumed to be replacing lignite coal in slightly more efficient (+14 %) combustion processes. This would lead to a reduction of 10 million t/y of CO<sub>2</sub>\_eq, or 150 million t CO<sub>2</sub>eq over 15 years. The causality factor was assumed to be weak (15 %), as it is very unlikely that this huge biomass potential will be transformed in the next 15 years.

Further, the grid electricity emissions factor (0.519 t CO<sub>2</sub>/MWh) was used from a recent study by Bureau Veritas, and grid electricity transfer and distribution losses were set to zero, as we look at the on-site power generation with combined heat and power plants. Lifetime of the technology was assumed to be 15 years.

**ANNEX F: CHANGES ON THE PROJECT OUTCOMES AND OUTCOMES IN ALIGNMENT WITH THE PROJECT DESIGN WITH THE ORIGINAL PIF**

Project Components		Project Outcomes		Project Outputs		GEF Funding (USD)		Co-financing (USD)	
PIF	CEO	PIF	CEO	PIF	CEO	PIF	CEO	PIF	CEO
1. Demonstration of modern bio-energy technologies and energy efficiency measures in the agro-industrial sector	<i>1. Demonstration of modern bio-energy technologies and energy efficiency measures in the agro-industrial sector</i>	1. Modern bioenergy technologies demonstrated and ready for scale-up	<i>1. Modern bio-energy technologies demonstrated and ready for scale-up</i>	1.1 Feasibility studies based on detailed techno-economic potentials of bio-energy in agro-industry (per geographical region) are further refined, with focus on economically less developed regions in the country	<i>1.1.1 Twenty business plans for sustainable supply chain management of agricultural residues prepared based on a call for applications and supported pre-assessment</i>	800,000	<i>800,000</i>	4,000,000	<i>5,000,000</i>
				1.2 Modern bio-energy (and energy efficiency) technology applications in selected SME subsectors are prepared, with focus on process heat applications	<i>1.1.2 Twenty-five feasibility studies for modern bio-energy technology applications with focus on process heat applications are prepared based on a call for projects and supported pre-assessment</i>				
				1.3 Linkage with existing financing instruments established for an accelerated scale up across agro-industrial subsectors	<i>1.1.3 Ten supply chain and twelve bio-energy technology projects made bankable and linked with existing financing instruments for an accelerated scale-up across agro-industrial subsectors</i>				
				1.4 An estimated 5-7 innovative and highly replicable technology applications with an estimated total capacity of 2.3 MW (or equivalent) in targeted sub-sectors as pilot facilities are realized	<i>1.4 Five sustainable bio-energy supply chains and five innovative and highly replicable technology applications with an estimated total capacity of 10 MW<sub>th</sub> are realized and monitored for economic and energetic performance</i>	2,400,000	<i>2,400,000</i>	16,800,000	<i>17,000,000</i>

2. Refined policy and regulatory framework to enable transformation across sub-sectors	<i>2. Refined policy and regulatory framework to enable transformation across sub-sectors</i>	2. Policy and regulatory environment is fine-tuned to enable scale-up of bio-energy plants	<i>2. Policy and regulatory environment is fine-tuned to enable scale-up of bio-energy plants</i>	2.1 Sectoral policies, plans, programs, associate legislative and regulatory instruments are analysed and tailored recommendations for improvement are developed  2.2 Strategic roadmap is developed to enhance use of agricultural and agro-food waste streams for industrial renewable energy applications in target sub- sectors, with focus on process heat applications	<i>2.1.1 Sustainable crop management – Regulations concerning the use of agricultural resources</i>  <i>2.1.2 Policies and programs to integrate heat from biomass</i>  <i>2.1.3 Incentive programs and financing schemes for bio-energy promotion</i>	500,000	<i>350,000</i>	2,500,000	<i>2,750,000</i>
3. Capacity base strengthened and awareness raising increased	<i>3. Capacity base strengthened and awareness raising increased</i>	3. Capacities of key players strengthened and information made available to market enablers and major stakeholders	<i>3. Capacities of key players strengthened and information made available to market enablers and major stakeholders</i>	3.1 Capacity building mechanism for O&M, technical and service roles is established to develop and retain skilled workforce for innovative bio-energy technologies in industry through training of 400 technicians, 50 senior management level decision makers, 50 government representatives, and 50 trainers of trainers, in cooperation with technical partners (e.g. academic, industry associations etc.) through 25 workshops  3.2 Capacity and knowledge of 50 decision makers in government and private sector are improved	<i>3.1.1 Awareness on biomass technologies increased through development of tailored knowledge products to facilitate technology transfer in the agro-industry</i>  <i>3.1.2 Capacity and knowledge of 50 decision makers in government and private sector are improved through 5 tailored workshops</i>  <i>3.1.3 Capacity building mechanism for O&amp;M, technical and service roles is established to develop and retain skilled workforce for innovative bio-energy technologies in industry through training of 20 trainers and 550 engineers, technicians, governmental and financial stakeholders, in cooperation with technical partners through 15 workshops<sup>55</sup></i>	405,914	<i>555,914</i>	2,529,570	<i>3,297,400</i>

<sup>55</sup> The number of workshops is decreased to 15 from 25 (PIF) as TAGEM’s facilities can host larger number of participants.



				through 5 tailored workshops  3.3 Awareness in relevant sectors about biomass technologies increased through the development of tailored knowledge products to facilitate technology transfer in the agroindustry					
4. Monitoring and evaluation.	<i>4. Monitoring and evaluation.</i>	4. Project's progress towards objectives continuously monitored and evaluated	<i>4. Project's progress towards objectives continuously monitored and evaluated</i>	4.1 A monitoring and evaluation plan will be prepared and carried out.	<i>4.1.1 A monitoring and evaluation plan will be prepared and carried out.</i>  <i>4.1.2 Technical performance of demonstration projects will be monitored and publicized</i>	100,000	<i>100,000</i>	500,000	<i>500,000</i>
Sub-total						4,205,914	<i>4,205,914</i>	26,329,570	<i>28,547,400</i>
Project Management Cost (PMC)						210,296	<i>210,296</i>	1,051,480	<i>1,051,480</i>
<b>Total project costs</b>						<b>4,416,210</b>	<b><i>4,416,210</i></b>	<b>27,381,050</b>	<b><i>29,598,880</i></b>



## ANNEX H: BUDGET SHEET

The budget sheet is tentative and exact amounts will be finalized with the relevant execution partners in the inception phase of the project.

	Type of Expense	GEF Grant Budget Component 1												Execution Modality	
		Yr 1		Yr 2		Yr 3		Yr 4		Yr 5		Output Total			
		w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$		
1.1.1 Twenty business plans for sustainable supply chain management of agricultural residues prepared based on a call for applications and supported pre-assessment	International Expertise	5	19,000	22	76,000							27	95,000	Execution Agreement with TAGEM	
	Local Travel		1,000		1,000								2,000	Execution Agreement with TAGEM	
	National Expertise	28	21,000	64	48,000							92	69,000	Execution Agreement with TAGEM	
	Training/Workshops														
	Equipment														
	Miscellaneous														
	<b>Output sub-total</b>		33	41,000	86	125,000							119	166,000	
1.1.2 Twenty-five feasibility studies for modern bio-energy technology applications with focus on process heat applications are prepared based on a call for projects and supported pre-assessment	International Expertise	5	19,000	75	261,251							80	280,250	Execution Agreement with TAGEM	
	Local Travel		1,000		1,000								2,000	Execution Agreement with TAGEM	
	National Expertise	20	15,000	220	165,000							240	180,000	Execution Agreement with TAGEM	
	Subcontract for services (academia)				37,800									37,800	Execution Agreement with TAGEM
	Equipment														
	Miscellaneous														
	<b>Output sub-total</b>		25	35,000	295	465,051							320	500,050	
1.1.3 Ten supply chain and twelve bio-energy technology projects made bankable and linked with existing financing instruments for an accelerated scale-up across agro-industrial subsectors	International Expertise			7	23,750	7	23,750					14	47,500	Execution Agreement with TAGEM	
	Local Travel				1,000		1,000						2,000	Execution Agreement with TAGEM	
	National Expertise			32	24,000	32	24,000					64	48,000	Execution Agreement with TAGEM	
	International Workshop				2,000		3,000							5,000	Execution Agreement with TAGEM
	Equipment														
	Miscellaneous				2,000		2,000							4,000	Execution Agreement with TAGEM
	<b>Output sub-total</b>				39	52,750	39	53,750					78	106,500	
1.1.4 Five sustainable bio-energy supply chains and five innovative and highly replicable technology applications with an estimated total capacity of 10 MWthe are realized and monitored for economic and energetic performance	International Expertise							3	9,500			3	9,500	Execution Agreement with TAGEM	
	Local Travel								1,000		1,000		2,000	Execution Agreement with TAGEM	
	National Expertise							16	12,000			16	12,000	Execution Agreement with TAGEM	
	Training/Workshops														
	Equipment						1,070,000		1,200,000		130,000		2,400,000	UNIDO Technical Execution Support	
	Miscellaneous								3,950				3,950	Execution Agreement with TAGEM	
	<b>Output sub-total</b>						1,070,000	19	1,226,450		131,000	19	2,427,450		
<b>TOTAL Component 1</b>		59	76,000	419	642,800	39	1,123,750	19	1,226,450		131,000	536	3,200,000		

2. Refined policy and regulatory framework to enable transformation across sub-sectors	Type of Expense	GEF Grant Budget Component 2												Execution Modality
		Yr 1		Yr 2		Yr 3		Yr 4		Yr 5		Output Total		
2.1.1 Sustainable crop management – Regulations concerning the use of agricultural resources		w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	
	International Expertise	12	45,600	3	11,400							15	57,000	Execution Agreement with TAGEM
	Local Travel		1,500		1,500								3,000	Execution Agreement with TAGEM
	National Expertise	32	24,000	9	6,750							41	30,750	Execution Agreement with TAGEM
	Training/Workshops													
	Equipment													
	Miscellaneous (guidelines for farmers, design, printing)				9,250								9,250	Execution Agreement with TAGEM
	<b>Output sub-total</b>	44	71,100	12	28,900							56	100,000	
2.1.2 Policies and programs to integrate heat from biomass		w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	
	International Expertise			12	40,200	9	30,150						70,350	Execution Agreement with YEGM
	Local Travel													
	National Expertise	5	4,250	12	10,200	12	10,200	2	1,700				26,350	Execution Agreement with YEGM
	Training/Workshops													
	Equipment													
	Miscellaneous (printing)								3,300				3,300	Execution Agreement with YEGM
	<b>Output sub-total</b>	5	4,250	24	50,400	21	40,350	2	5,000				100,000	
2.1.3 Incentive programs and financing schemes for bio-energy promotion		w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	
	International Expertise			6	21,000	12	42,000					18	63,000	Execution Agreement with YEGM
	Local Travel				2,000		2,000						4,000	Execution Agreement with YEGM
	National Expertise			24	18,000	36	27,000			7	5,250	67	50,250	Execution Agreement with YEGM
	Training/Workshops				9,000		9,000				9,750		27,750	Execution Agreement with YEGM
	Equipment													
	Miscellaneous (printing, communication etc.)						5,000						5,000	Execution Agreement with YEGM
	<b>Output sub-total</b>			30	50,000	48	85,000			7	15,000	85	150,000	
	<b>TOTAL Component 2</b>	<b>44</b>	<b>71,100</b>	<b>42</b>	<b>78,900</b>	<b>48</b>	<b>85,000</b>			<b>7</b>	<b>15,000</b>	<b>141</b>	<b>350,000</b>	

		GEF Grant Budget Component 3												
3. Capacity base strengthened and awareness raising increased	Type of Expense	Yr 1		Yr 2		Yr 3		Yr 4		Yr 5		Output Total		Execution Modality
		w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	
3.1.1 Awareness on biomass technologies increased through development of tailored knowledge products to facilitate technology transfer in the agro-industry	International Expertise													
	Local Travel - Participation to symposia		500		500		500		500		500		2,500	Execution Agreement with TAGEM
	National Expertise		8,000		8,000		8,000		8,000		8,000		40,000	Execution Agreement with TAGEM
	Subcontract for Services (academia)								56,500				56,500	Execution Agreement with TAGEM
	Printing								1,500		1,500		3,000	Execution Agreement with TAGEM
	Subcontract for Services (website+social media)		5,000		2,000		2,000		2,000		2,000		13,000	Execution Agreement with TAGEM
	<b>Output sub-total</b>		13,500		10,500		10,500		68,500		12,000		115,000	
		w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	
3.1.2 Capacity and knowledge of 50 decision makers in government and private sector are improved through 5 tailored workshops	International Expertise	4	14,000									4	14,000	Execution Agreement with TAGEM
	Local Travel of participants		11,000										11,000	Execution Agreement with TAGEM
	National Expertise	24	18,000									24	18,000	Execution Agreement with TAGEM
	Training/Workshops		12,000				15,000						27,000	Execution Agreement with TAGEM
	Equipment													
	Miscellaneous													
	<b>Output sub-total</b>	28	55,000				15,000						28	70,000
	w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$		
3.1.3 Capacity building mechanism for O&M of bioenergy plants is developed and implemented through training of targeted 400 technicians, 50 senior management level decision makers, 50 government representatives, and 50 trainers of trainers, in cooperation with technical partners through 25	International Expertise	3	10,500	3	10,500	3	10,500	6	20,900	6	21,000	73,400	62,903	Execution Agreement with TAGEM
	Local Travel		1,500		1,500		1,500		1,500		10,511		16,511	Execution Agreement with TAGEM
	National Expertise	24	18,000	24	18,000	48	36,000	48	36,000	48	36,000	192	144,000	Execution Agreement with TAGEM
	Training (ToT /study tour for trainers)								20,000				20,000	Execution Agreement with TAGEM
	Trainings/Symposia		17,500		25,000		17,500		17,500		25,000		102,500	Execution Agreement with TAGEM
	Participation in trade shows		5,000		5,000		5,000		5,000		5,000		25,000	Execution Agreement with TAGEM
	<b>Output sub-total</b>	27	52,500	27	60,000	51	70,500	54	100,900	54	97,511	73,592	370,914	
<b>TOTAL Component 3</b>	<b>55</b>	<b>121,000</b>	<b>27</b>	<b>70,500</b>	<b>51</b>	<b>96,000</b>	<b>54</b>	<b>169,400</b>	<b>54</b>	<b>109,511</b>	<b>73,620</b>	<b>555,914</b>		

		GEF Grant Budget Component 4												
4. Monitoring and evaluation.		Yr 1		Yr 2		Yr 3		Yr 4		Yr 5		Output Total		Execution Modality
Type of Expense		w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	
4.1.1 A monitoring and evaluation plan will be prepared and carried out.	International Expertise	3	10,450			4	12,540			5	18,810	12	41,800	UNIDO as Implementing Agency
	Local Travel						2,000				4,000		6,000	UNIDO as Implementing Agency
	National Expertise	7	5,100			8	6,120			12	9,180	27	20,400	UNIDO as Implementing Agency
	Training/Workshops													
	Equipment													
	Miscellaneous													
<b>Output sub-total</b>		<b>10</b>	<b>15,550</b>			<b>12</b>	<b>20,660</b>			<b>18</b>	<b>31,990</b>	<b>39</b>	<b>68,200</b>	
4.1.2 Technical performance of demonstration projects will be monitored and publicized	International Expertise									3	11,400	3	11,400	UNIDO as Implementing Agency
	Local Travel										1,500		1,500	UNIDO as Implementing Agency
	National Expertise									24	18,000	24	18,000	UNIDO as Implementing Agency
	Training/Workshops													
	Equipment													
	Miscellaneous										900		900	UNIDO as Implementing Agency
<b>Output sub-total</b>										<b>27</b>	<b>31,800</b>	<b>27</b>	<b>31,800</b>	
<b>TOTAL Component 4</b>		<b>10</b>	<b>15,550</b>			<b>12</b>	<b>20,660</b>			<b>45</b>	<b>63,790</b>	<b>66</b>	<b>100,000</b>	
		Project Management Costs (PMC)												
Project Management Costs (PMC)		w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	w/w	\$	
Local Travel			3,000		1,000		2,000		1,496		2,000		9,496	UNIDO Admin. Exe. Support
National Expertise (Techn.		51	38,560	51	38,560	51	38,560	51	38,560	51	38,560	257	192,800	UNIDO Admin. Exe. Support
National Expertise														
Training/Workshops														
International meeting			2,000		1,000		1,000		2,000		2,000		8,000	UNIDO Admin. Exe. Support
Miscellaneous														
<b>TOTAL PMC</b>		<b>51</b>	<b>43,560</b>	<b>51</b>	<b>40,560</b>	<b>51</b>	<b>41,560</b>	<b>51</b>	<b>42,056</b>	<b>51</b>	<b>42,560</b>	<b>257</b>	<b>210,296</b>	
<b>Total</b>		<b>Year 1: 327,210</b>		<b>Year 2: 832,761</b>		<b>Year:3 1,366,970</b>		<b>Year 4: 1,437,906</b>		<b>Year 5: 361,861</b>		<b>TOTAL</b>	<b>4,416,210</b>	

## ANNEX I: LEGAL CONTEXT

The following legal context will apply to the project: “The Government of the Republic of Turkey agrees to apply to the present project, mutatis mutandis, the provisions of the Revised Standard Technical Assistance Agreement concluded between the United Nations and the Specialized Agencies and the Government on 21 October 1965.”