



Investing in rural people

## Kingdom of Cambodia

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Building Adaptive Capacity through the Scaling-up of  
Renewable Energy Technologies in Rural Cambodia (S-RET)

Project Design Report

Main report and appendices

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## Currency equivalents

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Currency Unit		
US\$1.0	=	KHR 4000

## Weights and measures

1 kilogram	=	1000 g
1 000 kg	=	2.204 lb.
1 kilometre (km)	=	0.62 mile
1 metre	=	1.09 yards
1 square metre	=	10.76 square feet
1 acre	=	0.405 hectare
1 hectare	=	2.47 acres

## Abbreviations and acronyms

ADB	Asian Development Bank
ASPIRE	Agriculture Services Programme for Innovation, Resilience and Extension
CARD	Council for Agricultural and Rural Development
CARDI	Cambodia Agricultural Research and Development Institute
CCCAP	Cambodia Climate Change Action Plan
CCCA-TF	Cambodia Climate Change Alliance – Trust Fund
CEW	Commune Extension Worker
CO <sub>2</sub>	Carbon dioxide
CO <sub>2e</sub>	Carbon dioxide equivalent
COSOP	Country Strategic Opportunities Programme
DAO	District Agriculture Office
FFS	Farmer Field School
GDA	General Directorate of Agriculture
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GRF	Group Revolving Fund
ID Poor	Identification of Poor Household Programme, Ministry of Planning
IFAD	International Fund for Agricultural Development
IGRF	Improved Group Revolving Fund
IRR	Internal Rate of Return
M&E	Monitoring and Evaluation
MAFF	Ministry of Agriculture, Forestry and Fisheries
MEF	Ministry of Economy and Finance
MFI	Micro-finance Intermediary
MIS	Management Information System
MoE	Ministry of Environment
MOI	Ministry of Interior
MME	Ministry of Mines and Energy
MoWA	Ministry of Women's Affairs
MoWRAM	Ministry of Water Resources and Meteorology
MRD	Ministry of Rural Development
N <sub>2</sub> O	Nitrous oxide
NAPA	National Adaptation Plan of Action
NBP	National Biodigester Programme
NCDD	National Committee for Sub-National Democratic Development
NCDDS	NCDD Secretariat
NCSD	National Council for Sustainable Development
NGO	Non-Governmental Organization
NPDD	National Programme for Democratic Development
NPV	Net Present Value
NSDP	National Socio-economic Development Plan
PADEE	Project for Agricultural Development and Economic Empowerment
PDA	Provincial Department of Agriculture
PDoWA	Provincial Department for Women's Affairs
PDoWRAM	Provincial Department for Water Resources and Meteorology
PDRD	Provincial Department for Rural Development
PIM	Project Implementation Manual
PPF	Project Preparation Facility
PV	Photo-voltaic
RAU	Royal Agricultural University

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RET	Renewable Energy Technologies
RGC	Royal Government of Cambodia
RIMS	Results and Impact Management System
SCCF	Special Climate Change Fund (of GEF)
SNEC	Supreme National Economic Council
SOP	Standard Operating Procedures
TA	Technical Assistance
TAP	Technology Action Plan
TNA	Technology Needs Assessment
TSSD	Tonle Sap Poverty Reduction and Smallholder Development Project
TWG- CCAFF	Technical Working Group on Climate Change of MAFF
UNCT	United Nations Country Team
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAHW	Village Animal Health Worker

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## Map of the project area

### Building Adaptive Capacity through the Scaling-up of Renewable Energy Technologies in Rural Cambodia (S-RET)

*Design report*



The designations employed and the presentation of the material in this map do not imply the expression of any opinion whatsoever on the part of IFAD concerning the delimitation of the frontiers or boundaries, or the authorities thereof.

Map compiled by IFAD

## I. Executive Summary<sup>1</sup>

### Country Context

1. Despite rapid growth and poverty reduction Cambodia remains a least developed country and highly vulnerable to climate change. Around 80% of the population live in rural areas and are fully or partially dependent on agriculture for their livelihoods. Agriculture is dominated by rice-based farming systems with most rice production reliant on annual wet-season rainfall. Climate change projections show Cambodia becoming hotter, with increased rainfall in the wet season and reduced rainfall in the dry season. These changes will be challenging for farmers who already report that the climate has become less predictable, making it difficult for them to select the optimal time to plant rice and other crops. Farmers suffer recurring losses through drought periods early in the wet season and through damaging floods which occur mainly, though not entirely, late in the season.
2. Cambodia's greenhouse gas (GHG) emissions are low but rising and the agriculture sector is estimated to produce 80% of national carbon-dioxide equivalent (CO<sub>2</sub>e) emissions<sup>2</sup>. Poor soil management together with deforestation and erosion exacerbated by increasing intensity of rainstorms are leading to loss of soil fertility in some areas. In turn, this drives increased use of chemical fertilisers.
3. There is high potential for introduction of appropriate and cost-effective renewable energy technologies (RET) for smallholder agriculture. Benefits of RET include lower energy costs, increased access to electricity, increased potential for post-harvest processing, reduced health impacts, workload and expenditure associated with fuel wood use and improved soil fertility based on use of bio-slurry. However actual adoption rates are low, with only biodigesters and (to a lesser extent) solar home lighting systems in rural Cambodia.

### Institutional Context

4. Cambodia's response to climate change is coordinated by the National Council for Sustainable Development (NCSO) which consolidated several previous committees including the National Climate Change Committee early in 2015. Ministry of Environment (MoE) hosts the Secretariat of NCSO and is the technical lead agency for climate change, while Ministry of Mines and Energy (MME) is responsible for energy policy and rural electrification. Ministry of Agriculture, Forestry and Fisheries (MAFF) has developed its Climate Change Action Plan through its Technical Working Group on Climate Change in Agriculture, Forestry and Fisheries (TWG-CAFF).
5. IFAD's Cambodia programme is defined by the Country Strategic Opportunities Programme (COSOP) 2013-18 and currently consists of three active projects: Tonle Sap Smallholder Development Project (TSSD) in the northwest, Project for Agricultural Development and Economic Empowerment (PADEE) in the southern provinces, and Agriculture Services Programme for Innovation, Resilience and Extension (ASPIRE) which is a national programme which began pilot activities in five northern and western provinces from 2015. PADEE supports resource poor smallholders who have no history of borrowing through organising them in Improved Group Revolving Fund (IGRF) groups for provision of financial and technical assistance for improved livelihood activities. PADEE cooperates with the National Biodigester Programme (NBP) to develop and test pro-poor biodigesters which are smaller (thus suitable

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<sup>1</sup> Mission composition: Mr. Julian Abrams (team leader), Ms. Sunae Kim (IFAD GEF Portfolio Officer); Mr. Karan Sehgal (IFAD Renewable Energy Technology Portfolio Officer), Mr. Kan Vibol (Policy and Institutions Specialist), Mr. Carlo Figà Talamanca (Renewable Energy Policy and Technology Specialist), Dr. Prasun Kumar Das (Rural Finance Specialist), Mr. Juan Morelli (Economist) and Mr. Meng Sakphouseth (IFAD Country Programme Officer). Benoit Thierry, CPM participated to the first week.

<sup>2</sup> For source references for all data, please see the main text of the report.

for farmers with few livestock) and cheaper than the standard models. PADEE will end in 2018 but ASPIRE will simultaneously roll out in the PADEE provinces, ensuring continuity of support.

### **Target groups and project area**

6. The proposed RET project will be implemented in the PADEE target provinces of Kampot, Kandal, Prey Veng, Svay Rieng and Takeo, all of which share a border with Vietnam. The project will target the 49,000 members of the PADEE IGRF groups with additional benefits from adoption of RET. Group members are resource poor smallholders with productive potential, who were selected using a poverty ranking process. The project target areas are predominantly lowland rice growing areas, usually growing one crop per year in the wet season or (in areas subject to annual flooding) a recession crop. In addition to rice most farmers own a few livestock (cattle, buffalo, pigs and chickens) and produce limited amounts of vegetables and fruit, mainly for home consumption. More than half of households in the target area supplement their farm income with off-farm employment, locally or through family members migrating to work. Land holdings are small, especially for poorer households, and about 10% of agricultural households do not own any land. Of those that do own land, only about 21% hold formal (“hard”) land titles. Other households usually have a “soft” title verified by the local authorities; this is usually regarded as sufficient proof of ownership for purposes such as land sales or collateral for loans. There are few areas of natural forest land within the target areas.

### **Project rationale and Global Environment Facility (GEF) added values**

7. The rationale of the proposed project, Building Adaptive Capacity through the Scaling-Up of Renewable Energy Technologies in Cambodia (S-RET) is that there is a large unmet potential for adoption of RET by Cambodian smallholders, but there are barriers to the realisation of this potential. These barriers include limited knowledge and understanding of RET, a limited range of proven technologies and applications, underdeveloped marketing, financing, installation and after-sales services for RET, high costs relative to the resources of poorer smallholders and a policy environment that, while generally favourable, does not fully reflect the potential economic and social benefits of RET.
8. Supporting smallholders to adopt proven RETs while seeking to overcome the identified barriers above will assist the smallholders to increase adaptive capacity and to develop profitable and climate-resilient farm enterprises. In addition to the adaptive benefits the S-RET will produce global environmental benefits related to reduced GHG emissions and reduced deforestation.

### **Country Eligibility and Ownership**

9. Cambodia is eligible for Special Climate Change Fund (SCCF) financing as a non-Annex 1 party to the UNFCCC. S-RET responds to the SCCF objective to support adaptation and technology transfer projects that are country-driven, cost-effective and integrated in national sustainable development and poverty-reduction strategies. S-RET will be implemented by MAFF and integrated with IFAD’s country programme which is strongly supported by RGC. The project will be under the direction of the Secretary of State responsible for the TWG-CCAFF who has actively advised on and participated in project design. The project design is supported by the Cambodia GEF Focal Point and by the leaderships of MEF, MAFF, MoE and MME.
10. S-RET responds to the RGC priority, expressed in its Rectangular Strategy and National Strategic Development Plan, to expand low-cost energy production, especially from new and clean energy sources. NSDP commits RGC to foster development of RET including biomass, biogas and biofuels. S-RET is aligned with Cambodia’s key climate change policy documents including the NAPA, the Green Growth Plan and the CCCSP. MAFF’s Climate Change Action Plan includes actions on promoting sustainable farming systems and appropriate technology to reduce GHG emissions.

### **Project Goal, Development Objective and Key Indicators**

11. S-RET will share the Goal of PADEE which is improved livelihoods for poor rural people in the target provinces. The Project Development Objective (PDO) of S-RET is to achieve a large-



scale adoption of RET in the agriculture sector of Cambodia. Achievement of the PDO will be measured by indicators relating to (1) number of users adopting climate-resilient RET (corresponding to CCA-1 Indicator 4) with a target of 8,000 users, at least 40% women; and (2) estimated reduction in GHG emissions (CCM-1 Indicator 4) with a target of at least 451,926 tonnes CO<sub>2</sub> equivalent.

## Project Components and Outcomes

12. S-RET will be implemented through two Components with associated Outcomes. Component 1, Climate Resilient RET for Smallholders, has the outcome “approximately 8,000 smallholder farm households with improved climate resilience due to investments in economically viable RET for agriculture production, processing and/or marketing.” Component 2, Policy Support for Climate Resilience and RET in Agriculture, has the outcome “an enabling policy framework and institutional modalities for facilitating scale-up of climate resilient RET in agriculture.”
13. The baseline projects for Component 1 are PADEE and the NBP. Component 1 will be implemented through three sub-components with associated Outputs.
14. **Output 1.1, supply chains established for climate resilient RET in smallholder agriculture**, will be achieved through grants awarded to government agencies, firms and organisations (including NGOs and CSOs) promoting innovative RET applications for smallholder agriculture. Grants will be awarded through a call for proposals process, with award decisions made by a project technical committee advised by independent experts. The S-RET Technical Committee is appointed by TWG-CCAFF and has the status of a sub-committee of TWG-CCAFF, and will be responsible for: i) approving RET technologies and applications that are eligible for S-RET support; and ii) reviewing grant applications and making recommendations for award of grants. The S-RET Technical Committee is chaired by the chair of TWG-CCAFF or his/her delegate and includes representation of: TWG-CCAFF; MAFF-PSU; IFAD; and PDA. There will be two types of grant, for the “testing” and “roll-out” phases of a technology. Testing grants will support initial testing and demonstration under smallholder farm conditions while roll-out grants will support the costs of developing marketing and after-sales service networks excluding technical research and development costs.
15. In the first year of the project there will be calls for proposals for RET applications to enter the testing phase, and roll-out phase for pre-identified RETs under PADEE and other already proven options. During the second half of the project, the best of the tested applications will be supported by roll-out grants.
16. **Output 1.2, PADEE smallholders integrate (non-biogas) RET into their production and processing activities** will be achieved through working with the IGRF groups to identify groups and members interested to invest in RET, developing business models, learning events, financial support and coaching and demonstration activities to assist the smallholders to integrate the RET into their livelihood activities. Eligible RET will be approved by the project technical committee and will include those supported by roll-out grants. In the first phase of the project this is likely to include solar water pumping and efficient biomass cookstoves for domestic cooking and small scale processing activities (palm sugar, smoked fish).
17. **Output 1.3, PADEE smallholders integrate biogas digesters into their farming systems**, will be delivered through the NBP with a similar set of activities to those supporting non-biogas RET for Output 1.2. In addition, S-RET will support NBP to develop and roll out innovative applications of biogas energy for agriculture, and to strengthen marketing and after-sales capacity.
18. **Component 2** will be implemented by the TWG-CCAFF with the evidence-based policy component of ASPIRE providing baseline resources. The component has sub-components relating to capacity support to the TWG-CCAFF, policy studies and knowledge management and policy dialogue respectively. Achievement of Outcome 2 will be defined by integration of CSO policies supporting RET in the MAFF Climate Change Action Plan, in the MAFF strategy

and action plan for the RGC's Cambodia Industrial Development Policy 2015-2025, and in policy proposals submitted to NCSD and other inter-Ministerial forums.

### **Linkages with Related Initiatives**

19. In addition to its integration in PADEE, the NBP and ASPIRE, S-RET will coordinate closely with ongoing initiatives promoting climate-resilient RETs in rural Cambodia. These initiatives include two GEF-funded projects of UNDP Cambodia: the Resilient Livelihoods project with MoE and the Early Warning Systems project with Ministry of Water Resources and Meteorology. S-RET will cooperate with the UNIDO-GEF renewable energy projects which work on biogas and rice husk technology for medium-scale electricity generation. Additionally, S-RET will establish relationship with other organizations /institutions with RET programmes in Cambodia. The Cambodia Climate Change Alliance is a sector policy support programme in MoE with technical assistance from UNDP, and is a key coordinating and knowledge sharing mechanism for climate change response initiatives in Cambodia.

### **Assumptions and Risks**

20. Key assumptions underlying the project design are documented in the Project Logical Framework. The assumption that integration of appropriate climate-adaptive RET for smallholder production and processing activities will result in improved livelihoods for poor rural people is considered well-founded based on the potential of RET and on results achieved in other countries. It is assumed with a high level of confidence that sufficient, appropriate technologies will be identified (Outcome 1) and that TWG-CCAFF will continue to enjoy its current strong level of leadership support (Outcome 2).
21. Risks are documented in the Logical Framework and the Project Risk Log and include (1) technical risk – selected RET prove inappropriate and / or unsustainable in smallholder agriculture applications in Cambodia – considered low probability; (2) market risk, i.e. energy market changes undermine the rationale for the project – this risk is considered low; (3) capacity risk: that the supply and service chains for RET do not reach a self-sustaining critical mass: this risk is considered medium probability; the risk that smallholders are unable to access finance for RET, considered small due to the linkage with PADEE, and political risk of an unfavourable policy environment (low probability). Risk mitigation measures are detailed in the main text and in the Project Risk Log.

### **Sustainability and Replicability**

22. RET have a high inherent sustainability which is reflected in the good performance, low running costs and extended use-life of those RET, including biodigesters, that are already familiar in rural Cambodia. A self-sustaining market requires a critical mass of installations to create incentives for private sector service providers. By linking RET to income-generating activities the project will assist smallholders to overcome the barriers to RET adoption and to achieve an identifiable positive net impact on household finances.
23. The potential for scale-up is large. S-RET will facilitate scale-up directly through increasing the number of proven applications of RET, developing supply chains and providing financial support to targeted smallholders, as well as indirectly by facilitating removal of policy barriers. Knowledge management activities of S-RET will raise awareness and create possibilities for future resource mobilisation.

### **Project Implementation**

24. MAFF will be the executing agency of the S-RET.
25. S-RET will be implemented by MAFF with the Secretary of State responsible for the TWG-CCAFF as Project Director. The TWG-CCAFF acts as the Project Steering Committee and plays a leading role in setting strategy and making key technical decisions on the implementation of S-RET. A Project Manager will report to the Project Director. There will be a

- Project Technical Committee chaired by the Project Manager and responsible for decisions on the technical direction of the project.
26. Project management functions for the S-RET will be embedded within the PADEE management structure. Work planning and budgeting, financial management, procurement, and monitoring will be assigned to the MAFF Project Support Unit (MAFF-PSU) of PADEE. Component 1 activities of the S-RET will be implemented through the PADEE structures and the NBP, while Component 2 will be implemented through the TWG-CCAFF and will align with the ASPIRE policy dialogue process. Upon completion of PADEE in 2018, project management functions will be transferred to the ASPIRE Secretariat. Considering that ASPIRE is a programme-based initiative several of the programme management elements are expected to evolve through the implementation process. As such, it is premature at present to define in detail how S-RET will be embedded within ASPIRE once PADEE is concluded. The details of the merger of S-RET with ASPIRE will thus be elaborated during the Mid-Term Review (MTR) of S-RET. Considering that the implementation of ASPIRE was initiated in Q4 of 2015, it is anticipated that by 2018 a well-functioning ASPIRE programme will enable for a smooth merger of S-RET with ASPIRE. Detailed project implementation arrangements with relation to PADEE and the process for facilitating the merger with ASPIRE will be described in the S-RET Project Implementation Manual (PIM).
  27. IFAD will advance the proceeds of the GEF-TF grant to a Designated Account opened by MEF. MEF will then transfer the proceeds to an S-RET account operated by MAFF and sub-accounts as necessary. These accounts will be used only for GEF-TF funds. Project expenditures financed by PADEE and ASPIRE (IFAD loan and grant), and by government counterpart financing, will be executed through the respective project accounts.
  28. S-RET audit will be through a bundled audit contract which covers the IFAD country programme projects including PADEE.

### **Planning, M&E and Knowledge Management**

29. Project planning will be based on performance indicators identified in the Project Logical Framework. Interim targets will be set and adjusted year by year and will be the basis of the project AWPB. Preparation of the AWPB will be integrated with the PADEE AWPB process.
30. Key data collection tools for M&E will include the PADEE MIS which will be adapted to record data on installation and use of RET, and the PADEE Major Impact Survey which will have supplementary questions on household energy use. The mid-term survey for PADEE is due in 2015 and will form the baseline survey for S-RET. The project budget includes provision for a further survey round at the end of S-RET.
31. MAFF-PSU will consolidate physical and financial progress reports into mid-year and annual project reports which will be prepared together with PADEE reports and signed by the S-RET Project Director. The annual report will include cumulative progress against logframe targets. IFAD will supervise S-RET jointly with PADEE.
32. Knowledge management activities will be coordinated with the NCSD and with the CCCA of MoE. Knowledge management activities will include discussion forums, production of videos, reports and policy briefs and publication through traditional and web-based media.

### **Project Time-Frame, Cost and Financing**

33. The planned implementation period of S-RET is four years. Implementation will commence in the second quarter of 2016 and will be completed in the first quarter of 2020.
34. The cost of GEF-funded S-RET is calculated as US\$ 4.6 million, representing US\$ 3.770 million for Component 1, US\$ 0.6 million for Component 2 and US\$ 0.23 million for management costs.

35. Co-financing of S-RET is estimated as US 17.592 million and includes the resources of IFAD loans and grants for PADEE (US\$4.5 million) and ASPIRE (US\$ 13.092 million), RGC (US\$ 3.5million).

## II. Logical Framework

Results Hierarchy	Indicators					Means of Verification			Assumptions
	Name	Baseline	YR1	Mid-Term	End Target	Source	Frequency	Responsibility	
<b>Goal:</b> Improved livelihoods for poor rural people in the target areas of Kampot, Kandal, Prey Veng, Svay Rieng and Takeo Provinces	Increased average value of household assets owned by participating households	0%	-	-	25%	A baseline and two follow-up quantitative surveys (budgeted under component 3 and to be consistent with RIMS)		PSU	Integration of appropriate climate-adaptive RET in agriculture value chains results in improved livelihoods for poor rural people
<b>Development Objective:</b> To achieve a large-scale adoption of Renewable Energy Technologies (RET) in the agriculture sector of Cambodia	Increased adoption rate of climate-resilient RET (50% of whom are female) (CCA-1 Indicator 4) <sup>3</sup>	0	-	-	30% increase	Project MIS measures number, type and usage of RET installations		PSU	Adoption and sustainable use of RET enabled through project and enhanced policy dialogue
	Reduction in GHG emissions through deployment of low GHG technologies and practices (CCM-1 Indicator 4) <sup>4</sup>	0	-	-	At least 451,926 tonnes CO <sub>2</sub> e	GHG emissions estimated for each type of installation backed by quantification methodology		PSU	Sustainable use of RET technologies promoted through project
<b>Outcomes/ Components:</b>  <b>Outcome 1.</b> Approximately 8,000 smallholder farm households with improved climate resilience due to investments in economically viable RET for agriculture production, processing and / or marketing  <b>Outcome 2:</b> Enabling policy	# of beneficiary households enabled to increase agriculture income through RET adoption	0	-	3,000	5,000	Major impact survey	Annual	PSU	Appropriate climate-adaptive RET identified to meet the varying needs of smallholders
	# of beneficiary households reducing dependence on high polluting energy sources by at least 25%	0	-	1,500	3,000	Major impact survey	Annual	NBP	
	Effective promotion of RET adoption for agriculture	-	-	-	Inclusion in policy, plans and programmes	MAFF Climate Change Priority Action Plan	Annual	PSU	TWG-CCAFF continues to enjoy strong leadership and support within MAFF and RGC

<sup>3</sup> Data collected from IGRF groups

<sup>4</sup> A study will be done for identifying an appropriate methodology for quantifying GHG emission reductions

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Results Hierarchy	Indicators					Means of Verification			Assumptions
	Name	Baseline	YR1	Mid-Term	End Target	Source	Frequency	Responsibility	
framework and institutional modalities for facilitating scale-up of climate resilient RET in agriculture	Inter-sectoral policies for RET identified and promoted	-	-	-	Inclusion in policy, plans and programmes	NSCD meeting agenda and minutes	Annual	TWG-CCAFF	
<b>Outputs:</b>	# of high potential innovative RET in agriculture tested using innovation grants	0	-	At least 5	At least 5	Project MIS	6 months	PSU	Unimpeded importation of innovative RET for in-country pilot testing
Supply chains established for climate resilient RET in smallholder agriculture.	# of best practice bio-digesters installed of proven models	0	-	1,500	3,000	Grantees self-reporting verified by project M&E staff	6 months	NBP	No changes to NBP programme
PADEE smallholders supported to integrate (non-biogas) RET into their production and processing activities.	# of installations of proven RET scaled-up through scaling-up grants	0	-	3,000	5,000		6 months	PSU	IGRF effectively sensitized on the economic benefits of RET
PADEE smallholders supported to integrate biogas digesters into farming systems.	# of TWG-CCAFF meetings held for policy dialogue with external stakeholders (donor agencies, private sector, civil society etc.)		-	2	6	Meeting results and Publications posted on <a href="http://www.cambodiagreen.org">www.cambodiagreen.org</a>	Annual	TWG-CCAFF	TWG-CCAFF continues to enjoy strong leadership and support within MAFF and RGC
Capacity Development of the TWG-CCAFF for facilitating coordination among departments within MAFF and with other relevant ministries for mainstreaming climate change resilience building and RET scale up	# of policy studies and their briefs prepared for submission to NCSD and broader dissemination	0	-	0	3		Annual	TWG-CCAFF	
Policy Studies to engender an enabling environment for scaling up RET in agriculture sector	# of events promoting RET scale-up in agriculture (meetings, workshops, trainings, policy seminars) with other relevant Ministries, civil society and private sector participation	0	-	5	12		Annual	TWG-CCAFF	
Awareness raising and KM for advancing policy dialogue and resource allocation for RET scale-up in agriculture									



### III. Situation Analysis

#### Country and rural development context

##### **Social and Economic**

36. Despite rapid improvement in its social and economic indicators in the past ten years, Cambodia remains a least-developed country. It is highly vulnerable to the effects of global climate change because of its physical characteristics as a low-lying, flood prone tropical country, but also because the large majority of its population remains dependent on rain-fed agriculture for income, employment and food security. About 70% of Cambodians live in rural areas and engage in agriculture, although off-farm employment makes an increasingly important contribution to household incomes<sup>5</sup>. Agriculture provides about 34% of Cambodia's GDP<sup>6</sup>. Rice is the predominant crop, accounting for about 79% of crop land<sup>7</sup>, while the rice value chain accounts for about 15% of GDP. About 79% of rice is produced in the wet season and this high proportion reflects the under-development of irrigation systems. Cambodia produces a significant rice surplus, estimated as 3 – 4 million tonnes of paddy, but most of the surplus production is exported to Vietnam for processing. The Royal Government of Cambodia gives a high priority to its Policy on Paddy Production and Rice Export which has the target of achieving one million tonnes of milled rice exports by 2016.

##### **Cambodia and Global Climate Change**

37. According to UNDP Climate Change Country Profile<sup>8</sup>, mean annual temperature has increased by 0.8C since 1960 with most rapid increase observed during the dry season. Future global climate change is predicted to result in Cambodian average temperatures increasing by between 0.7 to 2.7°C by the 2060s, and 1.4 to 4.3 degrees by the 2090s. The projected rate of warming is similar in all seasons and regions of Cambodia. Further, there will be a substantially increased frequency of days and nights that are considered 'hot' in the current climate. Annually, projections indicate that 'hot' days will occur on 14-49% of days by the 2060s, and 20-68% of days by the 2090s. Days considered 'hot' by current climate standards for their season are projected to increase fastest in June – August, occurring on 29-96% of days of the season by the 2090s. Nights that are considered 'hot' for the annual climate of 1970-99 are projected increase at a faster rate than hot days, occurring on 24-68% of nights by the 2060s and 38-88% of nights by the 2090s. Nights that are considered hot for each season are projected to increase most rapidly in June - August occurring on 73-99% of nights in every season by the 2090s. All projections indicate decreases in the frequency of days and nights that are considered 'cold' in current climate. These events are expected to become exceedingly rare, occurring on 0-7% of days in the year, potentially not at all under the higher emissions scenarios by the 2090s.

38. Average annual rainfall is predicted to increase as a result of climate change. This increase will occur mainly due to increased rainfall in the wet season (i.e. May - October). Conversely, the central predictions are for a decrease in rainfall during the dry season. The intensity of rain storms will increase: the proportion of total rainfall that falls in heavy events is projected to increase by up to 14% by the 2090s. Again, these increases arise mainly due to increases in heavy events in wet season rainfall, and are partially offset by decreases in the dry season. The

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<sup>5</sup> <http://www.tradingeconomics.com>, quoting World Bank data

<sup>6</sup> Statistical Yearbook 2011

<sup>7</sup> Cambodia Climate Change Strategic Plan 2013-24

<sup>8</sup> C. McSweeney, M. New and G. Lizcano; UNDP Climate Change Country Profiles: Cambodia



magnitude of 1- and 5-day rainfalls is projected to increase by up to 54mm and 84mm respectively by 2090<sup>9</sup>.

39. There is some regional variation in predicted changes, with rainfall in the June to August season predicted to increase in the northwest of the country and to decrease somewhat in the northeast.<sup>10</sup>
40. Farmers and local communities commonly report that the climate is less predictable than formerly: average rainfall and temperature data conceal significant annual variations but farmers find that it is becoming more difficult to plan the timing of planting and other key activities while floods and droughts can happen in seasons when they did not previously occur.
41. Sea level rise is likely to be significant for low-lying coastal plains and may also impact indirectly on the Mekong River system and its floodplains. According to the Fourth Assessment Report of the IPCC<sup>11</sup>, sea levels in the region are projected to rise by between 0.18m and 0.56m by 2090. The highest predicted rise would cause permanent inundation of about 25,000 ha of coastal Cambodia<sup>12</sup>.
42. Increasing temperatures and, in particular, increasing unpredictability of the climate area are already having important negative impacts on vulnerable smallholder farmers. Without access to adequate irrigation, farmers delay planting for fear of losing crops to droughts early in the wet season, but then are more vulnerable to flooding late in the wet season (the peak flooding periods occur in September-October) as well as losing the opportunity to plant a second crop.
43. Cambodia's Greenhouse Gas (GHG) emissions are low but rising, and the agriculture sector is estimated to produce over 80% of overall national equivalent CO<sub>2</sub> emissions (10,560Gg of the total 12,764.74Gg of CO<sub>2</sub> equivalent)<sup>13</sup>. The contribution of domestic livestock to the total emissions was 48% followed by rice cultivation and agricultural soils – hence rationale for enhancing the adoption of biodigesters. Agricultural emissions are largely in the form of CH<sub>4</sub> (methane) and N<sub>2</sub>O (nitrous oxide) which have much higher<sup>14</sup> greenhouse effects than CO<sub>2</sub>. Poor soil management techniques and erosion driven by deforestation, higher rainfall intensities and flooding is leading to loss of soil fertility in some areas of Cambodia. In turn, this drives increased use of chemical fertilisers in an attempt to maintain yields.

### **Energy Use and the Potential for Renewable Energy Technologies**

44. Cambodia's electricity tariffs are among the highest in ASEAN and in the world as Cambodia's domestic power electricity generation highly depends on imported oil. The electricity tariffs are even higher in the rural areas due to several factors such as different capacities of electricity suppliers, economy of scale, fuel transportation costs, cost of capital and financing, power supply loss, and high risk premium for rural consumers<sup>15</sup>. This is recognised as one of the key obstacles to achieving the Royal Government of Cambodia's (RGC) targets for increased in-country processing of agricultural commodities. Cambodia's electrification rate (34% in 2011) is still one of the world's lowest. The high costs and limited access to reliable electricity supplies severely constrain the quality of life and opportunities for development. The National Strategic Development Plan (NSDP) sets the target that all Cambodian villages will have access to electricity (including off-grid supplies) by 2020, while 70% of households would have power by

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<sup>9</sup> ibid

<sup>10</sup> ibid

<sup>11</sup> Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007

<sup>12</sup> Cambodia Climate Change Strategic Plan

<sup>13</sup> <http://unfccc.int/resource/docs/natc/khmnc1.pdf>.

<sup>14</sup> 1 tonne of CH<sub>4</sub> equal to 25 tonnes CO<sub>2</sub> according to the Global Warming Potential in AR4 of IPCC 2005, UNFCCC

<sup>15</sup> Poch, K. and S. Tuy (2012). Cambodia's electricity sector in the context of regional electricity market integration. In *Energy market integration in east asia: theory, electricity sector and subsidies*, ERIA research project report 2011-2017, Jakarta: ERIA, pp 141-172.

2030. This would mean that 30% of Cambodian households, all in rural and remote areas, will still lack reliable access to electricity.
45. Within the home, almost all farm households (94% nationwide average<sup>16</sup>) rely on fuel wood and charcoal for cooking while lighting is provided by a mixture of kerosene lamps and car batteries charged by diesel generators. A typical household might consume between 1 to 2 tonnes/year of fuel wood which represents an important contributor to gradual forest degradation. The increasing demand and unsustainable harvesting of biomass for cooking and other domestic, agricultural and industrial (e.g. brick-making) purposes is leading to increased deforestation rates and land degradation and the consequent release of GHG emissions. In addition, women are disproportionately affected from the use of firewood as they suffer from respiratory diseases and eye infections as a result of exposure to smoke. Use of firewood also imposes a high drudgery load on women for collecting firewood which may be at an increasing distance from the home. Time spent on collecting firewood is time that is lost for income-generating activities.
  46. Increasing mechanisation of agriculture, partly driven by labour shortages associated by migration for paid work, is leading to increased use of energy in agriculture. Climate change induced drought is also increasing the needs to pump from groundwater (particularly in Svay Rieng and Prey Veng provinces) and from surface water bodies. Mechanical traction, water pumping and post-harvest processing as well as transport overwhelmingly rely on diesel engines which are often old and inefficient. Because of lack of capital, the engines used are often multi-purpose but this means that their efficiency for any particular task is low. Lack of affordable energy for pumping water inhibits agriculture production and increases vulnerability to drought. Lack of affordable energy is also a major constraint to local post-harvest processing, meaning that Cambodian farmers and local communities lose the opportunity to benefit from these value-added activities, to diversify the local economy and to create wage employment opportunities in the local area.
  47. Given the high energy costs, depletion of natural resources and impacts on women's health and workload resulting from the current mix of energy sources used in Cambodian smallholder agriculture, there is high potential for increased adoption of renewable energy technologies (RET). One of the main components<sup>17</sup> of Cambodia's rural electrification policy is to seek renewable energy (solar, wind, mini and micro hydro, biogas and biomass)<sup>18</sup>. Adoption of RET will increase smallholders' climate resilience directly (through adaptive uses such as solar pumping for irrigation, and through use of RET by-products as natural fertilisers for improved soil management) and indirectly for increasing household incomes and assets and so making households less vulnerable to climate shocks. Increased use of RET will also reduce emissions of greenhouse gases (GHG). RET are known in rural Cambodia but technological advances (for example, the reduced cost of solar panels, improved designs of biodigesters etc.) favour more widespread adoption and a broader range of uses in agriculture production and processing and by agricultural households and communities.
  48. The potential of different renewable energy resources in Cambodia and RET for application in smallholder agriculture is discussed in Working Paper 1. Types of the highest potential RET identified through the demand assessment conducted by PADEE. These potential RETs include biodigesters, particularly if design modifications to suit the needs of resource-poor smallholders are adopted, solar photovoltaic (e.g. for water pumping), solar thermal (e.g. for drying) and sustainable use of biomass (e.g. more efficient cook-stoves with food processing as well as domestic applications). There is limited potential for wind or pico-hydro energy in the project

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<sup>16</sup> Census 2008

<sup>17</sup> Other components include an expanded power grid, diesel stand-alone, mini-utility systems, cross-border power supply from neighboring countries.

<sup>18</sup> ADB, Renewable Energy Developments and Potential in the Greater Mekong Subregion, 2015.  
<http://www.adb.org/sites/default/files/publication/161898/renewable-energy-developments-gms.pdf>

target area. Gasification technology was considered during project design but the scale and complexity of the technology makes it suitable for medium-sized processing enterprises (e.g. commercial rice millers) rather than for smallholders directly.

49. Cambodia has an average sunshine duration of five hours per day<sup>19</sup> which make solar electricity and other forms of solar energy use attractive. Photovoltaic (PV) panels and accessory equipment are mainly imported<sup>20</sup>.
50. Specific benefits to local communities expected from the adoption of RET include:
  - (a) Lower energy costs (such as reduced costs for water pumping);
  - (b) More widespread availability of electricity for domestic purposes;
  - (c) Potential to increase post-harvest processing using RET;
  - (d) Reduced health impacts from discontinuing use of fuelwood and charcoal;
  - (e) Reduced workloads, particularly for women;
  - (f) Environmental benefits, particularly from reduced deforestation and sanitation;
  - (g) Economic benefits, particularly saving from buying fuel wood and chemical fertiliser;
  - (h) Improved soil fertility and reduced costs and impacts of chemical fertilizer use (associated with use of biodigester residues for fertilizer); and
  - (i) Improved yield production from using bio slurry as fertiliser and fish feeding

#### **Barriers to Adoption of RET**

51. Despite the potential for enhanced use of RET in Cambodia, the current rate of adoption is low. The barriers to be overcome to increase the rate of adoption include lack of awareness of the technologies among Cambodian farmers, and cost barriers, particularly among the poor and vulnerable households. In addition, decision-makers in Government, the private sector and civil society lack awareness of the potential of RET and of the technology options available, and RET are not consistently promoted as a policy priority in the agricultural sector.
52. **Knowledge Barrier:** Most Cambodian farmers have some familiarity with basic RET technologies – most often, bio-digesters and solar panels. However, the range of technology options with which they are familiar is very limited. Biodigesters are perceived to be suitable only for relatively better-off farmers who can afford the installation costs and who have substantial numbers of animals to provide the feedstock. Uptake of solar panels for any purposes other than auxiliary lighting is very low. There is a need both to increase awareness of the potential of existing, proven technologies, to expand the range of uses for RET technologies and to introduce, test and demonstrate new technologies that are not yet present in the Cambodia countryside.
53. **Technical Development Barrier:** Newer, more innovative options cannot be promoted at scale to smallholder farmers until they have been field-tested, monitored, assessed, and evaluated in Cambodian conditions. There is a need for further research and development of RET applications in the Cambodian rural context for making technical improvements with regard to longevity, reduced operation and maintenance, and ease of handling. Also, the introduction of RET for energy generation along the agriculture value-chain needs to be examined as a means of building resilience and reducing GHG emissions.

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<sup>19</sup> [http://www.kamworks.com/uploads/tx\\_news/Sun\\_hours\\_in\\_Cambodia.pdf](http://www.kamworks.com/uploads/tx_news/Sun_hours_in_Cambodia.pdf)

<sup>20</sup> There is one local manufacturer (Star8 – an Australian company), but costs of local manufacture do not appear to be competitive with imported equipment yet.

54. **Cost Barrier:** While basic RET options are familiar in Cambodia, there remains a lack of quantitative evidence on the costs and benefits. The most widespread RET used in Cambodia is the brick-domed biogas digester which is supported by the National Biogas Digester Programme (see description of Baseline Project below). The cost of an NBP biogas digester to the farmer is between \$420 and \$1,100 depending on the size of the installation<sup>21</sup>. \$420 is approximately equivalent to the annual per capita consumption of a household living at the official poverty line<sup>22</sup>. Poor households lack the capacity to save, with income from agriculture and from paid work being largely used for daily consumption. Despite a large expansion in formal credit through micro-finance institutions, poorer households face difficulty in accessing credit due to lack of collateral and lack of confidence and experience in dealing with formal financial institutions. Interest rates for small or unsecured loans are often 3% - 4% per month. Combined with insecure incomes, this makes it difficult for poorer households to invest in RET. Other familiar technologies, such as solar lighting (except for the most basic portable models) price from \$500-\$1,000 and solar pumping sets currently on the market price from \$1,000-\$2,000. These are beyond the reach of small Cambodian farmers. This underlines the need to develop affordable technologies as well as to build financing mechanisms and incentive schemes to make RET adoption more affordable by the poorest households.
55. **Policy Barrier:** The policy environment in Cambodia is generally supportive of the use of biogas digesters but a broader scope of RET for its contribution to rural development in Cambodia has not been fully explored. Promotion of RET is mainly at small scale and is fragmentary with insufficient coordination and sharing of knowledge. At present, there is lack of awareness amongst policymakers of the potential of RET, particularly in the agriculture sector. Internally, increased technical capacity of key stakeholders in policymaking to formulate, implement and enforce renewable energy strategies is required. National Policy on Rural Electrification drafted by the Ministry of Industry, Energy and Mines (MIME)<sup>23</sup> also recognizes that there is a collective need for coordinated effort to increase awareness of RET and the different technology options to ensure that the potential role of RET is systematically considered in development of policy and programmes in the agriculture sector and beyond.
56. RGC electrification policy favours large investors in hydro-electric or coal-fired generating plant with long-term purchase contracts and tax concessions. More could be done to favour small-scale RET equipment with similar fiscal incentives.
57. This lack of awareness and technical capacities among policy makers has also resulted in the absence of policies that could neutralize any disadvantages of RET in the marketplace. Cambodia has the high rates of electricity tariffs, the most expensive in ASEAN, due to its status as a net oil importer. Supportive policies and a favourable market framework (ex. establishment of a favourable tariff regime for all RET as done for solar panels) can help stimulate the adoption of RET and diffuse RET deployment effectively.

## Institutions and organizations

### Policy Context

58. Although the main focus of Cambodia's climate change response to date has been on adaptation, Cambodia is beginning the process of estimating its GHG emissions and developing policies for emissions reduction. The national Green Growth Policy (MoE and NCCC, 2013) identifies the following objectives:
- (a) Defining a GHG reduction target, especially carbon dioxide;

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<sup>21</sup> This figure is net of the \$150 subsidy provided by NBP regardless of the size of biogas digester.

<sup>22</sup> World Bank 2013: *Where Have All the Poor Gone? Cambodia Poverty Assessment*

<sup>23</sup> MIME has now changed to Ministry of Mines and Energy (MME)

- (b) Preparing methodologies and defining an implementation standard for carbon reduction at small medium large enterprises; and
- (c) Enhancing carbon credit through international carbon sale by increasing forest cover for carbon storage sinks.

59. Cambodia's response to global climate change is coordinated by the inter-Ministerial National Council for Sustainable Development, which was formed in May 2015 and consolidates the responsibilities of a number of previously existing committees, including the National Climate Change Committee. The NCSD is chaired by the Prime Minister with the Minister of Environment as vice-chair. The Ministry of Environment houses the Secretariat of the NCSD.

### **Government Institutions**

60. **Ministry of Environment (MoE)** coordinates the development of climate change policy and Cambodia's representation in global climate change fora. Cambodia's GEF Focal Point is a Secretary of State of MoE. Ministry of Environment is the national implementing partner for the Cambodia Climate Change Alliance (CCCA) which receives financial and technical support from UNDP and other development partners. CCCA supports climate change policy development, capacity building and knowledge management activities and also manages a Trust Fund (CCCA-TF) providing grants for climate change related activities to government and non-government bodies.

61. The energy sector in Cambodia is overseen by the **Ministry of Mines and Energy (MME)**. Cambodian consumers face limited access to grid supplies, particularly in rural areas, high costs and chronic shortages of supply, with over half of electricity supplies being imported from neighbouring countries. Consequently the main energy policy is on the development of hydro-electric and coal fired generating plants (which receive government support in the form of price guarantees) and on expansion of the grid. Nevertheless MME also oversees a Renewable Energy Fund and the implementation of a Renewable Energy Action Plan. The National Strategic Development Plan (NSDP) 2013-2018 commits MME to "Further foster development of all types of renewable energy such as biomass, biogas, bio-fuel etc., and enhance the efficiency of energy through the use of energy-saving stoves, to reduce the use of fuel, firewood, charcoal, etc."

62. **Ministry of Agriculture, Forests and Fisheries (MAFF)** oversees the agriculture sector and is the most important implementing partner for IFAD's country programme. The agriculture sector is of key importance in development of renewable energy because of the low access and high costs of conventional electricity supplies for Cambodian smallholder farmers who represent up to 80% of the population, because of the constraints on agricultural production and processing arising from energy shortages and costs, and because of the large amounts of biomass produced as by-products of agriculture activity which have the potential for use in biomass energy production. MAFF oversees one successful ongoing programme, the National Biodigester Programme (NBP) which has the potential both for further scale-up of its core biodigester technology and also for diversification into other types of agriculture-linked RETs.

63. MAFF has formed its internal Technical Working Group on Climate Change in Agriculture, Forestry and Fisheries (TWG-CCAFF) with leadership at Secretary of State level. Through this body, MAFF has prepared its Climate Change Action Plan and is in the process of seeking funding for priority actions of the plan from the CCCA-TF.

### **IFAD Programme in Cambodia**

64. The IFAD country programme in Cambodia is defined by the COSOP 2013-18 which has three strategic objectives:

- 1) Poor smallholders enabled to take advantage of market opportunities

- 2) Poor rural households and communities increase resilience to climate change and other shocks
  - 3) Poor rural households improve access to strengthened rural service delivery by Government, civil society and private sector agencies.
65. There are three ongoing projects under the COSOP:
- 1) **Tonle Sap Smallholder Development Project (TSSD)** in partnership with Asian Development Bank, implemented in five Provinces in the Tonle Sap lake region. The principal implementing partner for the IFAD-financed component is the National Committee for Democratic Development at Sub-National Level Secretariat (NCDD-S);
  - 2) The **Project for Agriculture Development and Economic Empowerment (PADEE)**, implemented by MAFF and targeting 90,000 productive poor and vulnerable smallholder farmers in the provinces of Kampot, Kandal, Prey Veng, Svay Rieng and Takeo in southern Cambodia. The project implementation period is 2012-18 and the total project cost is \$43.2 million of which \$35 million is IFAD loans and grants.
  - 3) The **Agriculture Support Project for Innovation, Resilience and Extension (ASPIRE)**; a national programme focusing mainly on climate-resilient agriculture extension services. The total estimated programme costs are USD 82.2 million over seven years. ASPIRE is implemented by MAFF from 2015-2021 and will be piloted in five northern provinces, but is planned to expand into PADEE target area from 2018.
66. The GEF SCCF financed RET project was developed for full integration into the PADEE project to start with the testing and roll out of RET (Component 1), and once PADEE is concluded in 2018, to transfer the RET project to ASPIRE for undertaking the more detailed policy related work and scaling up (Component 2).
67. PADEE has two key project components: Improved Access to Financial Services, introducing an Improved Group Revolving Fund (IGRF) model in cooperation with FAO; and Improved Access to Technology and Markets, which focuses on agriculture extension but also includes a small-business development sub-component. The IGRF group formation approach is being pursued because poor smallholder farmers in Cambodia do not have a culture of borrowing from banks or MFIs. The IGRF creates a safe environment for poor farmers to borrow (no collateral required), invest and pay back to the revolving fund. The IGRF groups are also supported with technical assistance, financial management and business plan development. Since the IGRF is a group of peers this allows for a gradual building of confidence among members for borrowing for investment purposes.
68. SNV is an implementing partner in PADEE and provides technical assistance for extension and for the small-business development sub-component. In addition, iDE supports (through the Lors Thmey social enterprise) its network of Farm Business Advisers (FBA) who conduct extension activities and retail quality-controlled inputs. Also, within the small business development sub-component, PADEE works with the NBP to develop, test, demonstrate with monitoring and assessment and market viable pro-poor biodigesters. This work on pro-poor biodigesters is intended to result in smaller size, lower cost and reliable technologies, and to be less dependent on animal waste feedstock as compared to the standard brick dome biodigesters. Having tested a number of alternative models since 2013, NBP expect to identify a design suitable for roll-out by end 2015.
69. PADEE targets provision of 3,000 of these pro-poor biodigesters. A floating drum model was developed in prototype but it has not proved possible to reduce the costs of this model significantly below the cost of the fixed dome biodigester (Farmer's Friend model). The project is now examining the possibility of supporting lower-cost versions of the new innovation hollow brick Farmer's Friend construction and / or a lower volume digester.

70. The roll-out of ASPIRE will ensure continuity of supporting arrangements for S-RET and will open possibilities for integrating support to RETs into the MAFF Strategic Budget Programme at Provincial level, as well as for mobilising additional resources for scale-up.
71. In addition, The **Accelerated Inclusive Markets for Smallholders (AIMS)** project will be designed in 2016 with a probable 2017 start date. AIMS will take a value chain approach to improving market access for smallholders. The sustainable business model approach of S-RET is a good fit with AIMS and options for synergies and scale-up support will be examined during AIMS design.

### Target groups and project areas

72. The project will be implemented in the PADEE target area which comprises the five southern provinces of Cambodia: Svay Rieng, Prey Veng, Kandal, Takeo and Kampot. These provinces have a total land area<sup>24</sup> of about 21,000 km<sup>2</sup> : around 11% of the land area of Cambodia, but have a population density around three times the national average<sup>25</sup>. Over 90% of the population of these provinces live in Communes classified as rural.
73. The population of the five provinces is overwhelmingly ethnic Khmer Buddhist; there are no indigenous minority groups but there is a small population (1 – 2%) of Cham Muslims who largely live in separate villages but engage in similar livelihood activities to the Khmer.
74. The rate of population growth in the five provinces is below the national average, probably as a result of out-migration to Phnom Penh and elsewhere. Although the growth of the total population is small, the growth of the labour force is much larger, due to the large numbers of young people born during the baby boom years of the 1990s that are now coming into adulthood.
75. Within the five target provinces PADEE is implemented in 246 out of 535 Communes, located in 36 Districts out of a total of 50. Following consultations with the local authorities, between five and eight target Communes were selected in each District from those with a poverty headcount over 19% and with a total of more than 200 poor families; and with more than 500 hectares of rice cultivation. Districts with an insufficient number of eligible Communes were not selected. The resulting 246 selected communes present an average poverty rate of 26.4% versus 22.3% for the 535 existing communes.
76. The target Districts are predominantly found in flat, low-lying areas. All the project districts share a tropical monsoon climate with a wet season from May to October during which 90% of annual rain falls. Average rainfall is around 1,200mm per year with coastal Kampot seeing about 1,800mm per year. Maximum temperatures vary relatively little, keeping between 30°C to 35°C throughout most of the year, while minimum temperatures fall to around 20°C in December-January and around 25°C in March – April<sup>26</sup>. Large areas of Prey Veng, Kandal and Takeo provinces are subject to seasonal inundation from the flooding of the Mekong river system.
77. Rice farming is the predominant economic and agricultural activity: over 80% of families describe rice farming as their main occupation and over 90% of the cultivated area is rice land. In most areas, one rice crop is grown per year – either a rain-fed wet season crop in areas that do not flood, or a recession crop in the dry season in inundating areas. In general, recession crops are grown with improved rice varieties and larger amounts of fertiliser and other inputs. These produce higher yields, although the traditional aromatic varieties often grown in the wet season have a higher market value. Supplementary irrigation is used for both wet season and recession crops. In limited areas with adequate irrigation, double cropping is possible.

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<sup>24</sup> Source: District Information System

<sup>25</sup> According to Census 2008 the total population of the five provinces was 4.1 million at that time.

<sup>26</sup> Statistical Yearbook 2008

Tubewells are quite widely used for irrigation of rice and vegetables in Prey Veng and Svay Rieng.

78. Most farmers grow vegetables for their own consumption or for sale in small quantities, while commercial-scale vegetable growing is practiced on the river banks where there is a continuous water supply. In some districts of Kandal province vegetable and fruit growing is more important than rice production. Smallholders keep livestock: cows, pigs, chickens and ducks, usually as a supplementary activity to rice growing. There is a small number of larger enterprises raising pigs or chickens.
79. More than half of households in the target area supplement their income with off-farm work, either locally or by family members migrating to work and sending remittances home. Average income of rural households is estimated at around USD 1,000 per year, excluding rice cultivation.
80. About 10% of rural households do not own any agricultural land. Of those that do own land, only about 21% hold formal titles, mainly as a result of the systematic land titling conducted by the Ministry of Land in some areas in recent years. Other households usually have a "soft" title verified by the local authorities; this is usually regarded as sufficient proof of ownership for purposes such as land sales or collateral for loans.
81. All five provinces share a border with Vietnam and this has important effects on the local economy. Surpluses of paddy and other raw agricultural produce find a ready market in Vietnam. Due to lower costs of inputs, most notably energy costs, in Vietnam, there is very little development of either agricultural input or processing industries on the Cambodian side of the border. Meanwhile, mechanisation is reducing the use of labour in smallholder agriculture. Therefore, the RGC has identified a priority to expand these linked industries and services which have the potential to generate employment for the expanding labour force in the target provinces.
82. In addition to importing inputs such as seeds and fertiliser, and exporting raw produce to Vietnam, some areas of the target provinces now have access to electricity from the Vietnamese grid. The price of grid electricity in the target provinces (where available) is approximately \$0.25 per unit, or up to five times the price paid by Vietnamese farmers and small enterprises. Local micro-grids and informal generators may charge up to \$0.50 per unit<sup>27</sup>.

### **Poverty in target area**

83. The most recent province-by-province poverty estimates are based on 2007 data and show the poverty headcount of the target provinces varies from around 20%-25% in Kampot, Takeo and Kandal to over 35% in Prey Veng and Svay Rieng, compared to a national average of around 30%<sup>28</sup>. The national poverty headcount was estimated as 20.5% (23.7% in rural areas) in 2013<sup>29</sup>. There are marked differences in poverty levels within as well as between provinces, and increasing inequality results in significant numbers of poor households even in the less poor Districts. At the household level, poverty is often associated with lack of land, high numbers of dependents and few or no able-bodied adults, leaving female-headed households with young children particularly vulnerable.
84. Households in the target Districts, and poor households more so, are vulnerable to economic stress due to ill health, animal diseases and loss of crops as a result of drought or flood. Land conflicts, either between local residents or (more rarely) with powerful outsiders, can also

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<sup>27</sup> Survey conducted by UNCDF, 2010, and field data,

<sup>28</sup> Data presented here on poverty figures use analysis based on 2007 CSES data. The selection of communes is based on poverty figures from the Commune Database (CDB) for 2010 which present slightly lower poverty rates.

<sup>29</sup> World Bank 2013: Where have all the poor gone? Cambodia Poverty Estimate 2013



threaten a family's livelihood. Alcoholism and domestic violence also affect living standards and household members' wellbeing.

### **Gender issues**

85. Women constitute more than 50% of the active labour force and head more than a quarter of Cambodian households (25.6%).<sup>30</sup> In the targeted provinces, out of more than 4.5 million people, more than half are women. At provincial level, women-headed households are 18.5% in Kampot and Takeo, 17.7% in Svay Rieng, 17.4% in Prey Veng, and 15.6% in Kandal.
86. Women comprise a major part of garment workers in cities and some market traders in rural areas. Women perform a number of agricultural activities, fish processing and sale (as they often cannot fish either in lakes or ponds), marketing, handicraft making, and run a range of food processing industries and small businesses. However, wage employment opportunities available to women outside the garment sector are still limited and women consistently earn less than men. At the household level, women are also primarily responsible for household food and nutrition security, taking care of domestic animals, and looking after children, old and sick people.
87. Migration trends in the targeted provinces show that women migrate more often than men. From interactions with communities and local authorities, it also emerged that young unmarried women are more likely to migrate, especially outside the country and for the long term. Women, especially those married with children, often pointed out they would prefer remaining in the village and find alternative livelihood opportunities (non-farm activities) rather than migrating. Qualitative field work during preparation with village focus group discussions indicated that women complained working conditions are often very bad and unhealthy and that some even contracted malaria. Most of women heads of households declared they are not in the position to migrate, because they cannot afford expenses for travelling and settling down. Female migrants with children usually leave them to elder children, relatives or neighbours.
88. While women are responsible for families' cash management and household chores, men are traditionally responsible for making most decisions on issues such as finding inter-provincial or migratory employments. However, compared to the past, overall, women have relatively more participatory power in family decision-making process. In the sample studies done for the PADEE, the percentage of households with decision-making by men is below 50% in all provinces. While less than 20% of households in the sample are headed by women, more than 20% of them have decision-making done by women. In Svay Rieng and Prey Veng the proportion is higher. In Takeo only about 15% of households have decision-making done by women.
89. The use of firewood has impacts on women in two ways: labour time and a health concern. Labour for daily chores such as firewood collection tends to fall more on women and children; women can save average 2 hours per day from the firewood collection. The combustion of firewood in cooking presents a health risk for women as well. Women suffer from chronic respiratory diseases and eye infections caused by toxic gases of carbon monoxide and nitrogen oxide as well as dust particles built up in the unventilated kitchen.
90. The productive use of energy can contribute by providing heat and motive power for small-scale agriculture-based activities that can run farm machinery (such as water pumps, fodder choppers, threshers, grinders, and dryers) thereby minimizing post-harvest loss. The application of renewable energy technologies such as hydro, wind pumps, solar dryers, and modern biomass energy for processing agricultural products can translate into stronger domestic enterprises with increased production and improved income generation.

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<sup>30</sup> General Population Census, 2008

### Access to Electricity

91. The great majority of households in the project target area do not have access to the electricity grid. Figures in Table 1 are extracted from the 2008 Census. At that time, only 15% of households had mains electricity, with the best served province being Kandal. Electrification rates in rural areas are much lower. The most common form of lighting is car batteries which are usually re-charged by a local generator operator, followed by kerosene lamps. The overwhelming majority of households – including those served by mains electricity – continue to use wood and charcoal for cooking.

Province	Kampot	Kandal	Prey Veng	Svay Rieng	Takeo	5 Provinces
<b>Lighting</b>						
Mains Electricity	12%	30%	7%	12%	10%	15%
Kerosene	54%	15%	28%	33%	34%	30%
Battery	33%	47%	64%	55%	53%	51%
Other	1%	8%	1%	1%	2%	3%
<b>Cooking</b>						
Fuelwood/Charcoal	97%	92%	98%	96%	97%	96%
LGP	2%	6%	1%	3%	2%	3%
Other	1%	2%	1%	1%	1%	1%

*Mains electricity includes households using a back-up generator*

*Source: Census 2008*

### Target group

92. The GEF SCCF financed project (“the project”) will extend access to the benefits of RET to the PADEE target beneficiaries, who are resource-poor rural women and men and their households, and smallholder rice farmers in particular. In PADEE, these farmers are organised in Improved Group Revolving Fund (IGRF) groups which directly provide access credit for investments in agriculture productivity, and are also the focus for agriculture extension and small business development activities under the project. It is expected that the most successful IGRF groups will evolve into formal farmer organisations and cooperatives in line with the cooperatives policy of MAFF. PADEE supports 984 IGRF groups of 50 members each for a total 49,200 IGRF group members.
93. IGRF group members are selected through a two-stage process. First, communes and districts were selected within the five project provinces based on poverty incidence and headcount, potential for agricultural production and cost efficiency criteria. Then, households within selected communes are chosen based on participatory wealth ranking and on assessment (including self-assessment) of willingness to participate and ability to fulfil the project associated tasks responsibly. Group composition is based on households rather than individuals, however at least 50% of household representatives in the groups are women.
94. The PADEE baseline survey sampled 1,530 IGRF group member households. Of these households, 1,158 (76%) owned a television set, indicating use of electricity within the household, although in the majority of cases this would be from local generators or car batteries. Thirty-four (34) households (2%) owned generators and 26 households (2%) owned bio-digesters. No other type of RET is listed amongst the household assets identified by the survey.

95. The project will support activities that give PADEE IGRF group members and their communities the benefits of RET, with emphasis on adaptive uses supporting climate resilient agriculture production, processing and marketing. To achieve this the project will support and facilitate installation of RET by individual smallholder households. Direct beneficiaries may also include individual or collective enterprises that indirectly benefit smallholders (for example, RET for rice milling, improving the market for smallholders' rice) and local enterprises in the RET value chain including marketing, financing, installation and after-sales service of RET.

## **IV. Project description**

### **Project rationale and GEF added value**

96. The project design responds to the analysis that there is a large unmet potential for adoption of RET in rural Cambodia, but that there are barriers to the realisation of this potential. These barriers include limited knowledge and understanding of RET; a limited range of proven technologies and applications; underdeveloped markets for services in financing, installation and after-sales service of RETs; installation costs that are challenging for resource-poor farmers; and a policy environment that, while generally favourable to RET, does not fully reflect the potential economic and social benefits of these technologies.
97. The potential for RETs is particularly strong in the agriculture sector, because the majority of Cambodian smallholder farmers are, and will remain for the foreseeable future, beyond the reach of the national electricity grid. Farmers face high energy costs and this increases the cost of agriculture production as well as constraining the development of other value chain activities (inputs, processing and marketing) which would allow farmers and agricultural communities to capture a larger share of value added.
98. Supporting the increased adoption of proven RETs and expanding the range of RET technologies and applications available to Cambodian farmers will assist them to develop profitable and resilient farm enterprises. In turn, this will reduce their vulnerability to climate change. Specific RET applications have a direct adaptive benefit, including the use of solar pumps to overcome drought and the use of bio-digester residues to restore soil fertility. Increased adoption of RETs by Cambodian farmers will have global environmental benefits through substituting for fossil fuels and reducing the use of non-sustainable firewood and charcoal for cooking.
99. The IFAD country programme in partnership with MAFF is well placed to assist smallholders to overcome the barriers to increased adoption of RETs. The S-RET project will leverage the benefits of an established project implementation structure in PADEE including the established project management capacity of PSU and the provincial project teams, the network of Commune Extension Workers (CEW) and Mobile Support Teams (MST) and the existing beneficiary groups (IGRF). The PADEE project also benefits from the partnership with the iDE supported Farm Business Adviser network and the role of SNV in supporting extension, small business development and (with NBP) the roll-out of pro-poor bio-digesters. Therefore, the intention of the project is to support, through PADEE and the broader IFAD country programme, a series of targeted measures to overcome the identified barriers to RET adoption in the smallholder agriculture sector. These activities will include introduction, testing and demonstration of new technologies (RETs and applications), capacity development of supporting services (finance, installation and after-sales) and support to scale-up of proven technologies particularly through increasing their accessibility to resource-poor smallholders.
100. PADEE has an Access to Technology and Markets component focusing on agriculture extension. This component has three sub-components: (i) support to innovation in capacity building; (ii) applied training and capacity building and; (iii) small rural business development (which includes support to scaling up of biodigesters piloted through PADEE under the National Biodigester programme). Continuity of these activities will be ensured in S-RET through the

business stimulus facility developed under PADEE. The component enhances farmer capacity in appropriate agronomic, marketing and post-harvest management techniques combined with support to the development of off farm activities and linkages to markets. Different agriculture activities will also be strengthened under S-RET by complementing the inclusion of RET in smallholder agriculture (chicken raising, vegetable farming, mushroom production, as well as various handicrafts and other non-agriculture related income sources).

101. Through the TWG-CCAFF the project will facilitate knowledge sharing and evidence based policy development engaging multi-stakeholders (relevant Ministries, CSOs, donor agencies, private sector) to overcome the remaining policy barriers to scaling up adoption of RETs in agriculture and the rural sector in Cambodia. The results of TWG-CCAFF led discussions will be prepared as policy briefs and submitted to the National Council for Sustainable Development (NCSA) which will consolidate national-level response to climate change.

## Country eligibility, ownership and drivenness

### Eligibility

102. Cambodia is eligible to receive financing from the SCCF as a non-Annex 1 party to the UNFCCC<sup>31</sup>. The proposed S-RET project responds to the objective of the SCCF to support adaptation and technology transfer projects and programs that are country-driven, cost-effective and integrated into national sustainable development and poverty-reduction strategies; and take into account national communications or NAPAs and other relevant studies and information provided by the Party. The primary focus of the S-RET will be on fostering adaptation through enhanced use of RET, though the project will also have transfer-of-technology aspects and provide global environmental benefits through reduced carbon emissions.

### Ownership

103. The S-RET will be implemented by MAFF and will be integrated with IFAD's country programme which is strongly supported by the RGC through Ministry of Economy and Finance (MEF), MAFF and other partner Ministries. In particular, the project will be under the overall direction of the Secretary of State responsible for the TWG-CCAFF and will be managed by the MAFF Project Support Unit. Key elements of the project will be implemented by the National Biogas Programme following the precedent established under PADEE.

### Country Drivenness (Responsiveness to national priorities)

104. The design of the S-RET project has been prepared with the active assistance, cooperation and support of the RGC's GEF Focal Point and of the Ministry of Environment as well as being under the direction of the MAFF Secretary of State chair of the TWG-CCAFF. Project design included discussions with the Minister of Agriculture, Forestry and Fisheries and the Minister of Economy and Finance.
105. Cambodia has prioritised the enhancement of the agriculture sector's contribution to national development, and renewable energy is a key element to achieving this objective particularly with low-cost alternatives. The RGC's overarching Rectangular Strategy (now in its third phase, known as RS-III) gives a high priority to the expansion of low-cost energy production and supply and distribution network, aimed at ensuring energy security, reliability and affordability to meet development needs, and to expanding the capacity of low-cost and hi-tech electricity production, especially from new and clean energy sources. The National Strategic Development Plan (NSDP) commits the RGC to foster development of all types of renewable

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<sup>31</sup> i.e. a State party to the United Nations Framework Convention on Climate Change, not listed in Annex 1 (developed countries party to the Convention).

energy such as biomass, biogas, bio-fuel etc., and enhance the efficiency of energy through the use of energy-saving stoves, to reduce the use of fuel, firewood, charcoal, etc. Other key policy documents promoting renewable energy systems to reduce GHG emissions and impacts on health include the Cambodia's Climate Change Strategic Plan (CCCSP 2014 – 2023) and the Green Growth Plan (2013-30). The potential for introduction of RET in Cambodia has been confirmed in Cambodia's Technology Needs Assessments (TNAs) and Technology Action Plans (TAPs) for climate change mitigation technologies.

106. Cambodia's climate change adaptation priorities are identified in the National Adaptation Action Plan (NAPA). The NAPA identifies and prioritises a range of project types contributing to CCA. Amongst the agriculture sector priorities in the NAPA, with which the S-RET is aligned, are (1) Promotion of Household Integrated Farming (high priority) and (2) Improving Farmers' Adaptive Capacity to Climate Change.
107. The Project is aligned with the CCCSP and its sectoral plan for Agriculture, Forestry and Fisheries 2014-2018. The CCCSP captures the main strategic objectives and directions for a climate-smart development of Cambodia in the next 10 years. The Project particularly focuses on supporting the following three strategic objectives:
  - (a) Strategic objective 1: Promote climate resilience through improving food, water and energy
  - (b) Strategic objective 4: Low-carbon planning and technologies to support sustainable development of the country
  - (c) Strategic objective 7: Strengthen institutions and coordination framework for national climate change response
108. The MAFF Climate Change Action Plan identifies 5 priority actions for 5 sub-sectors (agriculture and agro-industry, rubber, livestock, forestry and fisheries) and the Project will specifically contribute to the following actions:
  - (a) Agriculture and Agro-Industry Sub-Sector
    - (i) Action 1: Promoting and scaling-up sustainable farming system that resilient to climate change
    - (ii) Action 4: Promote research work on appropriate technology responding to climate change in Agricultural sector
    - (iii) Action 7: Promote appropriate technology/techniques that reduce GHG.
  - (b) Livestock Sub-Sector
    - (i) Action 2: Enhancing animal waste management and climate change emission mitigation.
  - (c) Cross-cutting
    - (i) Action 3: Institutional Mainstreaming Climate Change Adaptation by building capacity and scaling up community resilience
    - (ii) Action 4: Promote marginalized groups and women participation to climate change adaptation and mitigation strategy

### **Project goal, development objective and indicators**

109. The proposed project will be titled “Building Adaptive Capacity through the Scaling-up of Renewable Energy Technologies in Rural Cambodia”, abbreviated as (S-RET).
110. The S-RET will contribute to the overall **Goal** of the PADEE project, which is “Improved livelihoods for poor rural people in the target of Kampot, Kandal, Prey Veng, Svay Rieng and

Takeo Provinces.” The S-RET will contribute to improved livelihoods through enhancing climate change adaptation and resilience of PADEE’s target group of resource-poor smallholders, by improving their access to and uptake of RETs.

111. PADEE has three Goal-level indicators with associated targets: (1) increase in value of household assets owned by participating households; (2) decrease in prevalence of chronic malnutrition in children under 5 years old; and (3) increase in average annual per capita food consumption. S-RET will contribute to the achievement of all three of these targets. However, a specific, higher target is set for the first indicator for 8,000 households directly benefitting from S-RET: the target for these households will be an increase in value of household assets of 50% by end-of-project, as compared with the general target of 25% for all PADEE beneficiary households.
112. The Project Development Objective (PDO) of S-RET is “To achieve a large-scale adoption of Renewable Energy Technologies (RETs) in the agriculture sector of Cambodia<sup>32</sup>.” Two indicators are associated with the PDO. The first, “number of users adopting climate-resilient RET” corresponds to CCA-1 Indicator 4. The target achievement is 8,000 users, at least 40% of whom will be women. The second indicator: “estimated reduction in GHG emissions” corresponds to CCM-1 indicator 4. The target level of GHG emission reductions resulting from S-RET is 32,300 tonnes of CO<sub>2</sub>e.
113. S-RET will be implemented through two components, each of which has an associated Outcome. Component 1, “Climate Resilient RET for Smallholders”, will directly support and facilitate investments in RETs for agriculture production in the PADEE target area. Component 2, “Policy Support for Climate Resilience and RET in Agriculture”, will support complementary capacity building and policy development work at national level, primarily through the TWG-CCAFF. The two components will support each other: lessons learned in Component 1 will provide a basis of evidence for policy development under Component 2, while outreach and dialogue events supported under Component 2 will have the additional benefit of raising the interest of technology suppliers and promoters to participate in Component 1.

## Components and Outcomes

### Component 1: Climate Resilient RET for PADEE Smallholders

114. The **baseline projects** to which Component 1 of S-RET will add value are the IFAD-financed PADEE project and the National Biodigester Programme. From 2018 on, the new IFAD-financed ASPIRE programme will expand its activities into the S-RET target area.
115. PADEE will complete the establishment of 984 Improved Group Revolving Fund (IGRF) groups of 50 resource-poor smallholders per group in 2015. These groups have established capacity and provide their members with access to credit which can be applied to financing RET installations. PADEE has established an extension structure including Commune Extension Workers (CEW), Mobile Support Teams (MST) and in partnership with iDE, a network of Farm Business Advisers (FBA). In addition, PADEE has supported development of pro-poor biodigesters to the roll-out readiness stage. S-RET Component 1 will be functionally integrated in PADEE, particularly for the following: (1) identification of agriculture applications of RET and direct RET beneficiaries through the PADEE IGRF group members; and (2) implementation of agriculture demonstration and extension activities through the PADEE implementing partners (i.e. the Provincial Departments of Agriculture and / or the Farm Business Advisers).
116. PADEE will end in 2018 and thereafter sub-national coordination and delivery of S-RET will be through ASPIRE. In addition, RGC and IFAD will design the AIMS project in 2016 and opportunities for synergies with S-RET will be identified.

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<sup>32</sup> This wording is slightly modified from the form used in the PIF, but the sense has not changed.

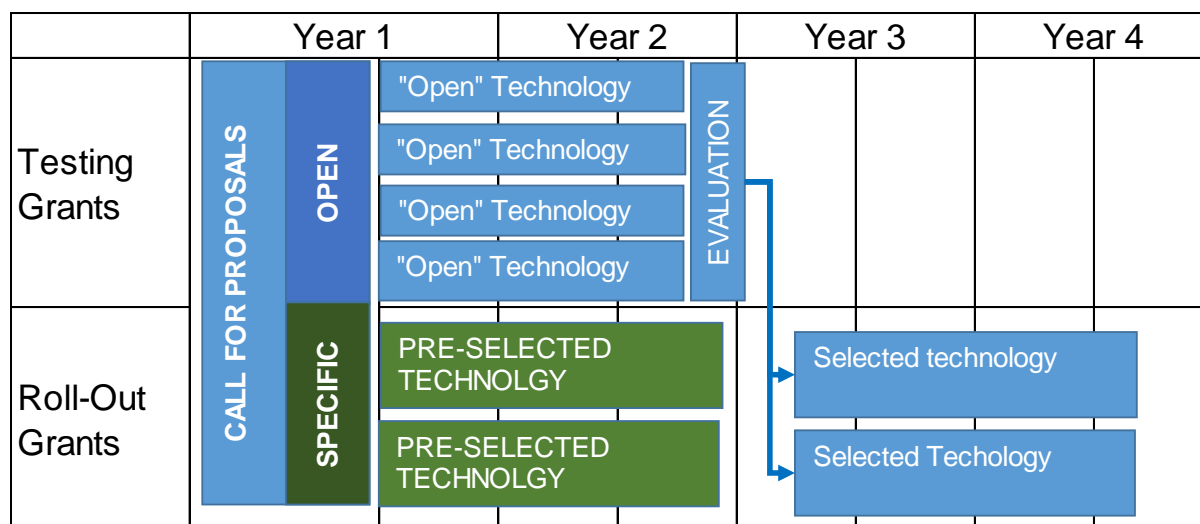
117. The National Biodigester Programme has established technical and implementation capacity including provincial structures in the S-RET target provinces and a network of trained Biodigester Construction Companies (BCC) specialising in installing the NBP biodigester designs. S-RET support for biodigester technologies will be implemented through the NBP. The Project will coordinate selection of biodigester technologies, financing packages and selection of target areas and beneficiaries with NBP to ensure synergy and avoid duplication. The NBP Biodigester Construction Companies (BCC) will be a focus for capacity development support under the Project. Expanding the capacity of the BCCs for installation and after-sales service of other RET could assist the BCCs to become fully commercially sustainable. The project will assist NBP to advocate for a favourable policy environment through Component 2.
118. **Outcome 1** is defined as “Approximately 8,000 smallholder farm households with improved climate resilience due to investments in economically viable RET for agriculture production, processing and / or marketing.”
119. Two **indicators** are associated with Outcome 1:
- (a) Number of beneficiary households enabled to increase agriculture income through RET adoption (target: 5,000);
  - (b) Number of beneficiary households reducing dependence on non-sustainable energy by at least 25% (target: 3,000).
120. Component 1 is structured in three sub-components with associated Outputs. The first sub-component will identify RET with potential for application in smallholder agriculture and assist the developers, promoters and / or suppliers of these technologies to field test them and develop supply chains and service capacity. The second sub-component will work through the PADEE planning and implementation structures to identify smallholders interested in investing in RET (other than biodigesters) and will assist these smallholders, through their IGRF groups, to install the technology and integrate it into their agriculture value chains. The third sub-component will be implemented largely through the National Biodigester Programme (NBP) and will support IGRF group members to install biodigesters and integrate bio-slurry use in their production, as well as supporting technology development and capacity building activities in NBP. Evaluation reports, impact assessments as well as lessons learned from experiences of existing biodigester technologies piloted through the NBP will be reviewed ahead of the S-RET start-up.
121. **Output 1.1, “Supply chains established for climate resilient RET in smallholder agriculture”**, will be implemented through grant awards to assist government agencies, non-governmental organisations (NGO) and private sector firms to develop and prove the viability of renewable energy technologies for smallholder agriculture in Cambodia, and to establish supply chains and after-sales support for the most promising RET. Grants will be awarded to the best proposals received in response to an open call for proposals with transparent and rigorous criteria for eligibility and ranking. The grant awards will be determined by a technical committee based on recommendations from independent expert evaluators and will be subject to no objection by IFAD.
122. There will be two types of grants: “testing” grants and “roll-out” grants. “Testing” grants will support the costs of field testing and demonstration that the technology is appropriate and cost-effective for smallholders’ needs. Roll-out grants will support the costs of development of supply chains and service capacity. Grants will not support costs of technological research and development.
123. Testing will take place during the first half of the project life and the most successful of the technologies supported by the testing grants will be rolled out, supported by the roll-out grants, during the second half of the project. In addition, pre-identified, priority technologies (see paragraphs 126 and 128 below) will be selected for roll-out beginning in the first half of the

- project. Therefore, two calls for proposals will be issued simultaneously in the first year of S-RET, an “open” call for proposals, through which testing grants will be awarded, and a “specific” call for proposals, which will award roll-out grants for priority RET.
124. *The “open” call for proposals* will invite government agencies and business oriented and development motivated firms and / or NGOs with an eligible RET to apply for testing grants. Criteria for eligible technologies will be elaborated in the S-RET PIM and will include the following:
- (a) The RET responds to a priority need of IGRF group smallholders;
  - (b) The RET is an existing technology, either successfully deployed outside Cambodia or developed to readiness for field testing in Cambodia;
  - (c) Is genuinely innovative, i.e. the RET is not already widely adopted, in its proposed application, by smallholders in Cambodia;
  - (d) Financial and procurement scheme proposed to facilitate accessibility to resource poor smallholder farmers including advantages or barriers in local manufacturing;
  - (e) Application in the smallholder agriculture value chain;
  - (f) Projected economic internal rate of return of at least 30% and positive cash flow impact for smallholders;
  - (g) Marketing and after-sale service strategies;
  - (h) Projected environmental benefits and impact in reducing non-sustainable energy use, in relation to observed energy use patterns of Cambodian smallholders.
125. Testing grants will support establishment of a minimum of 10-12 test sites with PADEE participating farmers. The objective will be to demonstrate the technical viability, ease of use, durability, cost-effectiveness and potential contribution to climate resilience of the technology. On completion of the first stage, the grantee will be required to submit the documented technical results of the tests, the costs and benefits of the technology (including resulting reductions in GHG emissions) together with a business plan for rolling out the technology. Grantees will be expected to demonstrate a cost contribution of at least 10% of the cost of the testing which may be costs in kind.
126. Results of testing will be rigorously evaluated. Roll-out grants will be awarded based on an evaluation of the technology and of the business plan for roll-out. The roll-out grant will co-finance the cost of training local sales and after-sales agents and demonstrating the technology to PADEE participating farmers. The intention is to assist a total of at least 8,000 PADEE IGRF group farmers to adopt the innovative technologies and to integrate them into their agricultural production, processing and / or marketing. Grantees will be expected to contribute 50% of the cost of rolling out the technology, with at least half of this contribution in the form of identifiable cash expenditures.
127. *The specific calls for proposals* will invite business oriented and development motivated firms and NGOs to submit proposals for a roll-out grant to scale up pre-identified priority technologies. Through demand assessments conducted by SNV, iDE and the PADEE MIS team, the project has identified solar water pumping suitable for smallholder vegetable production as a priority and one specific call for proposals will be for a firm or NGO with the most suitable model to bring the technology to market in the PADEE target areas. Other technologies could be identified and fast-tracked based on (1) there is an existing technology which has completed initial field testing; and (2) the technology supports an income-generating activity for which there is significant interest demonstrated by IGRF members. The project will award a matching grant to the firm or NGO presenting the best proposal to roll out these technologies to PADEE smallholders. Evaluation criteria for the grant awards will include:



- (a) Performance specifications for the technology;
  - (b) Maximum cost of the technology and procurement scheme including consideration of the possibility of local manufacturing;
  - (c) Number of units to be installed;
  - (d) viability of business model including financial scheme proposed to facilitate affordable sales; proposed marketing and after sale service strategies; and financial projections.
  - (e) Co-financing to be provided by the grantee;
  - (f) Number of local agents (marketing and after-sales) to be trained;
  - (g) Criteria for cooperation with the PADEE agencies.
128. It is anticipated that approximately 5- 6 testing grants will be awarded and about 3 – 4 roll-out grants (including one or two which will be pre-identified during the first half of the project).
129. Component 1.1 expenditures will include the grants, the cost of preparing and issuing the call for proposals, technical assistance for expert evaluators to advise the project technical committee on the merits of the proposals, and costs of monitoring the use of the grants.

**Figure 1: Sequencing of Sub-Component 1.1**



130. **Output 1.2 is PADEE Smallholders integrate (non-biogas) RET into their production and processing activities.** Eligible RET will be determined by the project technical committee and will include technologies for which roll-out grants are awarded under sub-component 1.1– either pre-selected (e.g. solar energy equipment for water) or eventually selected after being awarded with testing grants. Other available and appropriate technologies (for which roll-out grants are not required because there is an adequate existing supply chain) may also be determined as eligible. Biogas and applications are separately supported under Output 1.3 (below).
131. Output 1.2 will be achieved through the following activities:
- (a) Capacity development: training of PADEE project staff (including PDA, PDoWA and iDE staff) in assessing which RET may be suitable for the situation of each IGRF group;
  - (b) Identification of IGRF groups which have a proposed business model for use of RET in agriculture and meet the physical criteria for applicability of the proposed RET: there is a minimum number of farmers willing to invest in the RET and the group has agreed to make loans from the IGRF available for this purpose;

- (c) Initial orientation of the smallholders interested in RET, including a demonstration at an existing demonstration site wherever possible and clear explanation of the costs, benefits and operational requirements of the RET;
  - (d) Facilitation of the IGRF group members to buy and install the RET using finance from the IGRF (or from an MFI); and
  - (e) On confirmation that the RET has been properly installed and is operational, and data is entered in the PADEE MIS, the group (or the individual farmer) will receive a cash subsidy which will offset part of the loan costs.
132. The conditional cash transfers will include an amount to provide a direct subsidy to the individual farmer installing the RET, plus a top-up amount to the group revolving fund which will increase the total size of the fund and off-set the additional burden of providing loans for the RET. This “top-up” amount will also provide an incentive for all group members to agree to finance the RET installation. The amount of the cash transfers will depend on the cost of the technology and will be determined by the project technical committee. In no case however will an individual farmer receive a subsidy exceeding 50% of the cost of a RET unit or exceeding US\$150; the lower value will make up the subsidy. This price subsidy is essential for making RETs affordable to poor smallholder farmers and to facilitate a critical mass of uptake. Since the subsidy is being provided via the IGRF no price distortion is expected in the general RET market.
133. The project will support coaching and demonstration activities to assist smallholders to integrate RET in their agriculture, and will also use the successfully operated RET as demonstration sites for farmers from other groups. Issues related to sustainable natural resource use, specifically water-use efficiency, will be integrated into coaching and demonstration activities. The IGRF will be required to exert social control on members that do not adhere to sustainable natural resource use principles. Firms / NGOs or private sector companies awarded with a grant will be expected to identify capacity gaps in their operations and propose training/coaching for addressing those gaps. The training will be an eligible cost for financing by the grant (especially for the roll-out phase).
134. The successful roll-out of RETs will rely on the accessibility of the new solutions, such as sales and distribution (including maintenance and after sales services), and the availability of financing mechanisms. The project will first identify and review existing sales and distribution networks (such as NBP’s own sales, distribution and financing structure or microfinance institutions on solar home systems) for its efficiency and effectiveness for RETs, and then improve into a new model or adopt the existing model for RET sales, distribution and financing.
135. The target for Output 1.2 is to support installation of RET to benefit about 5,000 households. It is expected that about 2,500 households will benefit from pre-identified RET and a further 2,500 households will benefit from roll-out of technologies proven through the testing grants.
136. Component 1.2 expenditures are will include capacity development (including the cost of training project staff in the applications of RET), conditional transfers to the IGRF groups and costs of demonstration and coaching activities. Component 1.2 will support an RET Technical Adviser and direct technical support and monitoring costs.
137. **Output 1.3: PADEE smallholders supported to integrate biogas digesters into farming systems.** It is expected that NBP will select the best technology option from amongst the pro-poor biodigester models. NBP will roll out biodigesters to PADEE smallholders in Kampot, Takeo, Prey Veng, Kandal and Svay Rieng province through the following activities:
- (a) Capacity development including strengthening the marketing of biodigesters and after-sales service through agents who may be Village Livestock Agent (VLA), Farm Business Advisers (FBA) or Community Extension Workers (CEW);

- (b) Identification of PADEE IGRF groups interested in adopting biodigester technology.
  - (c) Groups will prepare a business model for use of their biodigesters including assessment of the costs, benefits and operational requirements; confirmation of the suitability of the location; there is a minimum number of farmers willing to invest in biodigesters and the IGRF group has agreed to make loans available for this purpose;
  - (d) Installation of biodigesters following normal NBP procedures (i.e. Installation of the biodigester must be done by a technician who is trained and supported by NBP and when the RET is operational, NBP inspects and certifies that the installation is complete);
  - (e) When NBP forwards the certificate to MAFF\_PSU, the subsidy amount and the top-up amount will be transferred to the IGRF account;
  - (f) The farmer repays the remaining loan to the IGRF group in instalments over an agreed period;
  - (g) The project provides extension training to assist the farmers to integrate biodigesters in their agriculture, particularly through the optimal use of bio-slurry for soil improvement.
138. When the subsidy is transferred to the IGRF account, the IGRF deducts the amount of the subsidy from the outstanding amount of the loan. The top-up amount is not deducted from the loan amount, but becomes part of the general fund of the IGRF and can be used to finance any type of loan under the normal rules of the IGRF.
139. In addition, NBP will co-operate with the project for innovative activities. The development of innovative applications of biogas for agriculture will be undertaken such as, heating for chicken hatcheries, conversion of mechanical equipment such as rice mills and water pumps etc. to run on biogas.
140. S-RET will support a study of the NBP marketing strategy which will make recommendations for how marketing can be improved, including by improving the incentives of local sales agents. Following the outcome of the study, S-RET will support training of local sales and after-sales service agents of NBP.
141. The target for Output 1.3 is to install a total of 3,000 best biodigester option selected by NBP, during the project life.
142. Component 1.3 expenditures will include incremental staff and operating costs of NBP, the cost of the marketing strategy study, capacity development costs, the subsidies and cash transfers for biodigester installation, and monitoring costs.
- Component 2: Policy Support for Climate Resilience and RET in Agriculture**
143. The **baseline project** for Component 2 of S-RET is the evidence-based policy component of the IFAD-financed ASPIRE programme. ASPIRE supports a structured process of study, dialogue and policy formulation for the agriculture extension sector, including climate resilient agriculture. S-RET will extend this process with GEF financing into the area of renewable energy and will benefit from ASPIRE policy dialogue structures including the support of an international policy adviser.
144. **Outcome 2** is defined as “An enabling policy framework and institutional modalities for facilitating scale-up of climate resilient RET in agriculture.”
145. Three **indicators** are associated with Outcome 2:
- (a) MAFF Climate Change Action Plan promotes adoption of RET for agriculture;
  - (b) MAFF strategy and action plan for implementation of the Cambodia Industrial Development Policy 2015-2025 reflects the important role of RET in energy for agro-industry (corresponding to CCA-3 Indicator 12); and

- (c) TWG-CCAFF identifies cross-sectoral policies needed to facilitate adoption of RET in agriculture and advocates for policies through the NCSD and other policy forums.
146. Component 2 is structured in three sub-components with associated Outputs. The first sub-component supports capacity development of the TWG-CCAFF<sup>33</sup>. The second sub-component will support policy studies and the third sub-component supports knowledge management and policy advocacy activities.
147. **Output 2.1: The TWG-CCAFF has sufficient capacity to identify and promote policies for climate resilience and RET in agriculture.** Given that the TWG-CCAFF is a relatively new body, a capacity needs assessment will be undertaken for designing a training programme for equipping members of the TWG-CCAFF to advance policy dialogue and formulation for scaling up RET adoption in the agriculture and rural development sector. In the first year of S-RET, the project will support preparation and delivery of a training course in policy options for promotion of RET and climate change adaptation in agriculture. The training courses will also include study tours to best practice sites in Asia. The TWG-CCAFF will develop a strategic plan for advancing the policy agenda replete with key milestones to be achieved. This will enable a close monitoring of the activities of the TWG-CCAFF for pursuing a dynamic policy formulation process.
148. Expenditures under sub-component 2.1 will include training costs, costs to support meetings and field visits of the TWG-CCAFF, and personnel costs for a Policy and Evaluation Adviser and an Administrative Assistant to support the TWG-CCAFF. The sub-component will also support the costs of MAFF representation in regional conferences.
149. The ASPIRE International Policy Adviser will support and cooperate with the Policy and Evaluation Adviser in building the capacity of the TWG-CCAFF.
150. **Output 2.2 Policy Studies to engender an enabling environment for scaling up RET in agriculture sector.** The Project will support the costs of technical assistance to develop policy for climate change adaptation and RET in agriculture and agro-industry. These studies will include an initial study on energy use in the smallholder agriculture value chain, opportunities for scaling-up, and a consideration of potential barriers to scaling up and suggestions on how to overcome these barriers. Other key studies include analyses on increasing affordability of RET through waiver of import duties, price rebates, provision of favourable credit terms, and ecosystem service payments (currently the NBP has a voluntary carbon trading initiative with Hivos Switzerland) to name a few. Further studies will be determined by the policy priorities of MAFF and most likely will include studies to support the integration of RET into the MAFF strategy and action plan for implementing the RGC's Cambodia Industrial Development Policy 2015-2025. A study will be conducted to substantiate the GHG emission reduction benefits of RET in smallholder agriculture.
151. **Output 2.3 Knowledge Management and Policy Dialogue to support Climate Resilience and RET in Agriculture.** Activities contributing to this output will include (1) Policy seminars; (2) workshops; (3) publication costs; (4) production of audio-visual materials; (5) website development and (6) an end-of-project survey to determine the impacts of RET installation on smallholders. Knowledge products will be developed for demonstrating the benefits of RET adoption including reduction in energy costs and labour, and improved income, health and environmental benefits. Under the KM activities an annual RET in Agriculture workshop and fair at which firms and NGOs can demonstrate and disseminate innovative ideas for applying RET in agriculture.

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<sup>33</sup> Or its successor body, in the case that the TWG is re-formed / re-named to correspond to the National Council for Sustainable Development structure.

152. S-RET will also support activities of the GEF Office of the Ministry of Environment, including costs of learning visits and dissemination activities related to S-RET and support to the Climate Change Project Implementation database.
153. Based on the policy studies and dialogue events, the TWG-CCAFF will prepare policy briefs outlining proposed policies that could strengthen climate resilience in agriculture and the more widespread adoption of RET in the agriculture value chain. These policy briefs will contribute to strengthening of the MAFF Climate Change Action Plan and in the MAFF strategy and action plan for implementation of the Industrial Development Policy. Policy briefs may also be submitted for consideration by the NCSD and other inter-ministerial policy bodies as appropriate.

### **Global Environmental Benefits**

154. The change from fuelwood and fossil fuels to RET will have important global environmental benefits due principally to reduced green-house gas emissions (CO<sub>2</sub> and CH<sub>4</sub>)<sup>34</sup> and decreased deforestation and forest degradation. While emissions from Cambodian agriculture remain low, mechanization is proceeding rapidly using mainly general-purpose diesel engines which are of low efficiency for any given application. Therefore, the opportunity to avoid future GHG emissions by encouraging the widespread adoption of RET is considerable.
155. The current estimation of reduced carbon dioxide equivalent (CO<sub>2</sub>e) emission is mainly based on the replacement of Kerosene lamp, charcoal and firewood use. The RET will allow approximately 100,428 tonnes of CO<sub>2</sub>e of direct emission reduction during the project year and 351,498 tonnes of CO<sub>2</sub>e of indirect emission reduction. The total emission reduction is estimated to be 451,926 tonnes of CO<sub>2</sub>e (see Appendix 8 for details). This is a conservative assessment without considering the mitigation benefit from avoided deforestation, land use changes and improved manure management<sup>35</sup>.

### **Linkages with other related initiatives**

156. In addition to its close functional relationship with the baseline projects / programmes PADEE, ASPIRE and NBP, described above, S-RET will actively seek cooperation and knowledge sharing arrangements with other ongoing initiatives promoting climate-resilient agriculture and RETs in rural Cambodia. Some of the key linkages are described in the following paragraphs.
157. **UNDP-GEF Resilient Livelihoods Project:** UNDP has submitted a proposal for LDCF funding for a project supporting climate resilient livelihoods in two Provinces, which is expected to be approved shortly. The Implementing Partner is Ministry of Environment (MoE) with MAFF and NCDDS as Responsible Parties. The Resilient Livelihoods project has a strong knowledge management component which will be implemented by the MoE through its Climate Change Department in close collaboration with the knowledge management platform of the CCCA. The Project will seek opportunities for coordination and knowledge sharing which may focus on (1) suitable investments in RET to enhance climate resilient livelihoods; and (2) climate resilient agriculture extension materials and methodology suitable for implementation in synergy with RET packages.
158. **UNDP-GEF Early Warning Systems Project:** UNDP is implementing an LDCF Early Warning Systems Project with Ministry of Water Resources and Meteorology (MoWRAM) as the Implementing Partner. The Project will seek opportunities for coordination and knowledge sharing which may include locally specific climate data which will be of use in assessing the potential of RET, particularly solar energy.

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<sup>34</sup> Global Warming Potential per tonne of CH<sub>4</sub> is estimated to be 25 times that of CO<sub>2</sub> (AR4 of IPCC, 2005)

<sup>35</sup> Based on the NBP-Cambodia's Monitoring Report III of Credit Period II issued in September 2015, the average GHG reduction for 1 biodigester is 4.5 tons of CO<sub>2</sub>/year/biodigester taking all effects into account.

159. **UNIDO-GEF Renewable Energy Projects:** UNIDO is implementing two projects transferring renewable energy technology for medium-scale electricity generation (3MW-5MW range) in Cambodia, using biogas and biomass (rice husk) technologies respectively. The technologies supported by the UNIDO projects are similar to those that will be supported by the SCCF project, but the SCCF project will work with much smaller installations (50kw-300kW), suitable to its beneficiary group of smallholder farmers, and the direct applications of the RETs are different. Possible synergies between the UNIDO projects and the SCCF project, and options for mutual learning, knowledge sharing and other forms of cooperation, will be explored during project preparation and coordination arrangements will be included in the final project design.
160. **SNV Renewable Energy Programme:** SNV has a country Renewable Energy Programme backed by its worldwide expertise and focussing on biodigesters, rice husk gasification, clean cookstoves and microfinance for solar energy. The partnership of SNV in the project will provide opportunity for extensive sharing of knowledge, technical expertise and data and will particularly enhance the research and innovation aspects of the project. SNV is also initiating work with local solar-PV product suppliers to develop quality control systems and standards for selling solar products into rural areas. With funding from ADF, SNV is establishing an incentive scheme fund of US\$1 million. The GEF grant can enhance this initiative also by diversifying into other RET and creating increased technical training opportunities for the rural youth.
161. **Cambodia Climate Change Alliance** is a sector policy support programme linked to the Global Climate Change Alliance and financed by GCCA, Sweden and European Union. UNDP provides technical assistance. The Project will coordinate with the CCCA particularly for policy support and promotion of policies favourable to RET. CCCA has a Trust Fund which provides grants, principally for policy development support based on the Climate Change Action Plans of priority Ministries including MAFF. The possibility of collaboration in this area will be explored.

## Assumptions and Risks

### Assumptions

162. Key design assumptions are documented in the Project Logical Framework. The linkage of the Project Development Objective (large-scale adoption of RET) to the Project Goal (improved livelihoods) is founded on the assumption that Integration of appropriate climate-adaptive RET in agriculture value chains results in improved livelihoods for poor rural people. This remains an assumption because Cambodian smallholders have not yet adopted RET on a large scale for this purpose, but the assumption is well-founded on knowledge of the cost-effectiveness of RET and on experience from other countries.
163. At the Outcome 1 level, the linkage to the PDO is supported by the assumption that sufficient climate-adaptive RET will be identified to meet the varying needs of smallholders. This assumption is supported by the findings of research with technology companies and NGOs and with smallholders during the design mission, and will be confirmed through the demonstration and testing activities in Component 1.1.
164. The design of Component 2 is based on the assumption that the TWG-CCAFF continues to enjoy strong leadership and support within MAFF and RGC. However, the influential role they can play will need to be closely monitored and supported. The new structures under the NCS have yet to be fully elaborated but the project design team received strong assurances on this issue from the leadership of Ministry of Environment and MAFF.

### Risks

165. Key risks are identified together with appropriate mitigation measures in the Project Risk Log (Appendix 8). The Project Risk Log should become active project management and oversight tool and should be updated at regular intervals during project implementation. The risks

identified in the Risk Log are also summarised on the Logical Framework and are discussed below.

166. **Strategic Risk (Project Goal level): Rapid changes to smallholder agriculture economy limit sustained impact of RET installations on livelihoods.** Livelihoods, employment patterns and farming systems are undergoing rapid change in rural Cambodia, associated with the increasing importance of off-farm wage labour, often involving migration away from the village, the pull factor of the growing urban economy, increased mechanisation and use of agricultural chemicals. Therefore, there is a risk that technologies appropriate to the present may prove less relevant in future. For example, the much reduced role of draught animals may lead to Cambodian smallholders reducing the number of cattle they own, thus making biodigesters less relevant, though this does not seem to be happening to any great extent as yet. The project will mitigate this risk by promoting green value chains and market linkages for smallholder produce benefitting from value addition through the adoption of RET in their farming systems.
167. **Technical Risk: Selected RET prove inappropriate and / or unsustainable in smallholder agriculture applications in Cambodia** (Potential Impact: High, Probability of Occurring: Low). The RET selected for scale-up are based on technologies already familiar and successful in Cambodia and / or in IFAD programmes elsewhere. Care will be taken to ensure that necessary support is in place (i.e. local private sector provision of marketing, installation, after-sales, plus extension support for application of RET to climate resilient agriculture) for successful technology transfer. For less proven technologies the project will focus on demonstration, testing and evaluation before any scale-up decision is taken. Given the innovative aspect of the project, it is acceptable that not all tested technologies will prove successful in a Cambodian context.
168. **Market Risk: future energy market changes reduce the scope for applying RET to smallholder agriculture.** (I: Medium, P: Low). Expansion of the mains electricity grid could radically change the economics of RET electricity generation (e.g. solar panels). Grid expansion plans will be taken into consideration in selecting project sites. The risk of a large (further) fall in fossil fuel prices is considered small.
169. **Support system (Capacity) risk:** the local private sector (marketing, installation, finance, after-sales) does not develop to achieve self-sustainability (I: High, P: Medium). With the partial exception of NBP (MFIs and BCCs) the market infrastructure needed to support RET remains underdeveloped in rural Cambodia. The project will address this need through specific capacity building measures and a supportive business environment (i.e. access to finance) aimed at equipping local entrepreneurs with the skills needed to serve the market, through the roll-out grant mechanism under Component 1.1.
170. **Financing Risk:** RET remain inaccessible to smallholder farmers because of lack of access to suitable finance (I: Medium; P: High). The cost of RET installations is high compared to the resources of smallholder farmers and compared to capital costs of alternatives such as diesel engines. Poor and vulnerable households face additional difficulties in accessing credit due to lack of secure incomes, lack of collateral and low educational levels making interaction with formal finance institutions intimidating. By working through the PADEE IGRF groups the project will seek to ensure that resource-poor smallholders can access affordable finance for RET, resulting in a positive net impact on income and household economy.
171. **Financing risk: financing system fails because RET loans are not repaid** (I: Medium, P: Low). This risk is considered low based on the previous experience of the microfinance sector in Cambodia both related to RET and generally. Defaults on loans made by the PADEE IGRF groups are negligible to date. The project will assist farmers to understand the cash-flow impacts of a decision to invest in RET. Defaults at a scale to pose a risk to the project would

likely only occur either in the event of technology failure (Risk 1 above) or in association with social or political instability which does not seem likely at present.

172. **Political risk: policy environment is unsupportive of RET or of the specific options promoted by the project** (I: Medium, P: Low). The overall policy environment is generally favourable for RET and the risk of policy changes making RET less viable is considered low. However there is a degree of inertia in policy-making in Cambodia particularly concerning cross-sectoral / inter-Ministerial issues. This could make it challenging to secure positive policy changes. This is not considered an overall risk to the viability of the project. Through Component 2 the project will work to build awareness and consensus on the need for policy changes to favour RET (e.g. reduced import tariffs for RET equipment; lower feed-in tariff rates and net measuring of electricity production from RET for selling back to national grid).

### **Sustainability and replicability**

173. The project supports uptake of RET, which have a high inherent sustainability. Because of the good performance of existing RET systems and the low running costs, the sustainability of installed systems is very high. After eight years of NBP operations, 96% of installations were found to be operating satisfactorily. Where biodigesters were no longer in use this usually resulted from a change in household circumstances or economic activities, for example migration for work or reduction in livestock farming for reasons unconnected with the biodigester. Other proven technologies such as solar photovoltaic (PV) systems have a similar good sustainability record in service. The process for introducing innovative technologies supported by the project will include a realistic assessment through field trials on a continuous basis on the impact of proposed RET in relation to household level costs, benefits and other factors affecting long-term sustainability.
174. A self-sustaining market will be achieved through reaching a “critical mass” of existing installations and private investments in new installations, such as to create opportunities for private sector suppliers in each component of the market system, i.e. supply, marketing, finance, distribution, installation and after-sales service. S-RET will support development of the market space for private companies to operate in what are still difficult conditions (legal, regulatory, policy and governance). In particular, the roll-out grants under Component 1 will assist technology providers to develop supply and after-sales service chains. In the biodigester sector, NBP has a well-established system (the “Biodigester Construction Companies or BCCs”) for local private-sector installation of biodigesters and the project will build on this model to strengthen the marketing and after-sales service capacity of NBP. The project will seek to build on existing partnerships through the PADEE project, notably iDE’s Farm Business Adviser (FBA) network who are local entrepreneurs using agriculture extension as a marketing technique for quality-controlled agriculture inputs. Sustainability will also derive from policy frameworks that will create institutional mechanisms to develop the rural energy sector through promotion of decentralized and small scale RET.
175. By linking RET to income-generating activities, the project will assist smallholders to invest in RET as an economic investment with a clear and identifiable impact on household income and cash-flow. Broader uptake of RET will reduce costs for installation and after-sales and thus enhance sustainability. Where viable, the RET installations should ensure linkages with potential agricultural processing activities that can increase agricultural productivity and increase income levels of which a percentage can be geared towards the operation and maintenance of proposed RET.
176. At the policy level the project will assist the TWGCC-MAFF to develop a favourable policy, institutional and incentive framework for widespread adoption of RET in Cambodia, thus assisting the development of a self-sustaining market in support of RET scale up. A review of existing government strategies surrounding the promotion of renewable energy in rural areas



- (i.e. Green growth strategies, curbing Greenhouse Gas emissions, reducing deforestation rates etc.) will allow for better linkage and alignment to national-driven programs.
177. The potential for scaling up use of RET in smallholder agriculture in Cambodia is very large, with around 2 million smallholder households, only a small minority of which use RET at present and of which less than half have access to mains electricity. Full scale adoption of RET will come about mainly through market forces, based on familiarity with demonstrated successful technologies and income-generating applications in agriculture. Increasing up-take will lead to stronger market mechanisms and reduced costs from economies of scale.
  178. The S-RET will directly facilitate scale-up through (1) increasing the number of proven applications of RETs, particularly income-generating applications in smallholder agriculture and closely related activities, thus increasing the attractiveness of RETs to smallholders; (2) support and capacity development of the local private sector; (3) direct financial and capacity support to resource-poor smallholders; and (4) policy support to remove policy barriers to adoption of RETs.
  179. Despite the large long term potential, the remaining barriers to adoption (see above) are significant and will require continued support of RGC and development partners to overcome. An increasing share of this support should be in the form of subsidies which off-set the cost of capturing the global environmental benefits of RETs (i.e. reduced carbon emissions<sup>36</sup>). The existing NBP combination of subsidies and affordable finance (i.e. the baseline scenario) is a good model, but more can be done to bring RET within the reach of poorer households such as carbon credit schemes to further bring down retail price of technologies.
  180. Through its knowledge management activities and through the advocacy of the TWG-CCAFF, the SCCF project will raise awareness of the potential of RETs in smallholder agriculture amongst Government and development partners and thereby facilitate resource mobilisation for support to scale-up. The integration of RETs into the IFAD Cambodia Country Programme will lead directly to possibilities for additional funding on a significant scale. On phase-out of the PADEE project, the ASPIRE programme will extend its results-based approach to agriculture extension services into the project target provinces. There will also be opportunities for collaboration with an upcoming IFAD-supported value-chain project (Accelerated Inclusive Markets for Smallholders, AIMS) which will be designed in 2016.

## V. Project implementation

### Approach

181. The implementation arrangements of S-RET are designed to maximise the effectiveness of the project, particularly through forming strong linkages between the roll-out of RET to resource-poor smallholders under Component 1, and the knowledge management and policy development activities under Component 2. The project will be implemented under the leadership of the TWG-CCAFF as Project Director, which will ensure the linkage to policy-making within MAFF as well as to the inter-Ministerial structure of the NCSD and other policy forums.
  182. Implementation of S-RET will not require creation of new project structures but instead will rely on the existing structures of MAFF-PSU, the PADEE project and the NBP (for Component 1) and of the TWG-CCAFF (for Component 2). Additional staff will be recruited to strengthen the capacity of these structures where justified by the additional workload. Capacity development of
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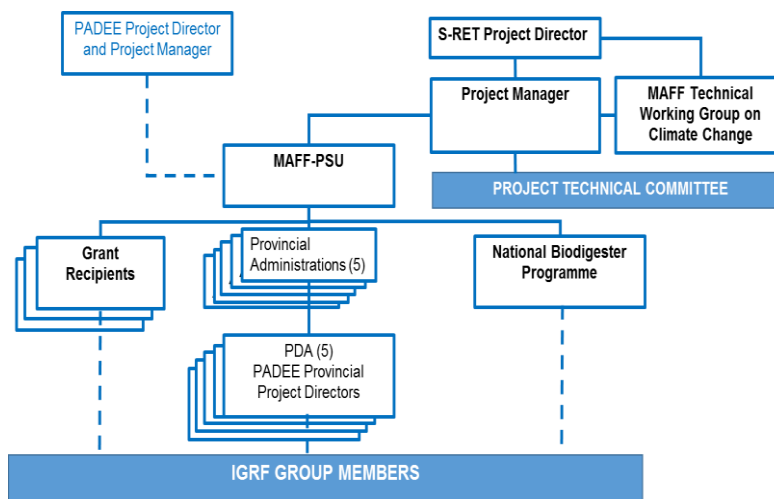
NBP (particularly in the area of marketing) and of the TWG-CCAFF are output-level results of the project.

183. The S-RET follows the gender mainstreaming approach of the PADEE. Within PADEE, gender mainstreaming and the specific needs of poor rural women are taken into account in all aspects of project design and implementation. Formation of the IGRF groups will be based upon participatory wealth rankings and assessment of willingness and capacity to participate, and the capacity building support provided to the groups will consist of a basic common curriculum plus options selected by the beneficiaries. Gender-based production technique training is integrated in the training approach and packages for better access to finance and practical application of techniques around small rural business activities. Through PADEE, the Ministry of Women's Affairs (MoWA) is directly involved in implementation of a gender mainstreaming action plan and provides specific technical assistance particularly on off-farm activities for women. The baseline project provides capacity building of gender officers in gender analysis, mainstreaming and other related topics and finances studies including a stocktaking of gender mainstreaming in agriculture and an assessment of drudgery patterns of women in target areas.

### **Organizational framework**

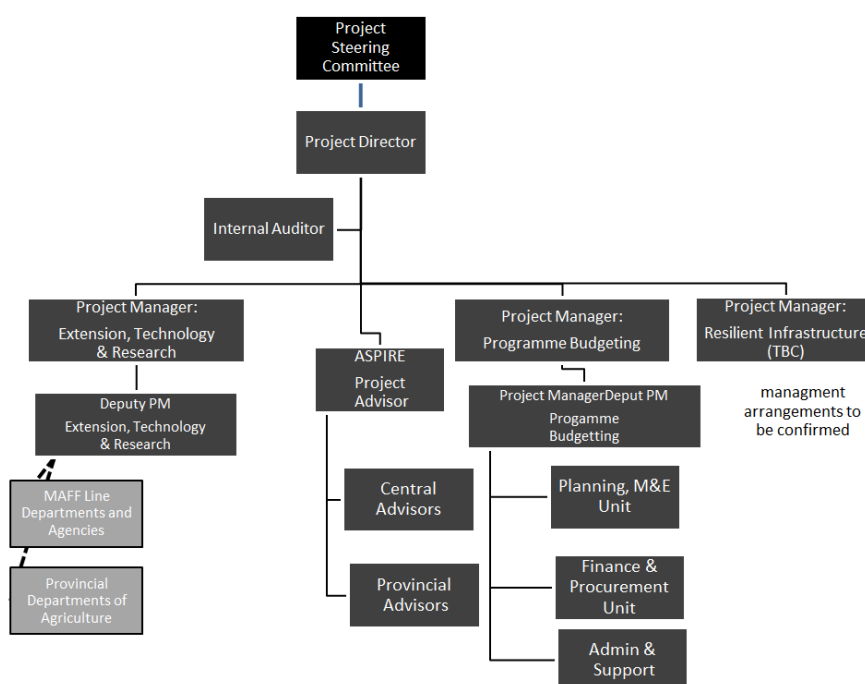
184. Ministry of Economy and Finance (MEF) is the official Representative of the Borrower/Recipient, i.e. Kingdom of Cambodia, and responsible for: (i) Providing inter-agency coordination when required; (ii) Fulfilling the government fiduciary oversight and management responsibilities; (iii) Providing sufficient counterpart contribution in a timely manner to finance the Project activities, including payment of government staff salaries; (iv) Timely processing WAs, approval of procurement actions and other necessary documents according to the SOP. MEF has assigned one officer of its the Office for Multilateral Cooperation II (OMCII)/Department of Cooperation and Debt Management (DCDM)/General Department of Budget (GDB) to work full-time on PADEE and this officer will also be responsible for S-RET.
185. MAFF will be the Executing Agency for the S-RET project. The project will be implemented under the leadership of the Secretary of State responsible for the TWG-CCAFF as Project Director. MAFF will report to the National Council for Sustainable Development (NCSA) on the technical and policy aspects of the project. A Project Manager will be appointed to be responsible to ensure timely and cost-effective implementation of all activities in the S-RET AWPB and will report to the Project Director.
186. **Project management functions as well as implementation of Component 1** will be embedded in MAFF-PSU which is also responsible for the PADEE project and with the provincial PADEE structures (see Figure 2). These structures will be strengthened with additional staff where necessary. Project monitoring, cash management and financial reporting will be conducted by the relevant units of MAFF-PSU. One additional project accounting officer, will be recruited/appointed who will report directly to the Project Manager but who will have access to and use the accounting systems and standards, including Peachtree software, of MAFF-PSU. One administration officer and one M&E officer will be recruited/appointed.
187. The S-RET project director will appoint an S-RET Technical Committee, which will be responsible for technical advice on grant awards and eligible technologies for support under Component 1. The Technical Committee will be chaired by the Project Manager and will include representatives of TWG-CCAFF, PADEE, the PDA, ASPIRE and IFAD. The S-RET Project Technical Adviser will support the committee.

**Figure 2: Project Organizational Structure under PADEE**



188. Upon completion of PADEE in 2018, project management functions will be transferred to the ASPIRE Secretariat (see Figure 3). Considering that ASPIRE is a programme-based initiative several of the programme management elements are expected to evolve through the implementation process. As such, it is premature at present to define in detail how S-RET will be embedded within ASPIRE once PADEE is concluded. The details of the merger of S-RET with ASPIRE will thus be elaborated during the Mid-Term Review (MTR) of S-RET. Considering that the implementation of ASPIRE was initiated in Q4 of 2015, it is anticipated that by 2018 a well-functioning ASPIRE programme will enable for a smooth merger of S-RET with ASPIRE. Detailed project implementation arrangements with relation to PADEE and the process for facilitating the merger with ASPIRE will be described in the S-RET Project Implementation Manual (PIM).

**Figure 3: Organisational Structure of ASPIRE Secretariat**



189. Component 1 will be implemented through the structures of the PADEE project including MAFF-PSU, the Provincial Administrations (for inter-agency coordination and financial management functions), the Provincial Departments of Agriculture (PDA), the NBP and implementing partners.
190. MAFF-PSU will coordinate Component 1 activities. MAFF-PSU will monitor implementation progress through the monitoring systems of PADEE and will keep the Project Manager fully informed.
191. Grantees under Sub-Component 1.1 will be responsible to plan and implement their own activities but will be responsible to keep MAFF-PSU and PDA in each province fully informed. All activities involving PADEE beneficiary farmers must be coordinated with PDA through the PADEE coordination systems. To this end, grantees will be required to attend the regular inter-agency coordination meetings of PADEE in Districts and Provinces where they have activities. In turn, PDA will assist grantees with identification of beneficiaries, liaison with local authorities etc. as needed. MAFF-PSU will directly monitor implementation of grant-financed activities and the grantees must facilitate this by providing activity schedules and other necessary information.
192. In each Province, the Provincial Administration (PA) has overall responsibility for PADEE project coordination and management and will play a similar role in S-RET. PA will undertake work planning, administrative and financial management roles and will report to MAFF-PSU. The Provincial Administration will lead AWPB preparation and project coordination at Provincial level but will be closely supported in these tasks by PDA.
193. PDA will work with the PA to coordinate and monitor all S-RET activities in the Province. Through the Commune Extension Workers (CEW) PDA will support and coordinate with the IGRF groups including identification of groups interested in investment in RETs, verifying eligibility for conditional cash transfers to IGRF groups based on installation of RET and implementation of coaching and demonstration activities.
194. NBP will be responsible for **implementation of Component 1.3**. The tasks of NBP include: (1) Advising on appropriate pro-poor models of biodigester that is suitable for S-RET support; (2) Strengthening the supply chain for pro-poor biodigesters including recruitment, training and support of local agents for marketing, sales and after-sales service; (3) Developing innovative applications of biodigesters for the smallholder agriculture value chains; (4) approval of proposed installations; (5) Technical supervision of installations; and (6) Certification of installations.
195. TWG-CCAFF will be responsible for **implementation of Component 2**. MAFF-PSU will ensure that TWG-CCAFF is fully informed of implementation progress in Component 1 and is able to monitor and participate in field-level activities in order to benefit from the learning experience of Component 1. Under component 2, a coordinator will be recruited as Policy Adviser for the S-RET. This Policy Adviser will work in close collaboration with the International Policy adviser under ASPIRE as well as ASPIRE national advisers on MIS and M&E. The role of the S-RET Policy Adviser will include linking provincial-level policy discussions and recommendations to the NCSD.
196. The Project Implementation Manual (PIM) will describe arrangements for project implementation in detail, insofar as these differ from implementation arrangements for PADEE. An outline of the S-RET PIM is provided as Appendix 9. Where PADEE procedures apply, the S-RET PIM will refer to the PADEE PIM. IFAD will conduct joint supervision missions for PADEE and S-RET.

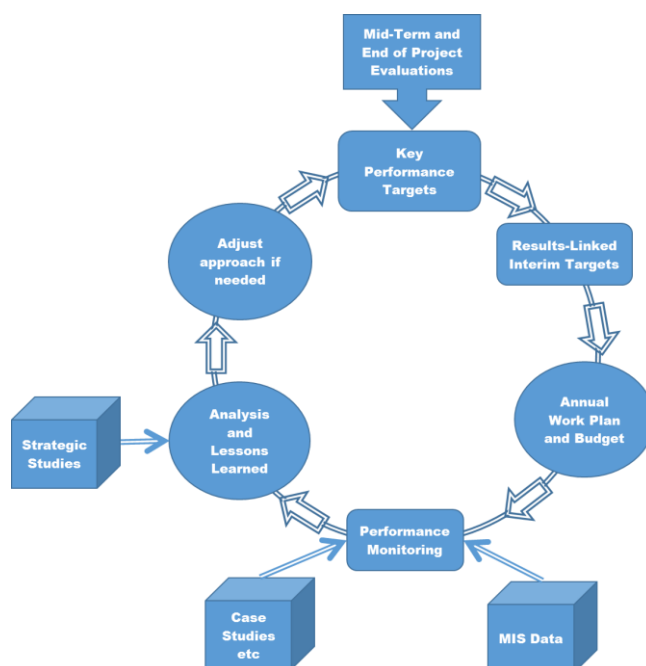
## Planning, M&E, learning and knowledge management

197. Planning, Monitoring and Evaluation of S-RET will make use of and leverage the established systems and capacity of PADEE and of the MAFF-PSU. At the same time, lessons learned from M&E of PADEE (as reflected in the MTR report) as well as more generally in implementation of the IFAD country programme in Cambodia, will be taken into account in designing robust and effective M&E systems for S-RET.
198. Strategic evaluation of S-RET will be integrated into the policy development framework. A Policy and Evaluation Adviser will be attached to the TWG-CCAFF for this purpose.
199. Monitoring and Evaluation will be integrated into the results-oriented management of S-RET. This means that M&E activities and outputs will be integrated in the project planning and implementation cycle and lessons learned will be used to adjust and improve the implementation approach. In particular, M&E will encourage a management focus on strategic results and on the mutually interdependent set of activities needed to achieve those results, rather than exclusively on delivery of work-plan activities in isolation as has sometimes been the case in the past.

### Planning

200. Key performance indicators are identified in the Project Logical Framework and are discussed in Section II above. While some of these indicators can be measured on an annual or more frequent basis, others reflect strategic results that may take several years to achieve. Therefore, annual work planning for S-RET will be based on a set of interim targets, clearly linked to the logframe indicators but susceptible to continuous monitoring. These annual targets will become the basis for preparation of the project Annual Work Plan and Budget (AWPB). Through the project Management Information System (MIS) and other instruments, project management will be informed of, monitor and report on achievement of these targets and will be enabled to take timely corrective action if there is a risk of under-achievement.

Figure 3: Project Planning and M&E Cycle



201. Preparation of the S-RET Annual Work Plan and Budget will be integrated with the PADEE AWPB planning system. Each province prepares an Annual Work Plan and Budget based on

the project costs at appraisal adjusted for actual current market prices of a given year and following consultations with districts and communes under their jurisdiction. NBP will prepare its AWPB for S-RET activities based on consultation and coordination with the provinces. Grantees under Sub-Component 1.1 will be required to submit draft work plans for grant-financed activities. TWG-CCAFF will prepare a draft AWPB for Component 2. All project implementing institutions at national and sub-national level will meet to review and consolidate the AWPBs in September each year. Project Manager will consolidate the above inputs into the final AWPB and Project Director will submit the final AWPB to IFAD for no-objection by November 15th every year. Interim performance targets will form the basis of project planning each year, and will be included in Annual Work Plans and Budgets and will be reported against in the Annual Implementation Report.

### **Monitoring and evaluation**

202. Monitoring and evaluation of S-RET will be the responsibility of the project management team in MAFF-PSU and will share resources including technical assistance with PADEE M&E. The PADEE Provincial project teams will be tasked to ensure that M&E data are collected in a complete and timely manner.
203. The principal M&E instruments will comprise (1) the PADEE project MIS, with suitable modifications; (2) supplementary data collection by project M&E staff, particularly focusing on complex or qualitative data that cannot be captured easily by the MIS; (3) the PADEE Major Impact Survey; (4) strategic studies; and (5) external evaluations at mid-term and end of project stages.
204. The PADEE project **MIS** is a web-based system comprising modules on the Improved Group Revolving Funds, participation in training and adoption of agriculture techniques by IGRF group members. Each farmer has a membership card with a unique ID in the system CEWs and other project staff are equipped with mobile devices allowing direct uploading of data from the field.
205. Some modifications will be needed to the MIS to permit recording of data on S-RET activities. The key data to be recorded in the MIS will comprise:
  - (a) Number, type and location of RET installations;
  - (b) Key uses (applications) of RET installations;
  - (c) Financial data (repayment of RET-linked loans.
206. The MIS data will be supplemented by regular, **sample-based data collection** by the project teams. The key types of data likely to require supplementary collection are:
  - (a) Data on the technical effectiveness of the RET;
  - (b) Impact of the RET on net farm incomes.
207. The **PADEE Major Impact Survey** is a household level sample survey with both cross-comparison (control sample) and longitudinal (panel survey) dimensions. The baseline survey data was collected in 2012 and the first follow-up survey will be conducted in 2015. There will be an end of (PADEE) project data collection in 2018. Supplementary questions will be added to the mid-term questionnaire in order to capture data on household energy use and access to RET, which will be incorporated into monitoring and evaluation of S-RET. Following the PADEE end-of-project survey, a review will be undertaken to determine the requirements for a further (end of S-RET) household survey, which may be conducted in conjunction with a broader survey for ASPIRE.
208. **Policy Studies** financed under Component 2 will be integrated into S-RET M&E, i.e. the findings of the studies will be analysed to identify recommendations for adjustments to the project approach or additional opportunities that can be taken up by the project. These studies are expected to include:

- (a) Energy use in the agricultural value chain, including energy consumption, typical source and costs for selected smallholder agriculture-based commodities;
  - (b) Best practices of sustainable agriculture powered by RET that seem transferable to targeted areas and the associated policy support measures;
  - (c) Research, study and review of RET with potential for introduction or scaling-up in smallholder agriculture production in Cambodia. This is likely to include innovative technologies being piloted by Government, civil society and / or the private sector in Cambodia or in neighbouring countries;
  - (d) Key obstacles to more widespread adoption of RET by Cambodian smallholders.
209. A small budget for **additional studies** is included in the S-RET M&E budget and will be allocated by the project management team, in discussion with IFAD, on an annual basis or as required. Priority will be given to studies designed to provide additional information or innovative solutions to problems encountered during implementation (i.e. as an integral part of the “analysis” step in the project planning, monitoring and evaluation cycle, Figure 1 above).
210. An external consultant team will be engaged to review progress of S-RET and prepare a report including achievement of performance targets, impacts and recommendations, to be taken into consideration by the project mid-term review. This exercise will be repeated as part of the final evaluation of S-RET.
211. **Monitoring and Evaluation of Component 2** will include monitoring of delivery and effectiveness of capacity development activities but will also include monitoring of performance targets using the same general approach as for Component 1. Strategic targets and indicators are identified in the project logical framework and interim targets will be developed and annually updated based on the policy development work-plan. Interim targets will reflect achievement of key steps such as completion and acceptance of policy studies, preparation of policy documents and approval of key policy instruments. Analysis of achievement or under-achievement vis-à-vis the key performance indicators, challenges and strategic response will be integrated in the project planning, monitoring and evaluation cycle.

### **Project Reporting**

212. MAFF PSU will be responsible to prepare and submit consolidated fiscal and financial progress reports of the S-RET at mid-year and annually. These reports will be submitted at the same time as PADEE reports but will be prepared and presented in a separate volume. The mid-year report is to be submitted no later than 31<sup>st</sup> July each year and the annual report by 28<sup>th</sup> February in the following year.
213. The primary content of the Mid-year report is data on physical and financial progress against the AWPB. The annual report presents the same data plus data on achievements against interim results and key performance indicators in the logframe. Both reports should include a short narrative which in particular should highlight challenges encountered and describe the management response. The annual report should include cumulative (multi-year) progress against logframe targets and cumulative disbursement figures. In addition the Project Manager is required to submit annually a Project Implementation Review (PIR) report based on the GEF template prior to annual supervision missions.

### **Learning and knowledge management**

214. Knowledge management activities under S-RET will be designed to ensure that knowledge generated by the project, particularly through the strategic studies, policy development and M&E activities, is both shared and validated with the wider community engaged in climate change and RET programmes in Cambodia, and at the same time, that lessons learned in other programmes are identified and incorporated into S-RET.

215. Knowledge management will be closely coordinated with the Ministry of Environment's Cambodia Climate Change Alliance programme, which has a knowledge management component with technical assistance from UNDP.
216. Knowledge management techniques will include hosting of discussion forums (workshops and seminars) as well as participation in discussion forums hosted by other programmes and publication of knowledge products (video case studies, presentations, reports and policy briefs) through both web-based and traditional media. In particular the Cambodia Green website ([www.cambodiagreen.org](http://www.cambodiagreen.org)) will be used to disseminate and as a repository for project knowledge products.

## VI. Project cost and financing

### Financial modalities and cost-effectiveness

#### Financing and incremental cost

217. The cost of GEF-funded S-RET is calculated as US\$ 4.6 million, representing US\$ 3.770 million for Component 1, US\$ 0.6 million for Component 2 and US\$ 0.23 million for management costs.
218. Co-financing of S-RET is estimated as US 17.592 million and includes the resources of IFAD loans and grants for PADEE (US\$4.5 million) and ASPIRE (US\$ 13.092 million), RGC (US\$ 3.5million).

SUMMARY COSTS BY COMPONENT (in '000 USD)		GEF	Co-financing
<b>Component 1: Climate Resilient RET for PADEE Smallholders</b>		<b>3,770</b>	<b>18,010</b>
1.1	Supply Chains Established	1,332	2,745
1.2	Support to integrating RET in smallholder value chains (non-biogas)	1,442	11,060
1.3	Smallholders supported to integrate biodigesters in farming systems	1,016	4,205
<b>Component 2: Policy Support for Climate Resilience and RET in Agriculture</b>		<b>600</b>	<b>2,024</b>
2.1	Capacity Development for TWG-CCAFF	185	901
2.2	Policy Studies on RET and Climate Change Adaption in Agriculture	117	962
2.3	Knowledge Management	298	161
<b>Management Costs</b>		<b>230</b>	<b>1,058</b>
3.1	Personnel	132	890
3.2	Equipment and office expenses	46	120
3.3	Start-Up Workshop, Mid-Term Evaluation and End of Project Evaluation	52	48
<b>Total</b>		<b>4,600</b>	<b>21,092</b>

219. RGC with the support of IFAD will explore the possibility of securing additional financing from other development partners. The priority use for additional financing would be to expand the S-RET activities to cover additional Provinces and agricultural communities. This could be done either formally within the framework of S-RET or through a parallel project according to the preference of the financing partner.

### Disbursement, procurement and audit



### **Financial Management, Disbursement and Flow of Funds**

220. Although significant improvements have been made in the overall public financial management environment in Cambodia, these have yet to make a substantial impact at the Ministry level. The project will be operating in a high risk environment. Integration of financial management procedures with the established procedures of PADEE will mitigate these risks as well as leading to efficiencies in management costs
221. At the national level PADEE applies the Standard Operating Procedures (SOP) for externally financed projects/programs in Cambodia, issued by MEF, as outlined under sub Decree No. 14 ANK.BK dated 26 February 2007 and its subsequent amendments. PADEE supported activities at the Provincial and District follow the administrative structures, systems and procedures of the Provincial Administration Office, in accordance with the Administration and Financial Management Manual, issued by NCDD, dated 22 December 2008.
222. The implementing agencies (IAs) and partners shall implement activities on the basis of the Project Design Document, Project Implementation Manual and the approved AWPB and Amendments which are consolidated by the MAFF PSU with approval from S-RET Project Director based on the AWPB submitted by TWG-CCAFF, NBP and the 5 Provincial Administration Offices, as well as grantees. The consolidated AWPB's of MAFF PSU shall include the budgets and work plans as submitted by the grantees under Sub-Component 1.1.
223. The PADEE financial management system has established separate accounts for IFAD loan proceeds, IFAD grant proceeds and RGC counterpart funds within MEF, in MAFF and at sub-national level (in the Provincial Administrations). S-RET will require the establishment of a single additional account at each level, to manage the proceeds of the GEF-TF grant, within this system.
224. Therefore, MEF shall open and maintain in the National Bank of Cambodia a Designated Account in USD to receive the proceeds of the GEF grant. MEF shall authorize the opening of an S-RET Project Account for the grant proceeds, to be operated and maintained by MAFF.
225. MEF shall authorize the opening of the designated account for S-RET. There will be one S-RET project account operated by MAFF under the authority of the Project Director. There will be six S-RET project sub-accounts including one managed by NBP and five by the PDA.
226. IFAD shall advance funds to the Designated Account based on an approved annual work plan and budget (AWPB) and cash flow projections for six months planned activities.
227. The S-RET Accountant will prepare a stand-alone set of financial statements on an annual basis to disclose the financial position of S-RET and report to Project Manager. These financial statements will be prepared using the same accounting policies and criteria of PADEE but on stand-alone basis to satisfy IFAD and GEF reporting requirements.

### **Procurement**

228. Procurement under S-RET will consist of (1) procurement of professional services for technical assistance, policy studies etc.; and (2) procurement of a limited amount of goods (mainly office equipment). No procurement of works is planned.
229. Project procurement actions will be carried out by MAFF-PSU with final approval authority being the S-RET Project Director. Procurement under the project will be carried out in accordance with IFAD's Procurement Guidelines and Procurement Handbook of September 2010. For each contract to be financed by IFAD proceeds, the types of procurement methods, the need for pre or post-qualification, estimated cost, prior review requirements and time-frame are to be agreed between the MAFF PSU and IFAD respectively in the Procurement Plan to be submitted by the Implementing Agencies. IFAD prior review threshold will be established at USD 100,000 for goods and works and USD 50,000 for consultancy services and services.

230. By working through MAFF-PSU, S-RET will benefit from the efforts of PADEE to strengthen procurement capacity. This includes the MAFF PSU Procurement Officer who has received support and training from an International Procurement Adviser.

#### **Audit**

231. S-RET will be subject to the audit arrangements of PADEE which include oversight by the MAFF Internal Auditor and annual external audits.
232. External audits are conducted by an audit firm acceptable to IFAD which is selected by MEF under the bundled audit arrangement with other World Bank and IFAD's financed projects in the Cambodia portfolio. The cost of the audit is financed from Project proceeds. The firm will audit the S-RET Project's consolidated annual financial statements. The audit will be performed in accordance with International Standards on Auditing complemented by terms of reference (TOR) acceptable to IFAD. The financial statements will be prepared in accordance with the cash basis of accounting in accordance with International Public Sector Accounting Standards (IPSAS).
233. The auditors will issue separate opinions covering the financial statements, statements of expenditures and the management of designated accounts, as well as a management letter outlining any internal control weaknesses. The audited financial statements and audit report will be submitted to IFAD within six months after the end of each fiscal year and after the Project closing date. The implementation status of the audit recommendations will be provided by each Implementing Agency in the separate section of quarterly IFRs to be submitted to MEF and IFAD.

#### **Taxes**

234. The tax amounts due on S-RET payments will be drawn on PADEE counterpart fund accounts.

## **Appendix 1: Letter of Endorsement from GEF OFP**

## **Appendix 2: Letter of Commitments from co-financiers**

## Appendix 3: Project cost tables

(For more details see Attachment in the MS Excel file)

Output	Activities	GEF funding	Cofunding (direct +indirect)
<b>Component 1: Climate resilient RET for PADEE smallholders</b>		<b>3 770 000</b>	<b>18 010 000</b>
Output 1.1: Supply chains established for climate resilient RET in smallholder agriculture	1) Innovation grants for RET	1 215 000	1 300 000
	2) Meetings, workshops and dissemination expenses	33 000	185 000
	3) TAs for call preparation and evaluation	45 000	235 000
	4) Monitoring and Evaluation	39 000	1 025 000
	<b>Sub-total for Output 1.1</b>	<b>1 332 000</b>	<b>2 745 000</b>
Output 1.2 Smallholders integrate (non-biogas) RET into their production and processing activities.	1) Training materials	109 000	0
	2) Conditional transfers for RET adoption	728 000	1 587 000
	3) Conditional transfers for IGRF to promote RET	349 000	9 200 000
	4) RET demonstrations for agricultural applications	59 000	23 000
	5) RET Technical Advisory and Monitoring services (personnel and travel)	177 000	250 000
<b>Sub-total for Output 1.2</b>	<b>1 422 000</b>	<b>11 060 000</b>	
Output 1.3 Smallholders integrate biogas into their farming systems	1) Subsidies for biogas digesters	416 000	0
	2) Conditional transfers for IGRF	170 000	2 560 000
	3) Marketing and after-sales services	313 000	1 600 000
	4) Monitoring and technical backstopping (personnel and travel)	117 000	45 000
	<b>Sub-total for Output 1.3</b>	<b>1 016 000</b>	<b>4 205 000</b>
<b>Component 2: Policy support for Climate Resilience and RET in Agriculture</b>		<b>600 000</b>	<b>2 024 000</b>
Output 2.1: Capacity Development of the TWG-CCAFF	1) Meetings and travel costs	29 000	85 000
	2) Personnel costs for a Policy and Evaluation Adviser and an Administrative Assistant to support the TWG-CCAFF.	93 000	616 000
	3) Training on policy options for RET in agriculture	63 000	200 000
	<b>Subtotal for Output 2.1</b>	<b>185 000</b>	<b>901 000</b>
Output 2.2 Policy Studies to engender an enabling environment	1) Initial study on energy use in the smallholder agriculture value chain (GHG emission reduction benefits of RET in smallholder agriculture).	30 000	62 000
	2) Other studies	87 000	900 000
	<b>Subtotal for Output 2.2</b>	<b>117 000</b>	<b>962 000</b>
Output 2.3 Knowledge Management and Policy Dialogue	1) Audio, visual, online, hardcopy publications	122 000	0
	2) Seminars, workshops, field visits	85 000	42 000
	3) Impact survey and implementation progress database	91 000	119 000
	<b>Subtotal for Output 2.3</b>	<b>298 000</b>	<b>161 000</b>
<b>Project Management Cost (PmC)</b>		<b>230 000</b>	<b>1 058 000</b>
Project Management	1) Personnel costs	132 000	890 000
	2) Office expenses (Provincial and PSU offices)	46 000	120 000
	3) Start-up workshops, Mid-Term and End of Project Evaluations	52 000	48 000
<b>Grand total</b>		<b>4 600 000</b>	<b>21 092 000</b>

## Appendix 4: Poverty, Targeting and Gender

(based on the PADEE project design report)

### Poverty

1. The Human Poverty Index in the 2009 UNDP Human Development Report (HDR) places Cambodia 87th out of 135 countries in terms of income poverty. In Asia, India, Nepal, Laos, Bhutan, Bangladesh and Timor-Leste are ranked below Cambodia. The 2006 HDR gave Cambodia the third lowest ranking in Asia after Papua and New Guinea and Bangladesh. The Human Development Index for Cambodia in 2010 is 0.494. The indicators of health and education are still low but improving rapidly.

2. Over the decade from 1993/04 to 2003/04, income poverty in Cambodia declined on average by about 1% per year. Using household expenditure data, the Cambodia Socio-economic Survey (CSES) 2003/04, estimated that 4.7 million from a population of 13.0 million (34.7%) were living below the poverty line, of whom 93% or 4.37 million were living in rural areas. Similarly, 2.44 million people were living below the food poverty line in rural areas, 93% of the total. Poverty is overwhelmingly a rural phenomenon.

3. According to most recent CSES data, poverty reduction observed over the previous decade (1994-2004) continued over the period 2004 to 2007. Over these three years, the poverty headcount index for Cambodia as a whole relative to the overall poverty line fell from 34.8% in 2004 to 30.1% in 2007, although wide variations exist between provinces. The decline in poverty during this period reflects substantial and statistically significant growth in real per capita household consumption (the measure of living standards used in Cambodia). This increase (averaging 21% for the population as a whole) was driven by rates of economic growth during these years that exceeded 10% per annum. The picture of welfare improvements amongst the bottom two quintiles is reinforced by improvements in a wide range of variables related to ownership of consumer durables, service delivery and human development outcomes. Cambodia is on target to achieve a number of the CMDGs targets.

4. The conclusion that poverty has declined is supported by other indicators and the poverty gap has also declined throughout the country. Broadly speaking, women as well as men have benefited from economic growth and rising average consumption, as significant numbers of young rural women have found employment in the garment industry. At the same time the construction industry provides employment outside the rice production season for many men who migrate from the provinces to the major urban centres, and to Thailand and Vietnam. Restaurants and hotels also employ young adults from the countryside.

5. While per capita consumption has risen and poverty has fallen, the richest quintile and people in urban areas have benefited the most. Nationally, inequality, as measured by the Gini Coefficient, has risen between 2003/04 and 2007 from 0.39 to 0.43 and in rural areas from 0.33 to 0.36. There is a need for continued monitoring of inequality, and for active policies to improve access for the poor to productive resources, capital and affordable services, to ensure that they can benefit from – and contribute to – national economic growth.

6. According to the COSOP, in terms of occupation, households engaged in agricultural activities experience high levels of poverty (41 per cent) and account for 48 per cent of the poor.<sup>37</sup> The rise in inequality nationally can be attributed primarily to differences in access to rural infrastructure, markets and services and to lack of adequate public investment in the agriculture and natural-resource-based sectors.

7. The majority of poor people, about 70%, live in the Plains and Tonle Sap basin areas. Poverty is most severe in the Tonle Sap and Mountain/Plateau regions and in districts close to the borders with Thailand and Laos in the North and North-east and with Vietnam in the East.<sup>38</sup> While the

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<sup>37</sup> Cambodia COSOP 2007, p. 2

<sup>38</sup> *Ibidem*

Mountain/Plateau regions record the highest rural poverty rate because of low population density, they have fewer people living below the poverty line (0.65 million).

8. According to the HDR 2009, Cambodia ranks 137 out of 182 countries in terms of human development. Infant and child mortality rates are still high (66 and 83, respectively), per 1,000 live births.<sup>39</sup> Nearly one third of children under age five is underweight (moderate and severe).<sup>40</sup> The maternal mortality ratio is estimated at 450 per 100,000 live births,<sup>41</sup> amongst the highest in Asia. Estimated adult HIV prevalence rate for people aged 15–49 is 0.8%;<sup>42</sup> main drivers are considered prostitution and migration. According to the 2008 census data, the total literacy rate was 78% (above the 67% measured in 2003/04 through the CSES survey), with male literacy accounting for 85% and female literacy accounting for 71%. The literacy rate is highest in Phnom Penh and much lower in rural areas. Access to potable water is under 40% in rural areas and less than 10% for the poorest half of rural population.

### Poverty in target provinces

9. Nearly one third of the total Cambodian population is concentrated in the five targeted provinces and is approximately equal to 4.12 million people. The provinces are among the most densely populated areas in the country, recording an average population density of 208 persons/sq. km, which is almost three times higher than the national average.

10. The large majority of people living in project area is Khmer and Buddhist, with more than 2% and 1% of people belonging to the Muslim minority group of the Cham living respectively in Kampot and Kandal provinces. Average size of households ranges from 4.2 people (in Prey Veng and Svay Rieng) to 4.9 people (in Kandal). More than 17% of households is women headed, of which 68% have one or more children below 5 years of age. According to the Provincial Profiles 2009, there are no ethnic minority groups in the five provinces, but there is a limited number of Muslim Cham.

11. The main occupation of nearly 81% of families living in the five provinces is rice farming. According to the Social Assessment (SA) for project preparation undertaken in targeted provinces, about 1 million hectares of the cultivated land of the five provinces is planted to rice, equal to 93.1% of the total cultivated area, followed by vegetables. In most of the cases, only one single rice crop – be it wet season rice or dry season rice – is grown. After rice cultivation, most of agricultural land is left fallow. In some cases double rice crops are cultivated on same parcel of land, one following another. Nearly 60% of income of the sample households is derived from farming activities in their own farms and working on other people's farms. In addition to crops, farmers also raise livestock, in particular poultry, pigs, cattle and buffaloes, and practice, to a very limited extent, some aquaculture.

12. Families whose main occupation is not rice production engage in several activities, including vegetable production (1.1%); fishery (1.4%); non-farm activities, such as handicraft making, food production, textile and clothing production; trading; and repairing and transport services (6%). In drought-prone areas of Svay Rieng province, particularly along the border with Viet Nam, farmers have also started growing cassava. The SA shows that there are also families having a member employed in government-related jobs (nearly 6%) or private sector (about 15%). An increasing number of people work in factories, generally garment factories (mostly women) and construction companies (mostly men), either in provincial cities, Phnom Penh, or to lesser extent in Thailand and along the Viet Nam border; most of them are young women.

13. Excluding income from rice production, a household earns on average over KHR 4 million/year (about USD 1,000/year) from various sources and saves about KHR 0.75 million/year (about USD 181/year). Excluding income from rice, seasonal non rice crops and livestock, about 68% of households were reported to live on less than USD 0.5/day.<sup>43</sup>

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<sup>39</sup> Data from the CDHS 2005 quoted by [www.foodsecurityatlas.org](http://www.foodsecurityatlas.org) (WFP)

<sup>40</sup> Data from WHO (2003-2008) quoted in UNICEF Cambodia website

<sup>41</sup> WHO\_Reproductive Health Indicators Database (July 2007)

<sup>42</sup> UNAIDS, 2008

<sup>43</sup> SA, p. 62

14. Members of landless households, who consist mainly of women-headed households, are sometimes hired to undertake farming work in the fields of other villagers or in neighbouring villages and some unskilled non agricultural work in the village. In some cases, these people migrate in search for wage employment. According to the Provincial Profiles (2009) and as emerged from field work, migration has been on the rise in the targeted provinces, including among women, and young women in particular.

15. Farmers living in the targeted provinces may have different types of farmland, which include rice, vegetable, home gardens, pasture/grazing land, forest land, and pond land. Rice land is the most important asset for the majority of them given that their major occupation is rice farming. According to the SA, average rice landholding is estimated at 1.3 ha/family.<sup>44</sup> The SA also estimates that more than half of the households (about 50-60%) have rice land equal to or less than 1 hectare and that about 30% have more than 1 hectare up to 2 hectares of land.<sup>45</sup> According to the Provincial Profiles 2009, families with rice land of less than one hectare are about 59% in Kampot, 70% in Kandal, 44% in Prey Veng, 33% in Svay Rieng, and 57% in Takeo.

16. The Provincial Profiles 2009 record that families who do not own any rice land are about 4% in Kampot, 10% in Kandal, 5.3% in Prey Veng, 4% in Svay Rieng, and 5% in Takeo. According to SA, agricultural landlessness rate is estimated at about 7-16% across the five provinces and average size of homestead land at 0.004 hectare/household.<sup>46</sup> The main reasons for landlessness include land fragmentation as some portions are given to marrying children; sale of land to cope with treatment of sickness, debt, or inability of widows to undertake certain agricultural activities after the husband's death; and long-term migration. Moreover, in some cases, evictions have also been reported as causes for landlessness.

17. The latest figures<sup>47</sup> from the WB (published in 2009 based on 2007 data<sup>48</sup>) show that poverty incidence in the five provinces varies between 25% to 45%, which compares to a country wide national average of 30% and of 35% for rural areas<sup>49</sup>. According to the data, Svay Rieng and Prey Veng are the poorest of the five, with poverty rate as high as 35-45%.

## Targeting

### *Geographical targeting*

18. The project will be implemented at the national level as well as in selected districts and communes in the five target provinces. The Provincial Departments of Agriculture (PDA) proposed districts and communes to be targeted by the project based on the following criteria: high incidence of poverty and large numbers of poor households, agricultural potential, exposure to natural hazards, food insecurity over the year, vulnerability of women and children, and commitment of the provincial, district and Commune Councils (CCs) and their administrations to work with communities and farmers.

19. To proceed with the final identification of communes and districts, the selection focused on those with a potential for agriculture and for reducing the number of poor households. The analysis used objective criteria for poverty targeting and the CDB data. From a total of 535 communes across 50 districts in the five project provinces, the criteria led to 246 communes in 33 districts being selected. The selection criteria included: (i) exclusion of all urban communes and municipalities, (ii) exclusion of all communes with less than 200 poor households and/or less than 500 hectares of rice

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<sup>44</sup> SA, p. 43

<sup>45</sup> SA, pp. 43-44

<sup>46</sup> SA, p. 43

<sup>47</sup> These figures relate to the latest available poverty analysis by The World Bank based on data from the CSES 2007. The data for the CSES 2009 was released in December 2010 and has not yet been analyzed. The problem with CSES 2007 analysis is that it did not include provincial or district level poverty details.

<sup>48</sup> "Poverty Profile and trends in Cambodia, 2007", The World Bank, June 2009

<sup>49</sup> Rural poverty as %age of rural population living below the national rural poverty line, while national average refers to the national poverty line (including urban areas).



cultivation<sup>50</sup> (wet and dry season and recession rice), (iii) elimination of communes with less than 19% poverty rate. For cost effective project implementation, the analysis then added two further criteria: (iv) exclusion of all the districts with five or less selected communes using the above criteria and (v) inclusion of a maximum of eight communes per district by eliminating those in excess of eight with lowest poverty rates. Details on the final selection by province can be found in the two tables below and in the figure in the following page.

20. Selection of Target Districts and Communes in the Five PADEE Provinces:

Province	Districts			Communes			Villages		
	Selected	Total	%	Selected	Total	%	Selected	Total	%
Kampot	5	8	63%	36	92	39%	204	482	42%
Kandal	5	11	45%	36	147	24%	295	1,083	27%
Prey Veng	11	13	85%	86	116	74%	921	1,137	81%
Svay Rieng	4	8	50%	30	80	38%	315	690	46%
Takeo	8	10	80%	58	100	58%	632	1,116	57%
<b>Total</b>	<b>33</b>	<b>50</b>	<b>66%</b>	<b>246</b>	<b>535</b>	<b>46%</b>	<b>2,367</b>	<b>4,508</b>	<b>53%</b>

21. Poor households, Poverty Rate and Rice Area:

Province	Households			Poor Households			Average Poverty Rate			Total Area in Rice (ha)		
	Selected	Total	%	Selected	Total	%	Selected	Total	Difference	Selected	Total	%
Kampot	56,000	126,000	44%	13,600	25,500	53%	23.9	19.9	4	57,900	117,600	49%
Kandal	70,000	250,000	28%	16,500	43,300	38%	23.9	17.8	6.1	68,700	145,000	47%
Prey Veng	185,000	242,000	76%	52,500	65,200	81%	28.4	26.9	1.5	260,800	333,800	78%
Svay Rieng	51,000	121,000	42%	13,300	27,800	48%	25.9	22.9	3	77,200	170,900	45%
Takeo	108,000	186,000	58%	29,000	46,600	62%	27.0	25.3	1.7	153,400	248,300	62%
<b>Total</b>	<b>470,000</b>	<b>925,000</b>	<b>51%</b>	<b>124,900</b>	<b>208,400</b>	<b>60%</b>	<b>26.4</b>	<b>22.3</b>	<b>4.1</b>	<b>618,000</b>	<b>1,015,600</b>	<b>61%</b>

*Household targeting*

22. The target group will include resource poor rural women and men, particularly smallholder farmers, the majority of whom engage in rice production. Considering that the Project focuses on agricultural productivity improvements and diversification there could be some risk of excluding some of the most vulnerable sections of IFAD's target group, despite indirect benefits which are expected to accrue to landless and near landless people through higher demand for labour as productivity increases and lower local rice prices arising from higher yields. Therefore, the project will pursue a proper balance between improving agricultural productivity and also supporting the poorest and vulnerable sections of rural populations in terms of their livelihoods, envisaging interventions specifically tailored to their needs and conditions (mainly off farm activities). Moreover, it will focus on those poor rural women and men that are all willing to participate in the project and capable of fulfilling the associated tasks responsibly.

23. The project will use a participatory wealth ranking process to select the members of the new IGRFs, with all villagers in the target villages and communes invited and with participation of the CCs, village chiefs and district staff, including gender staff and possibly Female and Children Focal Points. The villagers will carry out a village wealth ranking based on their perceptions and definitions of poverty to classify the households into the following categories: (i) poorest; (ii) poor; (iii) medium; and (iv) better off. Where available, the ID Poor methodology can inform this process<sup>51</sup>, although consideration must be taken for when the ID Poor analysis has been conducted given that it is not

<sup>50</sup> Given that rice is the main crop in the project area and due to unavailability of other crop area data, the area under paddy cultivation was used as a proxy for present total agricultural production potential.

<sup>51</sup> The Identification of Poor Households Programme (ID Poor) is led by the MOP in collaboration with the Department of Local Administration (DOLA) of the Ministry of Interior.

often updated. Through the wealth ranking, the fifty poorest and poor households will be selected. The result of the wealth ranking exercise will be validated in a participatory manner for a possible modification to ensure that the selected are all willing to participate in the project and capable of fulfilling the associated tasks responsibly<sup>52</sup>.

24. Targeting performance will be monitored by the Project through several M&E activities including participatory assessments carried out by the beneficiaries with facilitation of district staff. This will allow assessing the impact of the Project on the target groups and monitor activities. All data will be disaggregated by gender, socio-economic category, and possibly age, also to monitor group membership and leadership and trainees. Service providers will also be requested to incorporate targeting indicators into their systems and reporting to the project. A useful source of information will be the IT system put in place for IGRF data. Targeting performance will also be assessed at mid-term review.

25. The Project proposes a shift in the traditional IFAD approach in Cambodia in terms of group formation. As per the past approaches (RPRP and RULIP for example), households would first be stratified in socio-economic terms through a participatory wealth ranking process. Then they would be assigned to different groups based on their socio-economic status. In the case of RPRP for example, the poorest would be assigned to a LIG (Livelihoods Improvement Group) and the poor and medium poor to a FSI (Farming Systems Improvement Group).

26. In PADEE, households will be selected through the participatory wealth ranking methodology but will all form part of one bigger group (fifty households) for the purposes of improving their access to finance and creation of an Improved Group Revolving Fund (IGRF). While some rigidity (as in past IFAD approaches) is used for creation of the IGRF, the process is much more flexible in terms of training in on and off farm activities. In fact, selected beneficiary households from a given commune will express their interests in training and will be drawn together by the CEWs and DSTs around common interest groups, which will also include outstanding farmers from the community. Groups will be trained in common interest subjects (such as poultry or vegetables for example) to the extent possible given logistics considerations. Moreover, the project will also provide support to existing farmer groups, associations, cooperatives or organizations, including those previously supported with the assistance of IFAD-financed projects, other donors and NGOs. The latter will be exclusively for farmer organizations in project selected communes and in terms of improving their access to finance (see details in Annex IV).

### *Gender mainstreaming*

27. A gender mainstreaming action plan will be developed to include various levels (beneficiaries, components, implementation staff) to ensure maximum participation of women in project activities and the consequent benefits. Activities for gender mainstreaming will be carried out under the overall coordination of the Ministry of Women's Affairs (MoWA), in close collaboration with MAFF.

28. A reputed international or national consultancy will be financed to work with MoWA and MAFF to undertake a stocktaking exercise on the impact of gender mainstreaming in agriculture in IFAD projects in the country. The project will also finance a study assessing drudgery patterns of women in target areas. The outcomes of the stocktaking will inform and fine tune the gender strategy for project implementation as well as the training programme for project staff.

29. *Training to Group Members.* The Project will finance training and awareness raising on gender issues for all groups supported, CCs and/or Women and Children Focal Points. Both male and female group members will be invited to participate. The training will be an integral part of the initial package of trainings received by beneficiary households as part of forming Improved Group Revolving Funds (see also Annex IV) and will be under the overall coordination of MoWA central and decentralized services (such as PDoWA). In particular, successful attendance and completion of the training is a

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<sup>52</sup> There is some degree of flexibility and need for qualitative judgment given the type of project activities and need for participants that are able to take up the project tasks and responsibilities (namely on agricultural business and household finance).

pre-requisite for capital transfer to the IGRF as per the conditions of the Group Conditional Capital Transfer Scheme set up under PADEE.

30. A key principle of PADEE's gender approach is that training in gender will be integrated with all other key capacity building activities by the project. In this sense all key trainings under PADEE and namely the financial literacy course (under component one) and the first year on-farm training package, as well as off-farm trainings will all include topics on gender equality, domestic violence, and HIV/AIDS prevention and education, as well as themes particularly relevant to the topic at hand. The Project will develop appropriate information and communication materials and training contents, in collaboration with organizations that have consolidated experience in addressing HIV/AIDS issues and sensitize on risks and safe behaviours (such as UNAIDS, UNDP, NGOs). The training will also include awareness raising on fair and safe working conditions to reduce risk of exploitation, particularly for young women.

31. Additional specific training will be provided only to women, to promote their empowerment, enhance their capacity to articulate their roles and rights as well as strengthen their political voice in respective households and communities, and fully participate in and benefit from development opportunities, through confidence, self-esteem and self-respect building. Additionally, training on nutritional issues (particularly on recognizing/understanding nutritious vegetables) will also be provided to the women as part of the training package.

32. In planning the time of the training for the groups, consideration will be given to the seasonal calendar, related variations of the workloads, and migration periods, to make sure that the time and period of the training do not represent a barrier to participation. Experience with other IFAD projects in the country shows that participation of men in the gender training is lower compared to that of women and that men tend to ask their wives to replace them for the gender training attendance: attendance needs to be better monitored and it will be made clear that male members can participate with their wives but cannot be replaced by them. In order to facilitate men's participation, they can be exempted from participating in certain modules of the gender training (such as nutrition issues, vegetables), but not others (such as gender equality, domestic violence, etc.). PADEE includes incentives for men and women participation in gender training, such as food for them and the children and need for a minimum attendance due to the conditionality for capital transfers as part of GCCTS.

33. *Training to National, Provincial, District and Field Staff.* In order to further strengthen the guidance and support that field staff requires from national staff, the Project will provide (refresher) training on gender issues and gender mainstreaming in agriculture to senior staff of MoWAs, MAFF and others relevant implementing partners and Government Officials from the five provinces, possibly by the same consultancy who carried out the stocktaking exercise or other service providers also hired under MoWA supervision. The training will cover insofar as possible aspects such as non-farm activities/ participatory community development, migration issues, and HIV/AIDS. The training will also be provided to provincial and district staff. Training to CEWs, Village Animal Health Workers (VAHWs), project service providers/NGOs and other field staff as appropriate will be provided by the district staff and/or service providers.

## Appendix 5: Additionalities of SCCF vis-à-vis the baseline

### Introduction

1. The purpose of this Appendix is to describe how the S-RET project will strengthen climate change adaptation among the target resource-poor and vulnerable smallholder farmers through complementing, leveraging and enhancing a set of existing programmes in smallholder agriculture and addressing RET in Cambodia.
2. The Appendix begins with an overview of the potential for application of Renewable Energy Technologies (RET) in Cambodia, followed by the ways in which widespread adoption of RET can strengthen the climate resilience of smallholder farmers. The appendix then defines the baseline capacity and resources and describes the additionality of S-RET.

### Potential for Renewable Energy Technologies in Cambodia

3. Energy costs are high in Cambodia and this is recognised as one of the key obstacles to achieving the Royal Government of Cambodia's (RGC) targets for increased in-country processing of agricultural commodities. Cambodia's electrification rate (34% in 2011) is one of the lowest worldwide. The high costs and limited access to reliable electricity supplies severely constrain the quality of life and opportunities for development. The National Strategic Development Plan (NSDP) sets the target that all Cambodian villages will have access to electricity (including off-grid supplies) by 2020, while 70% of households would have power only by 2030. Even by then, 30% of Cambodian households, all in rural and remote areas, will still lack reliable access to electricity.
4. Expensive and inadequate electricity supplies are associated with reliance on imported electricity (about 60% of total supply<sup>53</sup>) and imported fuel (mainly diesel, heavy oil, and potentially coal in the future), inadequate generating plant and an under-developed grid. Costs of petrol, diesel, LPG and other imported fuels are also generally higher than in neighbouring countries.
5. Cambodia remains highly dependent on use of non-sustainable biomass, largely in the form of fuel-wood and charcoal for domestic cooking but also for industrial uses, particularly for firing of brick kilns and for heating water used in the production processes of garment factories. Overall, it is estimated that biomass contributes about 70% of Cambodia's energy consumption<sup>54</sup>. Over-use of fuel-wood is leading to reduced availability, increasing prices and is one of the drivers of deforestation.
6. At the same time, Cambodia considerable potential for use of renewable energy technologies (RET) at all scales from household level applications to grid electricity supplies. Cambodia has an average sunshine duration of 6-9 hours per day which make solar electricity and other forms of solar energy use attractive. Photovoltaic (PV) panels and accessory equipment are mainly imported. There is one local manufacturer (Star8 – an Australian company), but costs of local manufacture do not appear to be competitive with imported equipment yet. The agriculture sector produces a large amount of sustainable biomass (rice husks, straw etc) which is useable in a variety of RET applications, while biogas production is attractive in association with livestock production. The Government is actively expanding Cambodia's hydro-electric generating capacity although the process and environmental impacts are controversial.

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<sup>53</sup> POCH, K. and S. TUY (2012), 'Cambodia's Electricity Sector in the Context of Regional Electricity Market Integration' in Wu, Y., X. Shi, and F. Kimura (eds.), Energy Market Integration in East Asia: Theories, Electricity Sector and Subsidies, ERIA Research Project Report 2011-17, Jakarta: ERIA, pp.141-172.

<sup>54</sup> JOYA, Romain / GERES, 2015 – Geres Biomass Energy Consumption Patterns In Cambodia: Challenges And Opportunities – Presentation at the Green Business Forum

7. The potential for RETs is particularly strong in the agriculture sector, because the majority of Cambodian smallholder farmers are, and will remain for the foreseeable future, beyond the reach of the national electricity grid. Farmers face high energy costs and this increases the cost of agriculture production as well as constraining the development of other value chain activities (inputs, processing and marketing) which would allow farmers and agricultural communities to capture a larger share of value added. RGC in its Policy for Promotion of Paddy Production and Rice Export (2010) and its Industrial Development Policy (2015) recognises the serious constraint on agricultural processing industries represented by high costs and low quality of electricity supplies.
8. Smallholder farmers (including households with mixed farm and non-farm livelihoods) make up around 70% of the Cambodian population and are its poorest and most climate-vulnerable section. Smallholders are least likely to be well served by mains electricity and even when electric mains reach their village, face high costs for household connections. Smallholders face high fuel costs for transport and operating agriculture machinery such as tractors, pumps and local rice mills, as well as high costs and poor quality supplies of energy for domestic use. Smallholder households are almost entirely reliant on fuel wood for cooking and increasingly finding that local supplies have become scarce, necessitating either increasing time and effort (mainly by women and children) for collection or significant cash expenditures for fuel. In turn, lack of access to affordable and reliable energy constrains the types of agriculture production and processing activities in which smallholders engage.

### **Adaptive Benefits of RET in Smallholder Agriculture**

9. Given the high energy costs, depletion of natural resources and impacts on women's health and workload resulting from the current mix of energy sources used in Cambodian smallholder agriculture, there is high potential for increased adoption of renewable energy technologies (RET). As well as contributing to reduced greenhouse gas (GHG) emissions, widespread adoption of RET by Cambodian smallholders would have both general and specific benefits for climate change adaptation (CCA).
10. RET are known in rural Cambodia but technological advances (for example, the reduced cost of solar panels, improved designs of biodigesters, etc) favour more widespread adoption and a broader range of uses in agriculture production and processing and by agricultural households and communities.
11. Adoption of appropriate, cost-effective small-scale RET has potential to provide a range of benefits to Cambodian smallholder farmers. Specific benefits to local communities expected from the adoption of RET include:
  - (a) Lower energy costs (such as reduced costs for water pumping);
  - (b) More widespread availability of electricity for domestic purposes;
  - (c) Potential to increase post-harvest processing using modern technologies;
  - (d) Reduced health impacts from fuelwood and charcoal use;
  - (e) Reduced workloads, particularly for women;
  - (f) Environmental benefits, particularly from reduced deforestation and sanitation;
  - (g) Economic benefits, particularly saving from buying fuel wood and chemical fertiliser;
  - (h) Improved soil fertility and reduced costs and impacts of chemical fertilizer use (associated with use of biodigester residues for fertilizer); and
  - (i) Improved yield production from using bio slurry as fertiliser and fish feeding

12. Improved access to energy will empower smallholders to choose from a wider range of choices in their farming systems, including selection of crops and seed varieties, timing of crops and post-harvest drying, storage and processing. A particularly clear example is availability of power for cost-effective water pumping which can give the farmer confidence to plant earlier in the wet season when the risk of drought is higher but when the risk of major crop damage by flooding is low<sup>55</sup>. Reduced use of fuel-wood has the double benefit of conserving natural resources which form a buffer resource for local communities in times of stress, including climate-related stress, and reducing the deforestation which exacerbates climate-related effects such as flash flooding and erosion. Integration of biodigesters and other RET systems with residues suitable for use as fertiliser, into smallholder farming systems, preserves and improves soil fertility which is adversely affected by increased intensity of rainfall associated with climate change, as well as reducing the costs and environmental impacts of chemical fertiliser use.
13. Improved and diversified livelihoods, lower household expenditures and improved health (from reduced use of fuel wood) are also important contributors to the overall resilience of smallholder households and communities to climate change – driven shocks such as droughts and floods.
14. Therefore, the project design responds to the analysis that there is a large unmet potential for RET in Cambodia's agriculture sector and that widespread adoption of RET by Cambodian smallholders will have climate adaptive benefits as well as improving livelihoods and reducing GHG emissions. However the current rate of RET adoption is low. The barriers to be overcome to increase the rate of adoption include lack of awareness of the technologies among Cambodian farmers, and cost barriers, particularly among the poor and vulnerable households. In addition, decision-makers in Government, the private sector and civil society lack awareness of the potential of RET and of the technology options available, and RET are not consistently promoted as a policy priority in the agricultural sector.

## Baseline Projects and Programmes

15. The **IFAD country programme** in partnership with MAFF is well placed to assist smallholders to overcome the barriers to increased adoption of RETs. The country programme currently consists of three projects<sup>56</sup> of which two, PADEE and ASPIRE, will directly support and provide the baseline resources for the new S-RET project.
16. The Project Development Objective (PDO) of **PADEE** is improved livelihoods for poor rural people in the target provinces of Kampot, Kandal, Prey Veng, Svay Rieng and Takeo. The lead executing agency is Ministry of Agriculture, Forestry and Fisheries (MAFF) through its Project Support Unit (PSU). Ministry of Women's Affairs (MoWA) together with FAO and two NGOs, SNV and iDE, are implementing partners contributing resources to the project. The project directly supports the establishment of 980 Improved Group Revolving Funds (IGRF) which consist of 50 farm households each selected on the basis of poverty ranking and productive potential. These groups receive group conditional cash transfers which capitalise a revolving fund from which the farmers can withdraw loans for productive purposes. The groups are also the organisational basis for Farmer Field Schools addressing integrated rice-based farming systems, and identification of further income-generating opportunities for which Common Interest Groups of IGRF members receive additional training. IGRF groups are supported by a network of Commune Extension Workers (CEW) supported by the project
17. PADEE also has a small business development sub-component and a sub-component directly supporting RET in partnership with the National Biodigester Programme (NBP, below). Through

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<sup>55</sup> Dalglish, Neil, CSIRO Australia, 2015: Increasing Flexibility in Cambodian Monsoonal Rice Cropping Systems

<sup>56</sup> Tonle Sap Smallholder Development and Poverty Reduction Project (TSSD), Project for Agriculture Development and Economic Empowerment (PADEE) and Agriculture Services Programme for Innovation, Resilience and Extension (ASPIRE).

- PADEE support to NBP, a range of designs of pro-poor biodigesters have been field-tested, with the result that NBP is now approaching readiness to roll out a design which will be financially accessible to the resource-poor households comprising the IGRF groups.
18. The **ASPIRE** Programme is a national programme to develop and reform agricultural extension services, based on oversight by MAFF but integrating the efforts of the private sector and civil society with those of public sector extension agents through a system of Provincial level results-orientated planning and performance-based grants. ASPIRE mainstreams climate resilience in extension. ASPIRE will be piloted in five provinces in northern and western Cambodia from 2015 but is expected to expand to cover the PADEE target provinces from the ending of the PADEE project in 2018. ASPIRE includes a component supporting evidence based policy development, capacity development of the General Directorate of Agriculture (GDA) within MAFF, and a sub-component of grants for farm testing of innovations in climate resilient smallholder agriculture.
  19. **The National Bio-digester Programme (NBP)** is a programme of MAFF with the Department of Animal Health and Production as the advisory and coordinating agency. The Netherlands Development Organisation (SNV) provides technical assistance. NBP commenced in 2005 and operates in fourteen of Cambodia's 24 Provinces. Up to September 2015, 22,116 bio-digester units had been installed, benefitting over 100,000 household members. The first phase of the programme (2005-2012) concentrated on the introduction, promotion and dissemination of the technology and on setting up sector infrastructure, including training of masons. Phase 2 (2013-18) has a strong focus on private sector development and on strengthening all actors to ensure long-term sustainability and decrease dependence from donor funding.
  20. Specific activities of the NBP in Phase 2 are:
    - (a) To increase the number of family sized, quality biodigesters in selected provinces;
    - (b) To ensure the continued operation of all biodigesters installed under the bio-digester programme;
    - (c) To maximise the benefits of the operated biodigesters, in particular the optimum use of digester effluent; and
    - (d) Technical and promotional capacity development for further wide scale deployment of biodigester technology in Cambodia.
  21. To date, NBP has focused on installation of brick-lined, fixed-dome bio-digesters using five sizes from 4 m<sup>3</sup> to 15 m<sup>3</sup>. The total costs of the installations ranges from \$490 for the smallest to \$1,100 for the largest. NBP provides a direct subsidy to the farmer which is \$150 for all sizes of bio-digester. NBP partners with three Micro-Finance Institutions (MFI) of PRASAC, Amret and Hatta Kaksekar. Using low-cost capital, these MFI provide loans for bio-digester construction at interest of 1.2% per month which is well below the interest rate for general credit in the Cambodian countryside (2.5% - 4% depending on size of loan and collateral). About 70% of bio-digester constructions are supported by these credit arrangements. Sales of Gold Standard verified emission reductions (VERs) are supported through the Dutch based institution, Humanist Institute for Cooperation with Developing Countries (HIVOS).
  22. **SNV – Renewable Energy Programme.** SNV's cooperation with the NBP forms one component of its renewable energy portfolio in Cambodia. Other elements of the portfolio include the Waste-to-Energy (W2E) programme introducing advanced rice-husk gasification technology into the rice milling sector in Cambodia, the Advanced Clean Cooking Solutions (ACCS) programme in Cambodia and Laos and a Solar Microfinance Programme which will work with MFIs in cooperation with the Solar Energy Association Cambodia (SEAC) to provide affordable finance for solar electricity to Cambodian rural households. The four-year Solar Microfinance Programme is the largest solar energy program in Cambodia to date, largely

- funded by the **French Development Agency (AFD)**. This scheme is still in its initial phases therefore requires supporting policies, institutional and financing mechanisms for bringing to scale proven solar technologies through a market-driven approach. In addition, the incentive scheme offers the basis for the introduction of solar technologies and the project will examine opportunities of this program to expand and integrate other RET.
23. **United Nations Industrial Development Organisation (UNIDO)** is implementing two interrelated projects financed by GEF and concerned with transfer of renewable energy technology in Cambodia. These projects are 'Reduction of GHG Emission through Promotion of Commercial Biogas Plants' (GEF ID: 5421) and 'Climate Change Related Technology Transfer for Cambodia: Using Agricultural Residue Biomass for Sustainable Energy Solutions' (GEF ID: 4042). The latter is expected to be completed by November 2015 according to its PIF. Both projects focus on medium- (3 – 5 MW range) to large-scale uses of RETs and so the proposed focus of S-RET on small scale applications is highly complementary.
24. **Markets** are emerging in Cambodia for RET for solar home lighting systems, solar pumping/drying technology, solar ovens, fixed dome, new innovation hollow brick, and portable biodigesters, and biomass-energy plants (rice husk gasification). There is great potential for stimulating this nascent market for facilitating a broad take up of RET and for promoting decentralised renewable energy options to meet the energy needs of the rural populace as a means to improve their ability to better adapt to climate change. There are a considerable number of externally assisted programmes, mainly implemented through local or international NGOs, promoting RET in rural Cambodia. However, these efforts remain fragmentary and supporting systems for marketing, installation, finance and after-sales services have yet to develop to create a self-sustaining market. Existing efforts focus primarily on installation capacity and less on the optimal productive use of RET in agriculture. The current challenges with specific RET are not related to the technology per se, but the difficulties related in managing to create a network of satisfied customers who have gained trust in the technology and who receive quality and timely after-sales services. There are also weak linkages between promotion of RET sales and advocacy for policy reforms to create an enabling policy, regulatory, incentive and institutional environment.

### **Additionality of the S-RET Project**

25. The S-RET project will complement the baseline agriculture support and RET programmes described above, by addressing the identified barriers to widespread adoption of RET in the smallholder agriculture value chain. S-RET will be closely integrated with the PADEE project and the NBP and will benefit from the baseline resources of these projects and of ASPIRE, as well as from the broader technical capacity and implementation experience developed through existing RET programmes. S-RET will combine technical innovation, market capacity development and direct support to resource-poor smallholders, together with knowledge management and policy development activities to facilitate sustainable scale-up of RET adoption for agriculture.
26. S-RET will not support "pure" technical research and development (R&D) but will seek, through an open call-for-proposals process, existing technical solutions that are appropriate to the needs of resource-poor smallholders and that are ready to bring to the field-testing and / or market roll-out stage. This is likely to focus on innovative applications of existing RET (for example, using solar energy for water pumping, drying, processing or other activities in the agriculture value chain. Use of RET in smallholder agriculture production and processing is relatively limited at present (only bio-digesters have reached a significant scale) so this aspect of the project addresses an unfulfilled need.
27. As well as supporting technical innovation, S-RET will address the need to make RET accessible to resource-poor smallholders through a combination of developing appropriate,



- cost-effective technologies and financial support through accessible loans and targeted subsidies. The PADEE project is well suited to support this purpose of S-RET with its wealth-ranking based IGRF groups and established support and extension network.
28. S-RET will support testing, roll-out, market capacity development and targeted support to resource poor smallholders through integration with PADEE and the direct beneficiaries will be the PADEE IGRF group members and their communities. Component 2 of S-RET will ensure that lessons learned are shared and integrated into policy development through the Technical Working Group on Climate Change of MAFF (TWG-CCAFF) and through MAFF representation on the National Council for Sustainable Development. The leadership of the TWG-CCAFF is influential in other relevant policy areas including MAFF's strategy and implementation plan for the RGC's Cambodia Industrial Development Policy 2105-2025. Component 2 of S-RET will benefit from linkages to the evidence based policy component of ASPIRE which will include technical assistance from an international Policy Adviser.
  29. S-RET will leverage the benefits of an established project implementation structure in PADEE including the established project management capacity of PSU and the provincial project teams, the network of Commune Extension Workers (CEW) and Mobile Support Teams (MST) and the existing beneficiary groups (IGRF). The PADEE project also benefits from the partnership with the IDE supported Farm Business Adviser network and the role of SNV in supporting extension, small business development and (with NBP) the roll-out of pro-poor bio-digesters.
  30. The project will directly assist PADEE IGRF group members to install and make productive use of RET. It is recognised that cost is a significant barrier to adoption of RET by the poorest households. The project will address this issue by (1) piloting and rolling out low-cost RET technologies suitable for poorer households and small-scale farmers; (2) increasing familiarity with RET and strengthening the capacity of financing, installation and after-sales services to reduce the risk of investing in RET; (3) directly supporting low cost loans and subsidies to finance RET installation by smallholders; and (4) seeking to develop innovative alternative, low cost and low risk, financing approaches (e.g. rental or rental-purchase) suitable for poorer households.
  31. In addition, the S-RET project will extend the benefits of RET to IGRF group members by supporting adoption of RET by small and medium enterprises involved in agriculture processing and marketing within the local communities. These enterprises may include joint enterprises of the IGRF group members, supported under the PADEE small business development sub-component, as well as local entrepreneurs whose businesses improve access to input or product markets for IGRF member smallholders.
  32. Specific PADEE resources which will directly support implementation of S-RET include the financing of the IGRF and the training and support of the Commune Extension Workers who will directly link S-RET activities to the IGRG groups. PADEE systems will facilitate planning of S-RET activities including identification of IGRF groups and individual farmers with an interest in adopting RET, financing of RET through loans and subsidies, and extension training to assist farmers to integrate RET in their agriculture value chains. PADEE project management and technical assistance will greatly facilitate the implementation of S-RET.
  33. S-RET will also benefit from the existing structure and technical capacity of NBP. In principle, low-interest loans from MFI, linked to the NBP, will be available to finance biodigester installations by S-RET beneficiaries, as an alternative to financing through the IGRF (though it is understood that this facility will end in 2017). S-RET will both benefit from the baseline resources of NBP and complement these resources by supporting the field testing and scale up of other biodigester models that show potential for replication in the rural Cambodian context. The intention is to move beyond biogas for cooking and lighting, and enhance extension services support to implement an integrated farming systems approach ensuring that farmers

can make full use of the bioslurry (by-product of biodigesters) for increasing agricultural production. Under the NBP programme, the bio-slurry (about 10-15 tons per annum) is applied in different forms (liquid, middle dry and dry form). Most farmers dry the slurry in a compost hut and some farmers dry liquid slurry through sun-drying and transport it to their respective rice farms as dry matter. The mode of transport (where rice farms are far, 500m-2km) is through ox-carts pulled by water buffalos and/or cattle. However, smallholder farmers that have adopted biodigesters do not have the skills or marketing knowledge for selling bioslurry thus losing out on an income revenue stream. With PADEE set to roll out an improved biodigester technology to around 3,000 of its total 92,000 beneficiaries, the opportunity exists for additional funding to increase both the scope (more types of RET) and the scale (number of beneficiaries) of this linkage of RET support to climate resilient agriculture.

34. The ASPIRE resources have not been formally counted in the baseline financing of S-RET but there will be significant support and synergy including through the policy support component described above, and potentially through linkages with the climate resilient agriculture extension capacity development and innovation grants within ASPIRE. ASPIRE resources will replace PADEE resources to provide a baseline project and implementation framework for S-RET from 2018, although the details of this support will not be finalised until the ASPIRE Mid-Term Review which will include design of the expansion phase.
35. Beyond the resources formally considered as the baseline financing for S-RET, the project will benefit from cooperation with the broader RET support sector in Cambodia, including accessing innovative technologies that have reached readiness for field testing and roll-out as well as through exchange of knowledge and experience. S-RET will include support to events showcasing both technology and policy proposals for scale-up of RET and (non-GEF) resources will support participation by the TWG-CCAFF in regional learning and policy conference events.



## Appendix 6: Monitoring and evaluation plan and budget

### A. General and Project Start-Up

1. The project will be monitored through the following M&E activities. The M&E budget is provided in the table below. The indicators presented in the Project Logical Framework are aligned with the GEF6 Results Framework and with the IFAD RIMS framework.
2. **Project start:** A Project Inception Workshop will be held within the first 2 months of project start. The inception workshop will be hosted by MAFF with participation from all agencies with a role in project implementation, the IFAD Country Programme Team and other stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.
3. The **Inception Workshop** should address a number of key issues including:
  - (a) Assist all partners to fully understand and take ownership of the project. Detail the roles and responsibilities of the project leadership and implementing agencies, the PIM, planning, budgeting, implementation and monitoring and evaluation framework. The Terms of Reference for project staff will be discussed again as needed.
  - (b) The first Project Annual Work Plan and Budget will be discussed with stakeholders through the Inception Workshop prior to being finalised. This will include agreement of interim targets based on the Project Logical Framework indicators. Project risks and assumptions will be reviewed and validated.
  - (c) Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
  - (d) Discuss financial reporting procedures and obligations, and arrangements for annual audit.
  - (e) An **Inception Workshop report** is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

### B. Monitoring and evaluation tools

4. Monitoring and evaluation of S-RET will be the responsibility of the project management team in MAFF-PSU and will share resources including technical assistance with PADEE M&E. The PADEE Provincial project teams will be tasked to ensure that M&E data are collected in a complete and timely manner.
5. The principal M&E instruments will comprise (1) the PADEE project MIS, with suitable modifications; (2) supplementary data collection by project M&E staff, particularly focusing on complex or qualitative data that cannot be captured easily by the MIS; (3) the PADEE Major Impact Survey; (4) strategic studies; and (5) external evaluations at mid-term and end of project stages. [nb may not be needed depending on IFAD supervision arrangements]
6. The PADEE project **MIS** is a web-based system comprising modules on the Improved Group Revolving Funds, participation in training and adoption of agriculture techniques by IGRF group members. Each farmer has a membership card with a unique ID in the system CEWs and other project staff are equipped with mobile devices allowing direct uploading of data from the field.
7. Some modifications will be needed to the MIS to permit recording of data on S-RET activities. The key data to be recorded in the MIS will comprise:
  - (a) Number, type and location of RET installations;

- (b) Key uses (applications) of RET installations;
  - (c) Financial data (repayment of RET-linked loans).
8. The MIS data will be supplemented by regular, **sample-based data collection** by the project teams. The key types of data likely to require supplementary collection are:
- (a) Data on the technical effectiveness of the RET;
  - (b) Impact of the RET on net farm incomes.
9. In addition to monitoring through the MIS, MAFF-PSU staff will undertake regular monitoring visits to ensure timeliness and quality of implementation of all Component 1 activities.
10. The **PADEE Major Impact Survey** is a household level sample survey of 3,060 households consisting of IGRF group members and a control group. As the same households are sampled in the follow-up survey the study has with both cross-comparison (control sample) and longitudinal (panel survey) dimensions. The baseline survey data was collected in 2012 and the first follow-up survey will be conducted in 2015. There will be an end of (PADEE) project data collection in 2018. Supplementary questions will be added to the mid-term questionnaire in order to capture data on household energy use and access to RET, which will be incorporated into monitoring and evaluation of S-RET. Following the PADEE end-of-project survey, a review will be undertaken to determine the requirements for a further (end of S-RET) household survey, which may be conducted in conjunction with a broader survey for ASPIRE.
11. **Monitoring and Evaluation of Component 2** will include monitoring of delivery and effectiveness of capacity development activities but will also include monitoring of performance targets using the same general approach as for Component 1. Strategic targets and indicators are identified in the project logical framework and interim targets will be developed and annually updated based on the policy development work-plan. Interim targets will reflect achievement of key steps such as completion and acceptance of policy studies, preparation of policy documents and approval of key policy instruments. Analysis of achievement or under-achievement vis-à-vis the key performance indicators, challenges and strategic response will be integrated in the project planning, monitoring and evaluation cycle.
12. MAFF will engage an independent external consultant to conduct a **mid-term assessment** of S-RET. The assessment will be completed before the date of the Mid-Term Review mission (see below). The assessment will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The Terms of Reference for the mid-term assessment will be prepared by MAFF and agreed by IFAD.
13. An independent **End of Project Evaluation** will take place within three months of the closing date of S-RET. The end of project evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term review, if any such correction took place). The terminal evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by MAFF and agreed by IFAD. The End of Project Evaluation should also provide recommendations for follow-up activities.

## Project Reporting

14. **Baseline and Follow Up Surveys:** the impacts of S-RET will be measured through the PADEE Major Impact Survey which is a survey of 3,060 households consisting of IGRF group members

and a control group. Additional questions added to the PADEE survey instrument will measure household access to and use of energy including RET. The PADEE mid-term survey conducted in 2015 will form the baseline survey of S-RET, while the PADEE end-of-project survey, due to be conducted in 2018, will effectively be the mid-term survey for S-RET. A budget is provided for a further survey, probably with a reduced sample size, at the end of S-RET.

15. **Mid-Year Progress Reports:**

- (a) Mid-Year Progress Reports will be prepared by each agency with implementing responsibilities and will be consolidated by MAFF-PSU.
- (b) The Mid-Year Progress Report will include physical progress in each component and sub-component, financial progress report and early identification of challenges encountered and management solutions adopted.
- (c) The Quarterly Progress Report should include a review and update of the Project Risk Log.
- (d) The Mid-Year Progress Report is to be submitted no later than 31<sup>st</sup> July each year.

16. **Annual Progress Report:** This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (1st January to 31st December). The APR/PIR combines both IFAD and GEF reporting requirements.

17. The APR/PIR includes, but is not limited to, reporting on the following:

- (a) Achievement of interim targets identified in the previous year AWPB, with explanation of the target has not been met;
- (b) Cumulative progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets;
- (c) Project outputs delivered per project outcome;
- (d) Lesson learned/good practice.
- (e) Financial reports
- (f) Updated Project Risk Log

18. The Annual Progress Report will be presented and discussed with stakeholders at an **Annual Project Workshop**.

### **IFAD Supervision and Mid-Term Review**

- 19. IFAD will conduct regular **supervision missions** which will be combined with the supervision missions of PADEE and which will take place at least one time per year. Supervision missions will review all aspects of S-RET implementation and make recommendations for corrective measures where necessary. Supervision reports will rate project implementation using the standard methodology of IFAD.
- 20. IFAD will conduct a **Mid-Term Review mission** in late 2017 or early 2018. The Mid-Term Review mission will review all aspects of project implementation and make recommendations for implementation during the second half of the project life. In particular, the MTR Mission will review the arrangements for integration of S-RET with ASPIRE after the closing of the PADEE project in 2018.

### **Learning and knowledge sharing:**

- 21. Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums.

22. The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects.
23. There will be a two-way flow of information between this project and other projects of a similar focus.
24. Audit: Project will be audited in accordance with UNDP Financial Regulations and Rules and applicable audit policies. Provision for the cost of the audit is included in the project budget.

### Indicative M&E Work Plan and Budget

25. The indicative monitoring and evaluation plan and corresponding budgets is provided in the table below.

Type of M&E activity	Responsible Parties	Budget US\$ (excluding project team staff time)	Time frame
Inception Workshop (IW)	▪ MAFF	\$8,000	Within first two months of project start up
Inception Report	▪ MAFF	Included in the workshop budget	Immediately following IW
Adaptation of PADEE MIS to capture S-RET data	▪ MAFF-PSU	\$10,000	
Household survey (costs additional to base costs paid by PADEE)	▪ MAFF-PSU	\$80,000	Baseline, mid-term and end of project
Field Monitoring	▪ MAFF-PSU	\$40,000	
Annual Workshops	▪ MAFF	\$24,000	Annually and end-of-project
Independent mid-term evaluation	▪ External consultant	\$20,000	Report before MTR mission
Independent end-of-project evaluation	▪ External consultant	\$30,000	Within 2 months of end of project
Mid-Year Report	▪ Project manager and team	None	By 31 <sup>st</sup> July each year
Annual Report	▪ Project manager and team		By 28 <sup>th</sup> February in following year
IFAD Supervision Missions	▪ IFAD Country Programme Team		Annually
IFAD Mid-Term Review Mission	▪ IFAD Country Programme Team		Late 2017 or arly 2018
Audit	▪ Audit firm: bundled with contract for audit of other IFAD projects	Indicative cost per year: 5,000 (20,000 total)	Yearly

Kingdom of Cambodia

Building Adaptive Capacity through the Scaling-up of Renewable Energy Technologies in Rural Cambodia (S-RET)

Final project design report

Appendix 5: Monitoring and Evaluation plan and budget

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<b>TOTAL indicative COST</b> Excluding project team staff time and IFAD staff and travel expenses	US\$ 232,000 (+/- 5% of total GEF budget)	
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## Appendix 7: SECAP

### 1. Major landscape characteristics and Issues (Natural resources, social and climate)

**Agricultural sector and natural resources:** The total area of cropland in Cambodia is about 25,000 square kilometres, or 14% of the total land area. About 60% of the land area is classified as forest. Rice is by far the dominant crop, accounting for about 80% of the cropped area. Wet rice cultivation is concentrated in the low-lying provinces of the southern part of the country and the Tonle Sap basin, while the higher areas in the northeast and southwest are dominated by forest, plantation and upland crops. Livestock production, while important, is mainly by smallholders as an additional activity to rice growing. Rice production has grown faster than the overall agricultural economy, so that Cambodia has become self-sufficient in rice and exports significant quantities of paddy, mainly through informal channels to Vietnam, as well as smaller amounts of milled rice. Other cash crops such as cassava are also exported to Vietnam without processing.

Timber production and freshwater fisheries are major commercial activities in Cambodia. Although the forestry sector has been subject to a moratorium on logging for most purposes since 2002, in practice a considerable amount of production continues. Traditionally rural Cambodians harvest a wide range of natural products for processing, sale or domestic use. Although many of these products are of declining importance, most Cambodian rural households continue to rely on firewood for cooking fuel and catches of wild fish and small aquatic creatures make an important contribution to their diet.

**Land ownership:** The land ownership system in rice-farming areas of Cambodia results from the distribution of collectivised land to households in the late 1980s and developments since that time. Population growth has increased pressure on land while sales forced by poverty, debt or domestic emergencies, and in some cases expropriation of land, have resulted in smaller average plot sizes and increased inequality in land distribution. A 2005 survey found that 80% of holdings were less than 2 hectares; however holdings over 2 hectares accounted for 50% of all land. About 37% were less than 0.5 hectare and thus probably too small to provide for household consumption. Land ownership is governed by the Land Law of 2001 and despite a significant land titling effort most agricultural land is still not covered by formal land titles. Land holdings under informal titles are fairly secure in traditional rice growing areas, but land ownership disputes have become common in former forest land and also in high-value urban areas. Large areas of the forest estate have been awarded to commercial interests as concessions, often with accompanying criticism from civil society organizations (mainly on account of lack of transparency, failure to respect the rights of existing land users, weak control over the uses made of concession land and low productivity). The Government has also introduced a social land concession program aimed at distributing vacant land to the rural poor, although so far this is on a much smaller scale than the economic land concessions. In 2012 and 2013 the Government made a concerted effort to resolve outstanding land ownership disputes, particularly in forest and economic land concession areas, through a campaign of land surveying by student volunteers under the personal direction of the Prime Minister. It is said that 660,000 plots were surveyed 380,000 new titles issued under this scheme, however the long term effectiveness of the programme in ending land disputes is uncertain

### 2. Potential project's social, environmental, climate change impacts and risks

**Water availability and variability:** Cambodia's total water resources are very large, consisting of average annual rainfall of 1000mm to 1500mm in most areas and cross-border flows of river and groundwater. However effective water availability for agriculture is highly seasonal and often unpredictable. About 90% of all rain falls between May and October. Cambodia's irrigation

infrastructure is largely a legacy of schemes constructed by mass mobilisation of labour under the Democratic Kampuchea regime: these schemes were characterised by unrealistic ambitions and by very poor standards of design and construction. Most investment in irrigation since 1980 has gone into rehabilitating and improving the more promising parts of these Khmer Rouge systems: this is often the easiest course as it avoids land acquisition issues, although better technical solutions might be available. In 2006, only about 17% of the rice crop was fully irrigated, with the remainder being fully or partially dependent on rainfall. In most areas only one crop is grown per year, either a rain-fed wet season crop or in areas subject to annual inundation, a recession crop, with some supplementary irrigation used for both types. In recent years the Government has invested heavily in irrigation improvements, with most expenditure on headworks and main canals and rather less emphasis on distribution systems and maintenance.

**Water Resource Management:** Estimates of water use by sector show that 96% of the total water used goes to agriculture, 3% for domestic uses and 1% for industrial purposes. As the country grows and moves forward on its development pathway, it is anticipated that demand in all of these sectors will increase in the coming years (MoWRAM, 2012). Government policy directions are particularly focused on increasing irrigation and hydropower.

At the same time, water availability is expected to vary due to climate change. With increased evapotranspiration due to rising temperatures, availability of surface water decreases. The projected shifts in seasons and rainfall patterns (in terms of timing, duration and intensity) will bring about changes in the Mekong River hydrological system (reduced flow in the dry season and increased flow in the rainy season), changes in the rate of groundwater recharge and increased frequency and intensity of droughts and floods. These effects in turn will lead to uncertainty in availability of water for domestic and productive uses, potentially causing water scarcity and decreasing water quality. In addition, floods may cause damage to rural water infrastructure including water supply and irrigation systems. Over time, this may generate increased competition for water and privatization of water resources. These impacts will have the greatest consequences for the poorest people, including small-scale farmers and fishers.

As these scenarios reveal themselves, there will be increased need for water infrastructure designed to manage fluctuations in water availability (water storage and distribution, etc.). With an increase in the occurrence of droughts and floods, greater demand will be placed on emergency response systems, and there is potential for resources to be diverted from development initiatives to respond to emergencies as they arise.

**Climate risks in Cambodia:** Cambodia is vulnerable to the effects of global climate change because of the importance of agriculture and natural resources in the livelihoods of the majority of the population, and particularly of the poor, and because of the low level of technical and institutional preparedness. During the past 20 years successions of droughts and floods have resulted in a significant number of fatalities and considerable economic losses for the country. Climatic variations are expected to increase the severity and frequency of flood and drought events. The Mekong region in general and Cambodia specifically will experience a shorter rainy season and a longer dry season. According to recent analysis wet season flows could increase by as much as 41% in the Mekong basin and by 19% in the delta area. In contrast, dry season flows could decrease by 24% in the basin and 29% in the delta. Changes in flows and seasonality could also have adverse impacts on sensitive and economically productive wetlands such as Tonle Sap. The impacts on agriculture and fisheries are likely to be dramatic. Finally, it is expected that climate change will increase the incidence of infectious, water-borne and vector-borne diseases, heat stress and mortality, with significant impact on public health costs.

Despite the progress made in recent years there is scope for further gains in rice productivity, in crop diversification and improved livestock production. Constraints faced by Cambodian farmers include poor soil quality, small and fragmented plots, lack of water, lack of access to quality inputs including improved seeds, lack of access to finance (particularly for poorer households), inefficient production

techniques and high post-harvest losses. Poor road infrastructure is also a constraint (although the rural road network has improved greatly in recent years it is still far below the standard found in neighbouring countries) as are high energy costs and lack of access to electricity. Frequent crop losses due to extreme climate events reduce productivity and discourage investment.

**Climate Change impacts and Forestry:** Cambodia’s forests will also be affected by climate change impacts. The predicted increase in temperature has the potential to change the extent and composition of forests, including a decrease in wet forests and an increase in moist forests, each of which currently account for approximately 20% of the country’s forests (Cambodia National Mekong Committee, 2010). Changes to forest composition may lead to changing availability of forest resources for rural livelihoods. Shifting seasons and rainfall patterns may lead to reduced forest productivity and increased risk of forest fires. In coastal zones, mangrove forests may be submerged by rising sea levels. Collectively, these effects will lead to the degradation and/or loss of forests, leading to decreased income security for forest-dependent communities. Even communities who do not depend on forests for their livelihoods may rely on forest resources as an alternative source of income in times of crisis such as crop loss due to flooding. With increasing degradation and loss of forests, this important coping mechanism will no longer be available. As well, there is potential for increased competition for forest resources, and the possibility of conflict between different forest users.

To address these challenges, forest management strategies and techniques must take climate change and its effects on forests into account, while at the same time recognizing the important role forests play in storing carbon so that it is not released into the atmosphere. Government policies and strategies such as the National Action Plan on Climate Change (MoE, 2001) acknowledge the important role of both forest conservation and reforestation, however, these strategies must also consider how people are using forest resources for their livelihoods, and what implications both climate impacts and forest conservation policies have for forest user communities. Alternative strategies may need to be identified for these communities to replace the use of forest resources, whether as an ongoing livelihood strategy or as a coping mechanism to manage shocks and stresses.

### 3. Environmental and social category

The project objectives and outcomes sought are all aimed at positive influences on environmental and social settings, reducing deforestation, and fossil-fuel based cooking and agricultural production processing. Simultaneously, it is recognised that the utilization of biogas will enhance manure management and better use of fertilizer. Considering that the project activities focus on mitigating negative impacts and not present risk to contribute to negative impacts, but acknowledging possible areas to improve social inclusiveness and equal access to the project benefits, the risks reflect a B rating category.

In order to balance the successful take up of RET with being non-exclusive to the marginal population with less asset, the project will hold consultation meetings with communities and develop community group level benefit sharing mechanism.

Summary of Outcomes and Outputs	Environmental and Social Risk Category
<b>Outcome 1:</b> Approximately 8,000 smallholder farm households with improved climate resilience due to investments in economically viable RET for agriculture production, processing and / or marketing	C

1.1 Supply chains established for climate resilient RET in smallholder agriculture.	B
1.2 PADEE smallholders supported to integrate (non-biogas) RET into their production and processing activities	B
1.3 PADEE smallholders supported to integrate biogas digesters into farming systems	C
<b>Outcome 2.</b> Enabling policy framework and institutional modalities for facilitating scale-up of climate resilient RET in agriculture	C
2.1. Capacity Development of the TWG-CCAFF for facilitating coordination among departments within MAFF and with other relevant ministries for mainstreaming climate change resilience building and RET scale up	C
2.2. Policy Studies to engender an enabling environment for scaling up RET in agriculture sector	C
2.3. Awareness raising and knowledge management for advancing policy dialogue and resource allocation for RET scale-up in agriculture	C
<b>Project Management</b>	C

#### 4. Climate risk category

The climate risks for this project are linked to possible damage to installed RET or functional failure (such as the number of sunny days for solar use or flooding to damage the biogas system). The Climate Risk Category (under the SECAP guidelines) for this project is rated as Moderate category. The project activities being undertaken are all aimed at mitigating the climate related issues and aspects identified above so the project is not exacerbating those risks, but rather the risks above have potential to influence the outcomes of the project, but the project activities of themselves are not increasing the negative impacts, rather mitigating these, therefore warranting a Moderate category rating.

In considering the project activities, it is recommended that during the project implementation stages a series of climate change risk assessments are undertaken or such risk assessment to be included in the grant proposal development.

Summary of Outcomes and Outputs	Climate Risks
<b>Outcome 1:</b> Approximately 8,000 smallholder farm households with improved climate resilience due to investments in economically viable RET for agriculture production, processing and / or marketing	Moderate
1.4 Supply chains established for climate resilient RET in smallholder agriculture.	Moderate
1.5 PADEE smallholders supported to integrate (non-biogas) RET into their production and processing activities	Moderate
1.6 PADEE smallholders supported to integrate biogas digesters into farming systems	Moderate
<b>Outcome 2.</b> Enabling policy framework and institutional modalities for facilitating scale-up of climate resilient RET in agriculture	Low
2.4. Capacity Development of the TWG-CCAFF for facilitating coordination among departments within MAFF and with other relevant ministries for mainstreaming climate change resilience building and RET scale up	Low
2.5. Policy Studies to engender an enabling environment for scaling up RET in agriculture sector	Low
2.6. Awareness raising and knowledge management for advancing policy dialogue and resource allocation for RET scale-up in agriculture	Low
<b>Project Management</b>	Low

## Appendix 8: GHG reduction benefit assessment and monitoring

### 1. Approach

The assessment of GHG emission reduction amount generated by the S-RET follows *the GEF Guidelines for Greenhouse Gas Emissions Accounting and Reporting for GEF Projects* (May 2015) and *the GEF Guidelines for Estimating the GHG Benefits of Stationary Combustion of Biomass*<sup>57</sup> *Projects*. Following the GEF Guidelines, the project chose the GHG estimation methodology of the IFC Greenhouse Gas Reduction Accounting Guidelines for Climate-Related Projects (December 2013) as well as the IFI Approach to GHG Accounting for Renewable Energy Projects (November 2015).

### 2. Analysis

Project definition	Renewable energy (displacement of GHG-intensive electricity generation using fossil fuel)
GHG assessment period	<ul style="list-style-type: none"> <li>Length of the analysis period after the project closure: 20 years</li> <li>Maximum technology/ measure lifetime: 20 years (maximum default value)</li> </ul>
GHG effect boundaries	<ul style="list-style-type: none"> <li>Reduced GHG emissions as a result of reduced combustion of fossil fuels</li> <li>Increased GHG sequestration of carbon as a result of reduced demand for fuel wood</li> </ul>
Baseline scenario	Without the GEF project, the marginal technologies are fuelwood, charcoal and kerosene oil.
Project scenario	<ul style="list-style-type: none"> <li>Replacement of GHG-intensive electricity with clean energy</li> <li>Leakage from biogas based cooking</li> <li>Avoided deforestation of 1,760 ha is expected but not considered in this scenario given the challenges of assessing social dimensions of avoided deforestation in Cambodia</li> </ul>

### 3. GEF alternative

**Direct GHG emission reduction:** The direct emission reductions are achieved by the project's implementation period.

Factor	Value
Fuelwood dependency per household in rural	97%
Charcoal dependency per household in rural	35%
Kerosene oil dependency per household in rural	3%
Fuelwood emission factor	412.6 tC/1000 Mt (109.6 tCO <sub>2e</sub> /TJ)
Net calorific value of non-renewable biomass	0.015 TJ/Mt
Net calorific value of biogas	20 MJ/m <sup>3</sup>
Biogas consumed	0.7 m <sup>3</sup> /unit * 70%
Biogas density	1.2 kg/m <sup>3</sup>
Charcoal carbon coefficient	700 tC/ 1000 Mt (65 tCO <sub>2e</sub> /TJ)
Kerosene emission factor	19.5tC/TJ = 71.9 tCO <sub>2e</sub> /TJ
Biogas CO <sub>2</sub> emission factor	54,600 kg/TJ
Biogas CH <sub>4</sub> emission factor	1 kg/TJ
Biogas N <sub>2</sub> O emission factor	0.1 kg/TJ

<sup>57</sup> CDM defines biomass as non-fossilized and biodegradable organic material originating from plants, animals and micro-organisms.

Fuelwood consumption per HH per month	154 kg (1.85 MT per year)
Charcoal consumption per HH per month	23 kg (0.276 MT per year)
Kerosene consumption per HH per month	12 kg (0.144 MT per year)
Target poor HH in 5 target provinces	8000 HH
Target bioenergy user HH in 5 target provinces	3000 HH
Total community forest in 5 target provinces	69,286 ha / assuming 20% as baseline = approx 14,000 ha

The formula applied for the calculation of direct GHG emission reduction is:

$$\text{CO}_2 \text{ direct} = \text{Fuelwood emissions (a)} + \text{Charcoal emissions (b)} + \text{Kerosene emissions (c)} - \text{Bioenergy emissions (d)} = 100,428 \text{ tCO}_2\text{e}$$

$$\text{Fuelwood emissions} = 8000 \text{ (HH/yr)} * 0.97 * 1.85 \text{ Mt/HH} * 4 \text{ (years)} * 109.6 \text{ t CO}_2\text{e/TJ} * 0.015 \text{ TJ/Mt} = 97,324 \text{ tCO}_2\text{e}$$

$$\text{a) Charcoal emissions} = 8000 \text{ (HH/yr)} * 0.35 * 0.276 \text{ Mt/HH} * 4 \text{ (years)} * 65 \text{ t CO}_2\text{e/TJ} * 0.015 \text{ TJ/Mt} = 3,014 \text{ tCO}_2\text{e}$$

$$\text{b) Kerosene emissions} = 8000 \text{ (HH/yr)} * 0.03 * 0.144 \text{ Mt/HH} * 4 \text{ (years)} * 71.9 \text{ tCO}_2\text{e/TJ} * 0.04459 \text{ TJ/MT} = 110 \text{ tCO}_2\text{e}$$

$$\text{c) Biogas consumption} = 3000 \text{ units} * 0.75 \text{ (50\% units for 2 years and 50\% units for 4 years)} * 0.7 \text{ m}^3\text{/unit} * 20 \text{ MJ/m}^3 = 31,500 \text{ MJ} = 0.0315 \text{ TJ}$$

$$\text{CO}_2 \text{ emission} = 0.0315 \text{ TJ} * 54,600 \text{ kg/TJ} = 1720 \text{ kg}$$

$$\text{CH}_4 \text{ emission} = 0.0315 \text{ TJ} * 1 \text{ kg/TJ} = 0.0315 \text{ kg}$$

$$\text{N}_2\text{O emission} = 0.0315 \text{ TJ} * 0.1 \text{ kg/TJ} = 0.00315 \text{ kg}$$

$$\text{Total CO}_2\text{e} = 1720 [ 1 + (0.0315 * 21 \text{ (Methane GWP)}) + (0.0315 * 310 \text{ (Nitrous Oxide GWP)}) ] = 19,653 \text{ kg} = 19.6 \text{ tCO}_2\text{e}$$

$$\text{d) Avoided emissions from deforestation} = 0.11 \text{ ha/unit} * 8000 \text{ units} * 2 \text{ years} = 1760 \text{ ha}$$

Potential carbon balance from avoided deforestation of 1,760 ha in 14,000 ha could be as much as 700,535 t CO<sub>2e</sub>. However, this avoided deforestation benefit is not considered in measuring the total GHG emission reduction given the difficulties in assessing social dimensions and a wide range of the baseline forest areas (i.e. areas of forests related to activities of the project beneficiaries of 8,000 hh).

- i) **Indirect GHG emission reductions:** The indirect emission reductions are achieved as a result of market facilitation and development through project-supported policy and institutional frameworks, capacity building, information gathering and replication effects of demonstration activities.

$$\text{Bottom-up approach using the formula } \text{CO}_2 \text{ indirect BU} = \text{CO}_2 \text{ direct} * \text{Replication factor} = 100,428 \text{ tCO}_2\text{e} * 1.5 = 150,642 \text{ tCO}_2\text{e}$$

(Default replication factor suggested for a demonstration project with capacity building is 3. To be conservative, a replication factor of 1.5 is assumed.)

Approach 2. Top-down approach using the formula  $\text{CO}_2 \text{ indirect TD} = \text{total market potential for CO}_2 \text{ emission reductions} * \text{causality factor}$ . However, the S-RET market potential will be based on the RETs to be selected through the roll-out phases. To be conservative, an expansion of the same programme in 2 other provinces are assumed =  $100,428 \text{ tCO}_2\text{e} * 2 = 200,856 \text{ tCO}_2\text{e}$

Total indirect GHG emission reduction is approximately **351,498 tCO<sub>2e</sub>**

- ii) **Direct post-project emission reductions:** This quantifies the GHG emission reductions of GEF-supported revolving financial mechanisms that are still active after the project's closure.

Default lifetime value of a selected technology is 20 years. The project assumes that the revolving financial mechanism will be effective for the next 16 years after the project closure. Direct post-project emission reduction could be assessed as  $100,428 \text{ tCO}_2\text{e} * 16 \text{ years} = \mathbf{1,606,848 \text{ tCO}_2\text{e}}$

**Total 2,058,774 tCO<sub>2e</sub> will be mitigated through S-RET.** During the lifetime of the project (4 years), total direct and indirect benefit is **451,926 tCO<sub>2e</sub>**



## Appendix 9: Project Risk Log

#	Description	Type	Impact & Probability	Countermeasures / Mngt response	Owner
<b>PROJECT OBJECTIVE RISKS</b>					
1	RET adoption does not have a sustained impact on livelihoods due to changing structure of rural economy	Strategic	I: Med P: Med	Livelihoods, employment patterns and farming systems are undergoing rapid change so technologies appropriate to the present may prove less relevant in future. Project will work with farmers to evaluate how the benefits gained from RET may be affected by these changes.	Project Technical Committee, agencies, farmers
<b>OUTCOME 1 RISKS</b>					
2	Project is unable to identify sufficient RET with climate adaptive potential meeting the varying needs of farmers.	Technical	I: high P: Low	Project will select RET for roll-out based on proof of relevance, attractiveness, cost-effectiveness and adaptive capacity for significant numbers of target beneficiaries. Roll-out activities will include strengthening private sector service provision and training farmers in application of the technology. Innovative technologies will be selected through an open call for proposals with rigorous selection criteria and there will be an initial testing and demonstration phase before scale-up begins. Given the innovative aspect of the project, it is acceptable that not all tested technologies will prove successful in a Cambodian context.	Project Technical Committee, agencies, farmers
2	Future energy market changes reduce the scope for applying RET to smallholder agriculture	Market	I: Medium P: Low	Expansion of the mains electricity grid could radically change the economics of RET electricity generation (e.g. solar panels). Grid expansion plans will be taken into consideration in selecting project sites. The risk of a large (further) fall in fossil fuel prices is considered small.	RGC
3	Local private sector (marketing, installation, finance, after-sales) does not develop to achieve self-sustainability	Capacity	I: High P: Medium	With the partial exception of NBP (MFIs and BCCs) the market infrastructure needed to support RET remains underdeveloped in rural Cambodia. The project will address this need through by providing matching grants to develop marketing and after-sales service for priority RET	Project, private sector
4	RET remain inaccessible to smallholder farmers because of lack of access to suitable finance	Financing	I: High P: Low	The cost of RET installations is high compared to the resources of smallholder farmers and compared to capital costs of alternatives such as diesel engines. Poor and vulnerable households face additional difficulties in accessing credit due to lack of secure incomes, lack of collateral and low educational levels making interaction with formal finance institutions intimidating. The project will assist farmers to finance RET installations using	Project, farmers

#	Description	Type	Impact & Probability	Countermeasures / Mngt response	Owner
				the credit facilities already established by the PADEE project together with targeted subsidies to bring RET within reach of poorer farmers.	
5	Financing system fails because RET loans are not repaid	Financing	I: Medium P: Low	This risk is considered low based on the previous experience of the microfinance sector in Cambodia both related to RET and generally. Defaults on loans made by the PADEE IGRF groups are negligible to date. The project will assist farmers to understand the cash-flow impacts of a decision to invest in RET. Defaults at a scale to pose a risk to the project would likely only occur either in the event of technology failure (Risk 1 above) or in association with social or political instability which does not seem likely at present.	Project, IGRF groups
<b>OUTCOME 2 RISK</b>					
6	Policy environment is unsupportive of RET or of the specific options promoted by the project	Policy	I: Medium P: Medium	The overall policy environment is generally favourable for RET and the risk of policy changes making RET less viable is considered low. Due to the slow process of policy formation in Cambodia it could be challenging to secure positive policy changes facilitating RET in agriculture. This is not considered an overall risk to the viability of the project. The project will work through the TWG-CCAFF which has strong political leadership and good links to cross-Ministerial policy bodies including the National Council for Sustainable Development.	TWG-CCAFF



## Appendix 10: Outline of S-RET Project Implementation Manual

26. Implementation of S-RET will be governed by a Project Implementation Manual (PIM) which will be finalised by MAFF and submitted for No Objection by IFAD. A No Objection Letter (NOL) for the PIM will be a condition of project effectiveness. All expenditures of S-RET must be in compliance with the PIM.
27. A draft PIM will be prepared during project preparation prior to finalisation of the Grant Agreement between RGC and IFAD.
28. S-RET will be implemented through the PADEE structures and using PADEE management procedures. Therefore, the S-RET PIM will cross-reference relevant sections of the PADEE PIM. New procedures will be described in the S-RET PIM only where there is no existing procedure in the PADEE PIM.
29. The following outline indicates the structure and contents of the S-RET PIM.

	<b>Section</b>	<b>Contents</b>
1	Introduction	<ul style="list-style-type: none"> <li>• Purpose of the PIM</li> <li>• Intended Users</li> <li>• Status of the PIM</li> <li>• Relationship to PADEE PIM (as an annex?)</li> <li>• Overview of the PIM</li> </ul>
2	Project Overview	<ul style="list-style-type: none"> <li>• Project Rationale</li> <li>• Relationship to PADEE</li> <li>• Goal, PDO and key indicators</li> <li>• Components</li> </ul>
3	Project Management	<ul style="list-style-type: none"> <li>• Line of authority</li> <li>• Key roles and responsibilities by agency</li> <li>• Roles and responsibilities of key staff and advisers</li> </ul>
4	Overview of Component 1	<ul style="list-style-type: none"> <li>• Outcome</li> <li>• Key Indicators</li> <li>• Sub-Components</li> <li>• Work Planning</li> </ul>
5	Sub-Component 1.1	<ul style="list-style-type: none"> <li>• Purpose</li> <li>• Implementation Approach</li> <li>• Testing Grants                             <ul style="list-style-type: none"> <li>○ Eligible Grantees</li> <li>○ Eligible Purpose</li> <li>○ Eligible expenditures and conditions</li> <li>○ Selection Criteria</li> <li>○ Amount of Grants</li> <li>○ Timing of Grants</li> </ul> </li> <li>• Roll-Out Grants                             <ul style="list-style-type: none"> <li>○ Eligible Grantees</li> <li>○ Eligible Purpose</li> <li>○ Eligible expenditures and conditions</li> <li>○ Selection Criteria</li> <li>○ Amount of Grants</li> <li>○ Timing of Grants</li> </ul> </li> <li>• Call For Proposals and Grant Award Process</li> <li>• Monitoring of Grant Implementation</li> </ul>

	<b>Section</b>	<b>Contents</b>
6	Sub-Component 1.2	<ul style="list-style-type: none"> <li>• Purpose</li> <li>• Implementation Approach</li> <li>• Eligible Technologies</li> <li>• Eligibility for financial support / subsidies</li> <li>• Process Steps</li> <li>• Monitoring</li> </ul>
7	Sub-Component 1.3	<ul style="list-style-type: none"> <li>• Purpose</li> <li>• Implementation Approach</li> <li>• Eligibility for financial support / subsidies</li> <li>• Process Steps</li> <li>• Monitoring</li> <li>• Capacity Development of NBP               <ul style="list-style-type: none"> <li>○ Study of Marketing and After-Sales</li> <li>○ Design and implementation of capacity development measures</li> </ul> </li> <li>• Testing and Roll-Out of Portable Biodigesters</li> <li>• Testing and Roll-Out of Biogas Applications for Agriculture</li> </ul>
8	Overview of Component 2	<ul style="list-style-type: none"> <li>• Outcome</li> <li>• Key Indicators</li> <li>• Sub-Components</li> <li>• Overview of integrated policy process</li> <li>• Work Planning</li> </ul>
9	Sub-Component 2.1	<ul style="list-style-type: none"> <li>• Purpose</li> <li>• Implementation Approach</li> <li>• Key Activities</li> </ul>
10	Sub-Component 2.2	<ul style="list-style-type: none"> <li>• Purpose</li> <li>• Implementation Approach</li> <li>• Process</li> </ul>
11	Sub-Component 2.3	<ul style="list-style-type: none"> <li>• Purpose</li> <li>• Implementation Approach</li> <li>• Knowledge Products</li> <li>• Events</li> <li>• Publishing</li> <li>• Participation in Dialogue</li> </ul>
12	Financial Management and Procurement	<ul style="list-style-type: none"> <li>• Project Accounts</li> <li>• Roles and Responsibilities</li> <li>• Flow of Funds</li> <li>• Financing shares</li> <li>• Financial reporting</li> <li>• Replenishment</li> <li>• Audit Provisions</li> <li>• Procurement (PADEE PIM to apply)</li> </ul>
13	Monitoring and Evaluation	<ul style="list-style-type: none"> <li>• Purpose of M&amp;E</li> <li>• Responsibility for M&amp;E</li> <li>• Use of Interim Targets</li> <li>• Key M&amp;E Tools               <ul style="list-style-type: none"> <li>○ PADEE household survey</li> <li>○ Adaptation and use of PADEE MIS</li> </ul> </li> </ul>

	<b>Section</b>	<b>Contents</b>
		<ul style="list-style-type: none"> <li>• Year 1 Interim Targets</li> </ul>
	Annexes	<ol style="list-style-type: none"> <li>1. Draft Call for Proposals for Grants</li> <li>2. TORs of Key Project Staff             <ol style="list-style-type: none"> <li>a. Project Director</li> <li>b. Project Manager</li> <li>c. Administrative officer</li> <li>d. Accounting officer</li> <li>e. M&amp;E Officer</li> <li>f. NBP Technical Officer</li> <li>g. NBP M&amp;E Officer</li> <li>h. NBP Financial Officer</li> <li>i. TWG-CCAFF Administration Assistant</li> </ol> </li> <li>3. TORs of Key Advisers             <ol style="list-style-type: none"> <li>a. RET Technical Adviser</li> <li>b. RET Policy and Evaluation Adviser</li> <li>c. CFP Expert Evaluators</li> <li>d. Mid Term Evaluation</li> <li>e. End of Project Evaluation</li> </ol> </li> <li>4. Outline design of Project Inception Workshop</li> <li>5. Indicative Year 1 AWPB</li> </ol>

## **Appendix 11: Contents of Working Papers**

1. Working Paper 1 – Potential RET technologies in Cambodia
2. Working Paper 2 – Assessment of policies and institutional capacities for RET
3. Working Paper 3 – Access to financial services for RET in rural areas
4. Working Paper 4 - Renewable energy policies in Cambodia and policy support pathways for RET