UNDP/GEF project:
"Small Wind Energy Development and Promotion in Rural Areas (SWEDPRA)"

(GEF ID 2397; UNDP PIMS 751)

Final Evaluation Report

For: UNDP Country Office Pyongyang, DPRK

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List of Abbreviations and Acronyms

APR	Annual Project Report
CH_4	Methane
CO_2	Carbon Dioxide
CO_2eq	Carbon Dioxide-equivalent
CWERD	Centre for Wind Energy Research and Development
CTA	Chief Technical Advisor
DEX	Direct Execution Modality
DIM	Direct Implementing Modality
DoM	Department of Meteorology
DPRK	Democratic People's Republic of Korea
EDC	Environment and Development Center
EUPS-3	European Union Programme Support – Unit 3
GEF	Global Environment Facility
GHG	Greenhouse gas
ICF	Internal Control Framework
ITE	Institute of Thermal Engineering
kW	kilowatt
kWh	kilowatthour
MEC	Ministry of Electricity and Coal
MEI	Ministry of Electronics Industry
MFA	Ministry of Foreign Affairs
MLEP	Ministry of Land and Environment Protection
MMMI	Ministry of Metal and Mechanics Industry
MoA	Ministry of Agriculture
MW	Megawatt
MWh	Megawatthour
NCC-E	National Coordinating Committee for the Environment
NCEDC	Non-Conventional Energy Development Center
NPD	National Project Director
PIR	Project Implementation Review
PM	Project Manager
PMU	Project Management Unit
PSC	Project Steering Committee
PTM	Project Technical Manager
RBAP	Regional Bureau for Asia and the Pacific
RET	Renewable Energy Technology
RTA	Regional Technical Advisor
SAOS	State Academy of Science
SPA	Senior Project Advisor
SRED	Sustainable Rural Energy Development
SWEDPRA	Small Wind Energy Development and Promotion in Rural Areas
SWES	Small Wind Energy System
TPR	Tripartite Review
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
UNOPS	United Nations Office for Project Service
W	Watt
WFP	World Food Programme
WIPO	World Intellectual Property Organization

1. Executive Summary

This report describes the findings of the Terminal Evaluation of the UNDP/GEF Medium-Size Project 76431 "Small Wind Energy Development and Promotion in Rural Areas (SWEDPRA)" as carried out for UNDP Country Office in Pyongyang, DPRK. The Evaluation was carried out by a team consisting of a national and an international consultant. The mission to DPRK took place from 8 to 19 October, 2012.

The SWEDPRA Project Document was signed on 3 August, 2005. Project execution was through UNOPS under UN Agency modality until 2007, when UNDP suspended its activities in DPRK due to a number of factors not related to SWEDPRA. After resumption of UNDP in 2009, the Project Document was reviewed by UNDP Head Quarters and newly signed between UNDP CO and the Government of DPRK, on 25 August, 2010. The execution modality was changed into Direct Execution (DEX) in line with policy with regards to country office reopening and projects execution. SWEDPRA effectively restarted activity at the inception workshop held in May 2011. The envisaged closure date is April 2013.

Counterparts were the National Coordinating Committee Environment (NCC-E), the State Academy of Science (SAOS), and the State Commission on Science and Technology (SCST). GEF funding was US$ 750,000 and co-funding US$ 150,000 (UNDP TRAC funds) and US$ 545,000 (Government in-kind and cash funds). The disbursement rate of GEF resources, as of 9 November 2012, is 84%; expenditures are mainly on hardware (manufacturing tools, wind measuring systems, and office equipment), preparation and organization of training events, and international consultancy. Based on the available evidence (mission reports, purchase orders, descriptions of training events), the Evaluators conclude that outputs have been delivered as reported and that procured items are of good value.

SWEDPRA aimed to: (i) strengthen in-country capacities for wind resource assessment; (ii) design and manufacture small wind energy systems (SWES) for off-grid electricity production; and (iii) promote these systems in DPRK and abroad, and actually have a substantial number of SWES installed to supply households in the rural areas of DPRK with electric energy. The path from product development to successful commercialization proved to be much longer and more complex than assumed. The objectives of SWEDPRA were overambitious in relation to the short timeframe and modest budget of a GEF medium-sized project. There was no clear proposition for delivering SWES systems to rural families and the relevant actors for achieving this were not properly identified.

By consequence, SWEDPRA only achieved part of the anticipated outcomes. The Project made a critical contribution to establish in-country capacities for wind resource assessment by providing equipment, and by training and technical backstopping. Building upon the skills of counterpart staff at SAOS, the Project introduced internationally accepted methodologies and practices. At end-of-project, national experts have demonstrated capacity to work conform international standards, are endowed with hardware for wind measurements, and are reportedly involved in wind energy assessments for large-scale windfarm development in the country. This is a very good achievement in the context of a GEF medium-size project.

SWEDPRA also made a substantial contribution to the development of modern small wind turbines in the country. At end-of-project, a "new model" 300 W wind generator for battery charging is produced in small batch series. However, this product must still be subjected to long-term trials to determine its performance and durability. The wind generator is not yet optimized in terms of matching the local wind conditions and production capabilities. A mature product that can be commercialized on the national markets, may be achieved within 1-2 years, after completing a series of performance and reliability tests, and streamlining the production processes. The original objective to design and produce three different classes of wind generators, is out of reach of the Project.

SWEDPRA could not put the improved SWES design into production at the rural workshops. Besides some training events executed by CWERD, the Project did not have the outputs and resources assigned for promoting local SWES markets. The Project also lacked a detailed strategy to promote end-user

demand for SWES systems. The observed general shortage of raw materials and equipment, and the low occupation levels of rural workshops are caused by systemic barriers that cannot be removed by a project such as SWEDPRA. During the suspension period, CWERD's continued work primarily focusing on technology development; there was no strategic guidance to preserve SWEDPRA's overall strategy. The Evaluators did not find evidence that technology developed under SWEDPRA was actually transferred to local manufacturers to improve the product quality of "old model" systems, raise production volumes, or strengthen local production capabilities.

SWEDPRA did not achieve the overall objective to install improved small wind turbines among rural end-users, to establish decentralized production chains for SWES manufacturing, and to deliver direct global greenhouse gas (GHG) benefits. The UNDP country office made a valuable effort to visit installed "old model" systems[1] and assess their status and impact, but systematic, quantitative measurements are needed to draw firm conclusions with respect to their performance and effectiveness. The defined targets for GHG reductions were also not realistic.

The present, improved SWES design is not based on an explicit product philosophy. A user-oriented approach to product design, which is common in market-based economies, is less developed in DPRK. The programmed energy policy and promotional outputs were not well tuned to small-scale, rural energy development. A more successful approach might have been, to collaborate more closely with rural development organizations and cooperatives, rather than energy sector stakeholders. The Evaluators expect that such an approach would have provided substantial input information with regard to sales mechanisms, maintenance, energy demand, and cost constraints.

The Evaluators found the local counterparts and the UNDP Country Office highly committed to the SWEDPRA Project. CWERD continued its activities on wind energy development with the limited resources available during the suspension period; UNDP made available office staff and financial resources after project resumption. The Evaluators observed constructive working relations between UNDP and the national counterparts. As expressed by the counterparts, SWEDPRA enabled the development of a modern small wind turbine in DPRK, although at a slower pace than was hoped in 1999. The Project also generated useful learning experiences which can serve as input for future UNDP and GEF programming in DPRK.

Evaluation Ratings: SWEDPRA Project GEF 751			
1. Monitoring and Evaluation	***rating***	**2. IA& EA Execution**	***rating***
M&E design at entry	MS	Quality of UNDP Implementation	HS
M&E Plan Implementation	S	Quality of Execution - Executing Agency	S
Overall quality of M&E	S	Overall quality of Implementation / Execution	S
3. Assessment of Outcomes	**rating**	**4. Sustainability**	**rating**
Relevance	R	Financial resources	MU
Effectiveness	MU	Socio-political	U
Efficiency	S	Institutional framework and governance	L
Overall Project Outcome Rating	MS	Environmental	L
		Overall likelihood of sustainability	MU

[1] The "old model" SWES are small wind turbines for household electricity supply developed by local manufacturers in the decades before the start of the SWEDPRA project. These systems were designed by trial and error and have a low energy output. One of the objectives of SWEDPRA was to reach their manufacturers to transfer new technological concepts for improving these products. The Project did not manage to establish such a link between centralized product development at SAOS and decentralized production chains.

1. Executive Summary (Korean)

이 보고서는 조선민주주의인민공화국 평양주재 UNDP 사무소가 집행한 유엔개발계획(UNDP)과 세계환경기구(GEF)의 중규모대상계획 76431 : 《농촌지역에서 소형풍력에네르기개발과 촉진 (SWEDPRA) 》의 최종평가결과를 서술하고있다. 평가는 국내평가자와 국제평가자로 구성된 평가그루빠가 진행하였다. 조선민주주의인민공화국경내에서 이 평가사업은 2012 년 10 월 8 일부터 19 일까지 진행되였다.

SWEDPRA 대상계획문건은 2005 년 8 월 3 일에 조인되였다. 대상계획은 SWEDPRA 와 무관계한 요인들로하여조선민주주의인민공화국경내에서의 유엔개발계획이 자기의 활동을 림시중지한 2007 년까지 유엔기구의 사업절차에 따라 UNOPS 를 통하여 진행되였다.. 2009 년 UNDP 활동이 재개된후 대상계획을 UNDP 본부가 검토하고 2010 년 8 월 25 일 UNDP 사무소와 조선민주주의인민공화국정부사이에 재조인되였다. 집행방식은 사무소개설과 대상계획집행정책에 따라 직접리행(DEX)방식으로 변경되였다. 2011 년 5 월에 열린 개시모임을 시점으로 SWEDPRA는 활동을 재개하였으며 예상완료기일은 2013 년 4 월이다.

동반자는 민족환경조종위원회 (NCC-E), 국가과학원 (SAOS) 및 국가과학기술위원회 (SCST) 이다. GEF 기금은 총 750,000＄로서 그중 150,000＄의 UNDP TRAC 기금과 545,000＄의 정부 현물 및 현금지원이 속한다. 2012 년 11 월 9 일현재 GEF 기금지출비률은 84%로서 지출항목은 주로 설비 (제조설비, 풍력측정설비 및 사무설비), 양성준비 및 조직사업, 그리고 국제적 고문을 받는것이다. 증거서류(보고서들, 구입주문서들, 양성보고서들)에 기초하여 평가자들은 해당한 결과물을 확인하였고 결과가 충분한 가치를 가진다고 결론하였다.

SWEDPRA 의 목표는 (1) 풍력자원평가를 위한 국내능력의 강화 (2) 단독공급전력생산을 위한 소형풍력에네르기 체계(SWES)의 설계와 제작 (3) 조선과 국외에서 소형풍력체계의 촉진으로서 실제로 조선민주주의인민공화국 농촌지역 거주자들에게 전력보장을 위해 현저한 개수의 소형풍력에네르기체계를 제공하는것이다. 성공적인 상업화를 지향한 결과물개발경로는 대상계획설계단계에서 생각한것보다 길고 복잡하였다는것이 밝혀졌다. SWEDPRA 의 대상목표는 대상계획 리행기간이 짧고 GEF 의 중간규모계획에 해당한 자금량에 비하여 볼때 너무나도 포부가 컸다. 농촌가정들에 SWES 체계제공을 위한 명확한 제안이 없었으며 적절한 담당자를 선정하지 못하였다.

결과 SWEDPRA는 예상결과의 일부만을 달성하였다. 대상계획은 설비제공과 양성 및 기술적지원의 방법으로 국내풍력자원평가능력확립에 관건적인 기여를 하였다. 국가과학원 (SAOS) 의 해당한 연구집단의 능력강화에 의하여 대상계획은 국제적인증을 받는 방법론과 실천활동을 채용하였다. 대상계획 마감단계에서 국내전문가들은 국제표준을 확인하는 사업에서 능력을 과시하고 풍력측정설비를 기증받게 되였으며 나라의 대규모 풍력에네르기개발에 기여하고 있다고 보고되였다. 이는 GEF 중규모 대상계획에 준하여 볼때 대단히 훌륭한 성과로 된다.

SWEDPRA 는 또한 국내에서 효률적인 소형풍력타빈개발에 현저한 기여를 하였다. 대상계획 마감단계에서 《새형》의 충전용 300W 풍력발전기가 소규모로 생산되고 있다. 그러나 이 제품들은 에네르기 성능과 안정성을 결정하기위한 장기시험을 거쳐야 한다고 본다. 풍력발전기는 지역별 풍력조건과 생산능력의 효률성정합과 관련하여 최적화되지못하였다. 국내시장에서 상업화될수있는 성숙된 제품들이 1-2 년내에 이루어질수 있다고 본다. 3 종류의 서로다른 류형의 풍력발전기설계와 제작이라는 초기목표는 대상계획의 범위내에 존재하지 않는다.

SWEDPRA 는 개선된 소형풍력체계를 농촌제작자들에게 제공하지 못하였다. 풍력에네르기연구개발쎈터 (CWERD)가 일련의 양성활동을 진행하였으나 대상계획은 국내 SWES 시장개척을 위한 결과물과 원천을 가지지 못하였다. 대상계획은 또한 소형풍력체계에 대한 말단수요자수요를 높이기 위한 구체적인 전략이 부족하였다. 자재와 설비부족 그리고 농촌제작자들의 낮은 지위문제 등은 SWEDPRA 와 같은 대상계획이 제거할수없는 계통적인 장벽에 기인한다. 대상계획이 중지되였던 시기 풍력에네르기연구개발쎈터 (CWERD) 의 계속된 활동은

기술개발에 집중되였으며 SWEDPRA 의 전반적인 전략을 고수하기위한 전략적인 지도가 없었다. 평가자들은 SWEDPRA대상내에서 이룩된 기술이 실질적으로 지방의 생산자들에게《낡은형》체계의 질을 개선하고 생산량을 늘이며 지방에서의 생산능력을 강화하는데 이바지하였다는 증빙자료들을 얻지 못하였다.

SWEDPRA 는 농촌지역의 말단사용자들에게 개선된 소형풍력타빈 제공, SWES제작을 위한 종합적인 생산체계의 확립, 그리고 지구온실가스감소 추구와 같은 전반적인 목표를 달성하지 못하였다. UNDP 사무소가 설치된《낡은형》의 소형풍력체계에 대한 현지방문과 상태 및 영향평가에 귀중한 노력을 들였으나 성능과 효과성에 관한 확고한 결론을 이끌어내기 위하여서는 체계적이며 정량적인 측정이 필요하다고 본다. 지구온실가스감소목표는 비현실적이였다.

현재의 개선된 SWES 설계는 명확한 생산원리에 기초하지못하고있다. 시장경제체계에서 가장 일반적인 사용자지향제품설계는 조선민주주의인민공화국에서는 덜 발달되였다. 프로그람화된 에네르기정책과 장려적인 결과물은 소형 농촌에네르기계획과 일치하지 못하였다. 에네르기부문대상기관들보다는 농촌개발조직 및 협동농장들과 보다 긴밀히 협조하기 위한 보다 성공적인 방법들이 탐구되여야 하였었다. 평가자들은 이렇게 함으로서 판매기구, 관리, 에네르기 수요 및 가격제약과 같은 지속적인 입구정보들을 제공할수 있었다고 본다.

평가자들은 국내참가자들과 주조 유엔개발계획사무소가 SWEDPRA 대상계획을 성실히 집행하였다고 본다. 풍력에네르기연구개발중심(CWERD)은 대상계획재개후 제한된 자원을 가지고 풍력에네르기개발활동을 계속하였다. 평가자들은 유엔개발계획과 대상계획국내참가자들사이의 사업관계가 건설적이라고 본다. 대상계획참가자들이 언급한바와 같이 SWEDPRA 는 비록 1999 년에 계획한것보다 속도가 느리기는 하지만 조선민주주의인민공화국에서 현대적인 소형풍력타빈의 개발을 가능하게 하였다. 대상계획은 또한 조선민주주의인민공화국에서 앞으로의 UNDP 와 GEF 의 창발적인 활동을 위한 유익한 경험을 창조하였다.

평가등급 : **SWEDPRA Project GEF 751**			
1. 감시 및 평가	등 급	2. 리행기관 집행정도	등 급
초기 감시 및 평가	보통정도로 만족	UNDP 리행의 질적수준	대단히 만족
계획수행 감시 및 평가	만족	집행단위리행의 질적수준	만족
감시 및 평가의 전반적 질수준	만족	리행의 전반적 질적수준	만족
3. 결과물평가	등 급	4. 지속성	등 급
관련성	관련성있음	재정원천적 지속성	보통정도로 가망없음
효률성	보통정도로 불만족	사회정치적 지속성	가망없음
효률	만족	기구적틀거리와 지도의 지속성	가망있음
전반적인 결과물 등급	보통정도로 만족	환경적 지속성	가망있음
		전반적 지속성	보통정도로 가망없음

2. Introduction

This report describes the findings of the independent, terminal evaluation of the UNDP/GEF Medium-Size Project 76431 "Small Wind Energy Development and Promotion in Rural Areas (SWEDPRA)" as carried out for the UNDP Country Office in Pyongyang, DPRK. The Project Document was signed on 3 August, 2005; project execution was through UNOPS (under the execution modality "UN Agency") until 2007, when UNDP suspended activity in DPRK and withdrew its office. After resumption of UNDP DPRK in 2009, the Project Document was reviewed by UNDP Head Quarters and newly signed between UNDP CO and the Government of DPRK, on 25 August, 2010. Since then, the Project is executed under Direct Execution modality ("DEX") and will expectedly terminate in April 2013.

The Project was designed to assist the nascent small-scale wind energy sector in DPRK by improving national wind generator designs and strengthen manufacturing capabilities, by installing improved wind generators in the rural areas, and support market development for national manufacturers within DPRK and in foreign markets. The formal counterpart for UNDP is the National Coordinating Committee Environment (NCC-E), which has a liaison role between the Government and international agencies involved in environment-related initiatives. The direct counterpart is the State Academy of Science (SAOS), which hosts a number of research groups on wind technology, including small wind turbine development and wind resource assessment.

The SWEDPRA Project was funded by the GEF as a Medium-Size Project with a grant of US$ 750,000[2] and by UNDP using TRAC sources (US$ 150,000); Government co-funding amounted to US$ 545,000. The Terminal Evaluation was conducted by a team of two consultants (one national and one international). The evaluation mission was carried out from October 8 – October 19, 2012.

2.1 Purpose and scope of the evaluation

The Terminal Evaluation for the SWEDPRA project is initiated by UNDP DPRK in line with the UNDP/GEF M&E guidelines[3] and coordinated with UNDP's Regional Bureau for Asia and the Pacific in Bangkok. The Terminal Evaluation is one of the instruments used by UNDP and GEF to evaluate the degree of success and effectiveness of an intervention. The overall objective of the Terminal Evaluation is to evaluate the achievement of project results, to make specific recommendations to consolidate and enhance the results and benefits produced by the Project, and to draw lessons-learnt for further UNDP and GEF programming in DPRK and other countries.

The purpose and scope of the final evaluation of the SWEDPRA project are based on the UNDP/GEF guidelines for M&E[4] and are adhered to by the evaluation team. A list of evaluation questions is given in the Terms of Reference for the assignment (included in Annex A of this report). The evaluation will rate the following aspects of the Project according to the scale "HS/S/MS/MU/U/HU"[5]:

- Relevance: How does the Project contribute to the GEF, UNDP and country development objectives?
  - Is the project relevant to National priorities and commitments under international conventions (country-drivenness; national policy and institutional realities; promotion of wind energy across economic sectors; level of stakeholder participation in project design and ownership in project implementation)?
  - Is the project internally coherent in its design (logical framework, design of project components, choice of partners, structure, delivery mechanism, scope, budget, use of resources; project duration; accomplishment of outputs)?
  - Does the project provide relevant lessons and experiences for other similar projects in

[2] Including US$ 25,000 for project preparation (PDF-A).
[3] M&E: monitoring and evaluation.
[4] Available at: http://www.thegef.org/gef/sites/thegef.org/files/documents/Policies-TEguidelines7-31.pdf.
[5] The rating scale proposed by the GEF Based as follows: Highly Satisfactory (HS); Satisfactory (S); Moderately Satisfactory (MS); Moderately Unsatisfactory (MU); Unsatisfactory (U): Highly Unsatisfactory (HU).

the future (replicability)?

- Effectiveness: To what extent has the Project succeeded to achieve the objective and results set forth?
  - Has the project been effective in achieving the expected outcomes and objectives (accomplishment of performance indicators and targets)?
  - How is risk and risk mitigation being managed (management of risks, assumptions and impact drivers; quality of risk mitigation strategies)?
  - What lessons can be drawn regarding effectiveness for other similar projects in the future (lessons regarding achievement of outcomes; changes to the project design to improve the achievement of results)?

- Efficiency: Was the project implemented efficiently, in-line with international and national norms and standards and delivered results with the least costly resources possible?
  - Was project support provided in an efficient way (project management and reporting, administrative and financial systems; APR/PIR, and M&E system as a basis for performance evaluation and decision making; adaptive management practices; use of logframe and work plans as management tools; utilization of resources to produce outputs; details of co-funding provided[6] and its impact?
  - How efficient are partnership arrangements for the project (appropriateness of institutional arrangements and adequate commitment; collaboration between institutions; assistance received from project partners and stakeholders)?

- Sustainability: To what extent are there financial, institutional, social-economic, and/or environmental risks to sustaining long-term project results?
  - Will the project be sustainable on its conclusion and stimulate replications and its potential (strengthening local capacities in the design, manufacturing and implementation of SWES; improving energy access for rural areas; exit strategy)?

- Impact: Are there indications that the project has contributed to, or enabled progress towards maximizing environmental benefits?
  - What was the project impact under the different components (establishment of outcomes per component; leveraged co-financing)?
  - What are the indirect benefits that can be attributed to the project (spinoffs created as a result of the Project)?
  - What are the impacts due to information dissemination under the project (use of electronic information and communication technologies)?

2.2 Key issues addressed

In agreement with the meetings held with UNDP CO on October 8 and October 18, 2012 it was decided that the Terminal Evaluation would focus especially on the aspects of the Project that are relevant for future programming of UNDP initiatives in DPRK, including:

- Effectiveness of the Project to achieve clean energy access for rural peoples;
- Effectiveness of the Project to support small-scale wind technology development;
- Institutional arrangements and choice of the local counterparts;
- Impact of execution modality on Project effectiveness and implementation;
- Progress towards attainment of outcomes;
- Recommendations to devise an adequate exit strategy;
- Achievement of overall impacts, including global GHG benefits;
- Implications of country context on Project design and implementation;
- Effectiveness of field visits and verification of results in DPRK;

[6] Government support provided by SAOS, SCST, NCEDC, SWERD, and NCC-E.

- Specific recommendations for termination of SWEDPRA; and
- Lessons-learnt and recommendations for UNDP's energy and environment portfolio in DPRK.

As a consequence of UNDP's withdrawal from DPRK in the period 2007 - 2009, the institutional memory concerning the design stage and initial implementation of SWEDPRA, is limited. The Regional Bureau in Bangkok could provide useful information about the expectations regarding SWEPRA and the monitoring process[7]. However, there is no staff still working at RBAP that was involved in the design phase of SWEDPRA.

2.3 Methodology of the evaluation

The methodology followed for the Terminal Evaluation is based on the UNDP/GEF M&E guidelines and the Terms of Reference and consists of:

- A review of the project documentation submitted by UNDP to the evaluators;
- Collection of lacking information from UNDP Country Office;
- Collection of additional information regarding country context;
- Conducting semi-structured interviews with the national project counterparts, UNDP CO staff[8], Project Manager, Regional Technical Expert; and retained consultants;
- Analysis of information within the evaluation team;
- Assessment of the outputs, outcomes and impact of the Project in relation to the objectives and indicators set forth in the project logical framework;
- A review of the assumptions and the strategy of the project;
- A review of the achievements made by national counterparts in terms of small wind energy technology development; and:
- Two field visits.

The visits were made to the following places:

- On Friday 12 October 2012, to the State Academy of Science (SAOS) and its manufacturing facility, the nearby SWES test field, and a local hospital equipped with a wind-solar system for backup power; and
- On Monday 15 October 2012, to the Sukchon manufacturing workshop and installed wind energy units at Hanchon Ward (one community building and one individual household).

A plenary meeting was held with the national counterparts stakeholders (NCC-E, SAOS, and SCST[9]) on October 9, 2012, followed by a second one (October 17) for verification and validation of findings, and to obtain additional inputs. On October 18, the preliminary findings of the evaluation were presented to the direct counterpart (SAOS' project team), the Project Manager and UNDP's Senior Management. The evaluation team had the expectation to interview members of local communities to assess the impact of the Project on their energy situation and their quality of life. The field visits were mainly limited to a visual inspection of the installed small wind systems. One must observe that no information about the baseline situation was obtained before the Project was started.

2.4 Structure of the evaluation

The evaluation report follows the general document structure as suggested for this purpose. Section 3 provides a description of the Project and the devised strategy in relation to its development context. Section 4 presents the findings of the Evaluation Team covering project design, implementation and results. The sections 5 and 6 summarize the conclusions, recommendations and lessons learned.

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7 Interview with Regional Technical Specialist at RBAP Bangkok, 10 October 2012 (skype).

8 Specifically: UNDP DPRK's Deputy Resident-Representative, Senior Programme Officer, Procurement Officer, Programme Analyst.

9 The State Commission for Science and Technology.

3. The Project and its Development Context

3.1 Project start and its duration

The project document was signed on August 3, 2005. It was executed for 18 months (until March 2007). After resumption of UNDP DPRK in 2009, the Project Document was reviewed by UNDP Head Quarters and newly signed between UNDP CO and the Government of DPRK on 25 August, 2010 to continue execution for the remaining 32 months (until April 2013). Both periods together would add to the original throughput time of 50 months. However, activities were effectively resumed on May 11, 2011 when the inception workshop was held[10]. As indicated by the RTA in the 2012 PIR, the present Terminal Evaluation was scheduled for October 2012, while maintaining the anticipated closure date at April 2013.

3.2 Problems that the project seeks to address

The GEF MSP Project Brief[11] provides a description of the problem addressed by SWEDPRA and its scope and principal beneficiaries:

> *"Wind has for the last 15 years been considered a potential source of energy in the DPRK especially for off-grid stand-alone services. Although research and demonstration have been conducted these have never led to successful development of a prototype, much less wide dissemination and marketing of the technology. The proposed project addresses the problems of technology design and commercialization by assisting in the advancement of wind energy at selected points in the research to commercial market development chain of development.*
>
> *The technology focus of the project is small-scale, from 500 W to 5 kW. This size range can meet the demand of rural households as well as small-scale farm activities. Designs will be developed both on a "best practice" basis and on the basis of cost effectiveness with the limitations of DPRK industry in mind. Equipment will be provided to permit the manufacture and testing of such small units. Units will be commercially ready before they are demonstrated."*

The following barriers to the introduction of SWES in DPRK are mentioned[12]:

- incomplete wind data and wind data assessment;
- lack of information and awareness;
- lack of energy markets;
- lack of industrial manufacturing facilities for SWES;
- lack of appropriate SWES designs; and
- lack of technology planning and analysis skills.

In the opinion of the Evaluators the barrier analysis is not exhaustive and does not demonstrate a clear understanding or elaboration of the root causes why *"research and demonstration never led to successful development of a prototype"*. It was recognized that R&D on small wind systems in DPRK did not lead to successful designs, hence the GEF Project logically sought to achieve this. However, the Project also aimed at production and marketing to reach the end-user. A clear path as to how this had to be done was not identified in the project design, the underlying assumptions were not validated and the resources were not aligned with the ambitions. This situation is not uncommon for earlier GEF projects[13].

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10 This delay was due to the lengthy procedure needed to select and contract a new project manager for the combined UNDP SWEDPRA and SRED projects.

11 SWEDPRA Project Brief December 9, 2003, p.18 (source: GEF Project Database).

12 Ibidem, p.16-17.

13 Under the replenishment periods GEF-2 (1998-2002) and GEF-3 (2002-2006).

3.3 Goal and objective of the Project

The goal of the project as described in the Project Brief[14] is as follows:

> *"The goal of this Project is the reduction of the annual growth rate of GHG emissions from fossil fuel using activities through the removal of the major barriers to the development and widespread implementation of small-scale wind energy systems (SWES) to replace part of the current fossil fuel use in the Democratic Peoples' Republic of Korea (DPRK). This is carried out by assisting the nascent SWES industry on the road to full-scale commercialization by assisting SWES manufacturers and targeting the rural sector market, and to ensure sustainability of efforts made, also the overseas markets."*

The direct objective of the Project is defined as follows[15]:

> *"The purpose of the Project is the realization and advancement of the potentials and application of SWES in rural areas in the DPRK."*

3.4 Expected results

In order to achieve this purpose and ultimately contribute to the proposed development goal, the Project pursued the following results[16]:

(1) Assessment of the wind characteristics and energy potentials in the country are regularly conducted.
(2) The feasibility and benefits of wind energy technology applications in the country are widely disseminated to potential users in the country.
(3) The market for locally made SWES units is fully established and promoted both domestically and abroad.
(4) Locally made SWES units comply with internationally acceptable quality and performance standards.
(5) Manufacturing of locally made SWES is improved towards internationally accepted production practices and standards.
(6) Productive uses of electricity generated from SWES units are used in income generating livelihood activities, which contributes to socio-economic development of rural areas. And:
(7) Energy planning and policy making becomes part of the country's development planning system.

Although the proposed results (outcomes) were aligned with the identified barriers, there is no justification that they were feasible and that their combined action would be sufficient to improve the underlying development conditions. This is a direct consequence of the inadequate barrier analysis, particularly with respect to market development. The following excerpt from the Project Brief (p.16) may serve as an example:

> *"The export of such products to other countries, which is viewed as a means of sustaining the development and use of SWES, is a problem because of the poor quality of such products that are presently made. Moreover, DPRK has to establish foreign markets to open up investments for manufacture and sale of locally made SWES."*

One may wonder why the scope of the Project was not limited to technology demonstration. Foreign market development for DPRK is a problem by itself and from a very different nature than technology development and promotion. It is outside the field of interest and the direct mandate of the Project's principal counterpart (the State Academy of Science) and implies a process that is not easily controlled

[14] SWEDPRA Project Brief December 9, 2003, p.11.
[15] The direct objective is referred to as the project's "purpose" in the logical framework.
[16] These results are referred to as "objectives" in the Project Brief (p.11). In present GEF language, these results are at the level of project outcomes.

by a project limited in time and budget. The comment raised in the GEF Council highlights this point[17]:

> *"Also one of the outcomes of the project is to create a market abroad for the locally produced units. We do not believe this is a realistic assumption to believe that within four years one can create a local manufacturing capacity to compete with for example that of China in this respect."*

Apparently, the project proponents were very optimistic with respect to the successful design, testing, manufacturing and commercialization of small wind energy systems in DPRK.

The SWEDPRA logical framework provides a large list of indicators to monitor the delivery of project outputs and activities. The following table provides a simplified logical framework, based on the 2010 Project Document[18], which specifies quantitative end-of-project targets for the defined indicators:

SWEDPRA - SIMPLIFIED LOGICAL FRAMEWORK (BASED ON PRODOC 2010)				
Project Strategy			**Indicator**	**Target**
Goal		The annual growth rate of GHG emissions from fossil fuel using activities, is reduced through the removal of the major barriers to the development and widespread implementation of small-scale wind energy systems (SWES) to replace part of the current fossil fuel use in the DPRK.	GHG emission reduction by end of project (kton)	100
Objective		The potentials and application of SWES in rural areas in the DPRK are significantly achieved and advanced.	Annual growth in installed capacity of SWES (electricity and non-electricity) in the rural area of the country	30%
			Cumulative installed SWES capacity in the rural areas of DPRK (kW)	700
Components			**Indicator**	**Target**
1	**Wind Energy Resource Assessment**			
		Regular conduct of assessment of the wind characteristics and energy potentials in the country	No. of wind energy resource assessments conducted in the country.	5
			No. of wind maps produced.	5
2	**WE Technology Information and Awareness Enhancement**			
		The feasibility and benefits of wind energy technology applications are widely known to potential users in the country	No. of successfully conducted information dissemination and awareness raising activities for WE system users, developers and manufacturers in the country.	5
			No. of WE systems users, developers and manufacturers in the country that are planning to implement WE projects.	100
3	**Development of Domestic and Overseas Market for Locally-made SWES**			
		Fully established and promoted market for locally made SWES units both domestically and abroad.	No. of local SWES manufacturers in the country.	6
			Average annual local volume of sales of SWES units (US$)	150,000
4	**SWES Design Improvement**			
		Locally made SWES units comply with internationally acceptable quality and performance standards.	No. of local SWES designs that meet international design and performance standards.	3
			No. of local SWES manufacturers that are qualified to produce internationally-accepted SWES designs.	2
5	**SWES Manufacturing Improvement**			
		Improved manufacturing of locally made	No. of locally made SWES units that meet	1,000

[17] Project Document August 25, 2010 (p.2-3).
[18] Ibidem, p.20-39.

		SWES units towards internationally accepted production practices and standards.	internationally-accepted manufacturing standards.	
			No. of local manufacturers that are qualified and capable to produce export quality SWES units.	6
6	**SWES Technology Demonstration**			
		Successful showcasing of the installation, operation and monitoring of optimally designed and manufactured SWES units.	No. of installed optimally designed and manufactured SWES demo units that are successfully in operation.	6
			Cumulative collective electricity generation from installed SWES demo units (kWh).	34,000
7	**Energy Planning and Policy Formulation**			
		Energy planning and policy making becomes part of the country's development planning system.	No. of NRE projects developed and designed by Non-Conventional Energy Development Center (NCEDC).	3
			No. of energy planning activities carried out by NCEDC each year.	5

Table 1 Simplified logical framework at component (outcome) level based on the Project Document as signed in 2010.

In terms of overall achievements, the logical framework indicates the following end-of-project targets:

- cumulative greenhouse gas emissions reductions: 100 kton CO_2eq;
- annual growth in installed SWES capacity in the rural areas: 30%;
- cumulative installed SWES capacity in the rural areas of DPRK: 700 kW.

The Project is indeed very ambitious by setting quantitative targets that require a substantial rate of deployment of SWES systems in the country[19]. Moreover, since a few months after the inception workshop (May 2011) it was decided to focus on wind technology development alone given the very limited financial resources and time available[20]. This decision moved the Project definitively away from market development and direct end-user benefits, to put the focus on wind resource assessment and wind generator prototype design.

A more qualitative formulation of the expected end-of-project situation can be derived from the description of SWEDPRA's benefits in the Project Brief[21]:

- Increased capacity for development and exploitation of renewable energy;
- SWES designs built to international standards;
- Increased manufacturing capacity for SWES;
- A demonstration of SWES technology and a strategy for dissemination; and
- Increased stakeholder cooperation and coordination.

It may be clear that a rigorous evaluation of the Project's achievement viz-a-viz the defined, but unrealistic targets, would yield a poor performance. The evaluators will therefore follow a more holistic approach to assess the Project's merits and shortcomings.

3.5 Development context

The SWEDPRA project fits into DPRK's development context by:

- promoting a renewable energy technology (RET) to diversify the country's energy matrix and avoid GHG emissions from fossil fuel electricity generation;
- providing a cost-effective technology for stand-alone electricity generation for rural end-users;

[19] The Project Brief (p.2) establishes the following quantitative targets: 4,000 SWES systems sold to the local markets by the end of the project; and orders for 50 units placed by other countries. See sections 4.5 and 4.6 for a further discussion of the indicators.

[20] Project Technical Committee meeting November 30, 2011.

[21] SWEDPRA Project Brief December 9, 2003, p. 35.

- supplying electric energy to rural end-users, which presently have no access to electricity or are faced with an inadequate service; and
- supporting a nascent wind technology sector in DPRK through technical assistance and equipment.

Especially since the early 1990s, the energy sector in DPRK has declined rapidly due to a lack of investment, inadequate technology, an obsolete infrastructure and increased energy losses. The decline has been felt nowhere more than in the agricultural sector, where electricity shortages affect water supply, transport fuels are scarce, and rural households are cut off from grid electricity to give priority to productive processes. The SWEDPRA project was designed to provide a new, clean source of energy for rural families to improve quality of life and strengthen resilience of rural livelihoods.

The development of RETs, including wind power, is a national priority anchored in the Governmental Policy on Science and Technology (1991). The National Action Plan for Agenda 21 (1993) highlights the development of wind energy as a strategy towards a transition to sustainable development. This commitment is confirmed in the country's initial National Communication to the UNFCCC (2000). The SWEDPRA project fits into UNDP's corporate priority area "Energy and Environment"[22].

3.6 Beneficiaries and stakeholders

The following beneficiaries are explicitly targeted by the project (Project Brief, p.18):

> *"The rural areas are the main beneficiary targets for this project. From applications ranging from stand-alone units to wind power plant (with power distribution systems), this sector represents the greatest potential for replication because of severe electricity shortages. From a humanitarian perspective it is this sector where the need is greatest for an alternative form of energy."*

According to the Project Brief (p.28), the following stakeholders were identified:

- The Ministry of Land and Environment Protection (MLEP)
- The Environment and Development Centre (EDC)
- The Ministry of Electricity and Coal (MEC) / Electric Power Industry (MEPI)
- The Ministry of Metal and Mechanics Industry (MMMI)
- Kim Il Sung University
- Kim Chaek Polytechnical University
- State Academy of Sciences (SAOS)
- Institute of Thermal Engineering (ITE)
- Non-Conventional Energy Development Centre (NCEDC)
- On Chon County Windfarm Development
- The National Coordinating Committee for the Environment (NCC-E)
- The Ministry of Agriculture (MoA)
- The Department of Meteorology (DoM)
- The October 5 Manufacturing Complex
- The Management Committee, Daeryong-ri Farm, Onchon County
- Ministry of Foreign Affairs (MFA)
- Overseas Trade Offices of DPRK
- Ministry of Electronics Industry (MEI)

The evaluators have not found evidence of direct involvement of any of these stakeholders in SWEPDRA, with the exception of SAOS, the Non-Conventional Energy Development Centre (NCEDC), and NCC-E. According to the Project Manager, MEPI officers represent in the PSC of the parallel UNDP Sustainable Rural Energy Development (SRED) project, which is a TRAC (Target for Resource Assignment from the Core) funded project of UNDP.

[22] Source: SWEDPRA Project Brief December 9, 2003, p.1.

3.7 Institutional set-up

The SWEDPRA Project was implemented by UNOPS on behalf of UNDP ("UN Agency modality") until UNDP suspended activities in DPRK in March 2007. The choice for UNOPS was reportedly in line with the execution modality for other UNDP and UN activities at that time. The National Execution modality ("NEX") could not be used because of the mandatory role of the National Coordinating Committee NCC-E[23] at the highest Government level (instead of a line ministry which would normally assume a Project under NEX modality). Under the supervision of NCC-E and UNDP, the direct counterpart to implement project activities under SWEDPRA was the State Academy of Science (SAOS)[24]. Under SAOS, a number of research groups are involved in wind energy[25]:

(1) Wind Energy Resource Assessment and Monitoring Group, composed of the Institute of Geography, NCEDC, and the Department of Meteorology;
(2) Wind Energy Technology Development and Application Group, composed by the Wind Research Group of the Institute of Thermal Engineering;
(3) Wind Energy Market Development and Promotions Group, headed by the NCEDC and including participation from the MLEP, MEC, MEI, MoA and NGOs[26]; and:
(4) Wind Energy Policy and Project Development Group, also headed by NCEDC.

The revised Project Document further identifies the Centre for Wind Energy Research and Development (CWERD) at SAOS[27]. The Evaluators do not fully understand the scope of work of each of these groups. Contact during the mission was with the SAOS-CWERD project team[28], which presumably absorbed the groups (1) and (2). There is no evidence of involvement from the groups (3) and (4), perhaps with the exception of in-country training events in the period 2005-2007. In the opinion of the Evaluators, the detailed organization of project activities is the responsibility of the Executing Agency rather than the Project designers. The expected synergies between MLEP, MEC, MEI and MoA in the field of energy policy for rural development did not materialize. This is possibly because of the existence of more urgent issues at the national level (such as recovery from flooding, and food security); another reason can be the inability of the Project to bring national stakeholders together during the suspension period.

In 2009, the Academy of Science was split up into SAOS and the State Commission for Science and Technology (SCST), the latter with a mandate to promote and disseminate new technologies across the economy. This split-up brought along a separation between technology development (under SAOS) and market development. Since after resumption only SAOS acted as the direct counterpart, market development and promotion remained largely unattended.

3.8 Management arrangements

Given the UN Agency modality, no specific roles for project management and implementation within UNDP and the counterpart were defined. By consequence, no budget was allocated for project management, but a reservation[29] was made to compensate UNOPS for the services provided. A Project Steering Committee was apparently foreseen, which gathered once before the Project was suspended[30]; however, no reference to the roles and composition of such committee is found in the 2005 Project Document (nor in the 2003 GEF Project Brief).

After resumption in 2010, SWEDPRA was implemented under Direct Execution Modality ("DEX") in accordance with the MoU signed between the Government of DPRK and UNDP[31]. The role of the newly

[23] NCC-E acts further as the GEF Focal Point in the country.
[24] Also referred to as AOS in the period prior to 2010.
[25] Project Document August 25, 2010, p.8.
[26] Although mentioned in the Project Document, NGOs are not allowed to operate as such in DPRK and must line up with multilateral or bilateral agencies (interview Programme Manager EUPS-3, October 17, 2012).
[27] Project Document August 25, 2010, p. 3.
[28] With the exception of a visit to the Earth Environmental Informatics centre at SAOS, which produced the meso-scale wind atlas for DPRK.
[29] Amounting to 8% of the value of the contracts issued by UNOPS.
[30] Project Steering Committee cum Tripartite Review November 16, 2006.
[31] Memorandum of Understanding, February 27, 2009, section VI-2 (p.9).

formed SCST (2009) was recognized in the revised Project Document, as well as the Centre of Wind Energy Research and Development (CWERD), established in 2005[32]. The Government would appoint a National Project Director (NPD) responsible for managing and directing the day-to-day operations of SWEDPRA, and a Project Technical Manager (PTM) and Project Administration Assistant to support the NPD[33]. UNDP would recruit an international consultant as Chief Technical Advisor to coordinate the implementation of SWEDPRA[34].

Direct monitoring of progress and discussion of technical issues would take place in a newly formed Project Technical Committee (PTC). The role and composition of the Steering Committee is now defined as follows:

- a representative from UNDP/DPRK, who shall be co-chairman of the PSC;
- a representative from NCC-E, who shall be co-chairman of the PSC;
- heads of the four operating groups[35];
- the Project Director (who shall act as the PSC Secretary);
- the Chief Technical Advisor; and
- representatives from MoA, MEI and MEPI.

The functions of the PSC were defined as follows: (i) oversee and advise on the execution of the Project; (ii) monitor and supervise implementation of the Project; (iii) endorse the workplans; (iv) approve adaptations to the project components during the Project execution, if any; (v) evaluate the performance and impacts of the Project; and (vi) approve progress, mid-term and terminal reports of the Project.

Under the DEX modality, no cash advances to the Government can take place and ultimate approval of the annual workplan and expenditures rests with UNDP DPRK's Senior Management. Under these conditions, the unfamiliarity with GEF Projects and possible language constraints, it was not realistic to expect the national Project Director to assume daily project management. In the course of 2011, project management was shifted to the CTA[36], which by then became the formal Project Manager (PM), holding office at UNDP's premises. In the absence of a project budget for project management, the administrative support for procurement, reporting and monitoring (including field visits) is provided by the UNDP Country Office.

After resumption, the PSC meetings were held four times (July 7 and September 21, 2011; and February 29 and September 6, 2012). The PSC meetings are also used for discussion and the exchange of information between stakeholders. A good example of this is the latest PSC meeting (September 2012), which was programmed as part of a full one-day workshop on sustainable energy. Once a Project Manager was formally appointed, communication between UNDP and the national counterparts became much more intensive: 19 meetings of the Project Technical Committee (PTC) were held between August 24, 2011 and September 3, 2012.

3.9 UNDP's context in the DPRK

The UNDP Country Office in DPRK has an international staff of 7 persons (as a minimum) and about 20 national staff. Communication with local counterparts is done through a national liaison officer, appointed by the Government. This communication protocol affects project implementation since it slows down decision-making processes and the exchange of information. The frequent PTC meetings under SWEDPRA were convoked by the PM as a means to mitigate this issue and maintain a continuous flow of information between UNDP and SAOS' project team.

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[32] The perception obtained during the mission is that wind energy development by SAOS (wind resource assessment, research and SWES product design, and performance testing) is concentrated within CWERD.

[33] Project Document 2010, p.46-47.

[34] The Terms of Reference for the CTA were included in the 2010 Project Document. Given the obvious synergies, the CTA was a shared position for SWEDPRA and UNDP's Sustainable Rural Energy Development (SRED) programme and funded from the SRED budget (UNDP TRAC sources).

[35] These are: (i) wind resource assessment & monitoring group and (ii) technology development & application group, under CWERD; and (iii) market development & promotion group and (iv) policy and project development group, under NCEDC.

[36] Minutes PTC meeting August 24, 2011, mentioning the "recent agreement between NCC-E and UNDP that Project Manager responsibility were moved from Project Director to CTA".

The MoU[37] signed in 2009 grants UNDP "unhindered access, as necessary, for the implementation, monitoring and oversight of its programmes in DPRK". Notwithstanding, field visits must be prepared in advance in dialogue with the national counterparts to enable local actors to prepare themselves. After lengthy preparations, UNDP and SAOS agreed upon a field monitoring plan in November – December 2011. Since then, field visits have been more frequent[38], enabling the verification of the outputs produced under SWEDPRA. It is more difficult to assess project impact, as this normally requires closer interaction with the local population (in the case of SWEDPRA: rural families)[39].

A complicating factor is the existence of UN sanctions, as well as bilateral sanctions by some countries, with respect to the delivery of goods and technology to and from DPRK. The UN sanctions are based on Security Council Resolution 1718 (2006)[40]. The impact of the sanctions on the implementation of international cooperation initiatives in DPRK can hardly be underestimated, as they greatly limit the possibilities for procurement and require the incorporation of complex compliance checks that are time-consuming and represent an additional burden for project and office staff. The effectiveness and efficiency of international assistance programmes in DPRK are directly affected by the international sanctions.

Moreover, the provision of equipment and technical assistance by international agencies to DPRK has given rise to inquiries by UN member states. The primary concerns are: (i) diversion of "dual use" equipment[41]; (ii) the creation of transaction channels for DPRK that would otherwise be closed; and (iii) direct disbursements in hard currency to DPRK, which might be used for other purposes than intended. In the aftermath of DPRK's nuclear tests in October 2006, concerns about UNDP's role in DPRK became stronger. In January 2007 the Secretary General asked to undertake a review of UNDP, UNFPA, UNOPS, and UNICEF operations in DPRK. Simultaneously, the UNDP Executive Board imposed a number of conditions on UNDP programs in DPRK in face of the allegations that had been raised. Since no agreement was reached with the Government of DPRK and given the political context, UNDP suspended its program in DPRK in March 2007 and withdrew its office from the country.

In the course of 2007-2008, UNDP's role in DPRK was investigated by an independent Panel chaired by the former President of Hungary, Miklos Nemeth. It was concluded that there had been no "wrongdoing" by UNDP in DPRK, but tighter procedures were recommended to strengthen control over human and financial resources. Eventually, UNDP established a special Internal Control Framework (ICF) for its operations in DPRK. Early 2009, UNDP and DPRK could agree upon a new Memorandum of Understanding specifying the conditions for national staff, field operations, and financial transactions[42].

Notwithstanding, UN agencies in DPRK remain under scrutiny, as illustrated by the "WIPO case" in January 2012. WIPO[43] facilitated the procurement of computer hardware and software to DPRK as part of its technical assistance. Questions arose whether U.S. export sanctions were violated and whether UN Agency's immunity status might open up transaction channels for embargoed countries that would otherwise not be possible. The case gave rise to a new independent external review[44], which concluded that WIPO did not violate specific UN or country embargoes. However, the review also issued a list of recommendations with respect to due diligence in procurement and reporting and the consistent implementation of international sanctions by the agency.

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37 Memorandum of Understanding, February 27, 2009, section VI-3 (p.9).

38 Good working relations need time to develop. According to its Deputy Director, the World Food Programme (WFP) is by now well accepted in the rural areas in DPRK and the Government has lifted the usual requirement to announce field visits at least 24 hours ahead (interview October 19, 2012).

39 It is not impossible however (if properly prepared and negotiated with the Government) as suggested by UNFPA's support to the national census in 2010 (see: http://www.unfpa.org/public/site/global/lang/en/pid/5635).

40 A list of the prohibited items, materials, equipment, goods and technology is given on the website of the UN Security Council: http://www.un.org/sc/committees/1718/xportimport_list.shtml.

41 Which means that equipment would be relocated inside DPRK and used for non-project activities.

42 Confidential Report on United Nations Development Programme Activities in Democratic Peoples' Republic of Korea 1999-2007, External Independent Investigative Review Panel, May 31, 2008 (commonly know as the "Nemeth Report"). Publicly available at the UNDP-DPRK website: http://web.undp.org/dprk/index.shtml.

43 The World Intellectual Property Organization.

44 Independent External Review, WIPO Technical Assistance Program in Countries Subject to UN Sanctions, Edqvist S. and Barker J.P., September 9, 2012.

4. Findings of the Evaluation

4.1 Project design and scope

SWEDPRA is highly ambitious in its objectives by pursuing technology development, field demonstration and market development under a GEF Medium-Size Project (below US$ 1 million). The proposed activities are not always feasible and do not establish all necessary conditions to deliver mature SWES technology to rural end-users. The barrier analysis is not exhaustive and the underlying assumptions were not all made explicit and validated. According to the Evaluators, the Project describes fairly well what it wants to achieve but not how this could be done, and whether this is feasible or not. In other words, the relation between the development objective, critical development conditions (outcomes) and the products delivered by the project (outputs), is rather weak. During project implementation it became obvious that the proposed outputs were insufficient to achieve the objective. A validation of the assumptions during the redesign (2010) could have helped a course correction.

The scope of the Project was not well delimited due to the combination of technology and market development in one single project. Market development and energy supply to rural end-users fit into the GEF and UNDP objectives, but are a long way to go if adequate technology must first be developed. By result, SWEDPRA targeted national R&D groups to develop wind energy technology, which is a very different type of beneficiary. Combining technology and market development into one project is not a good practice, since it makes the latter subject to the success or failure of the former. Moreover, the complexity of technology development can hardly be underestimated. A lesson-learnt is, that only proven technology be used for providing energy to end-users[45]. Another reason why not to address two different types of beneficiaries is because of the increased number of processes and stakeholders to be managed in one project.

Given the status of the rural workshops, the expected installed SWES capacity (kW) at end-of-project is unrealistically high. This figure is probably determined to satisfy GEF requirements in terms of global GHG reductions (which is the ultimate rationale for GEF involvement). The national counterparts were also very optimistic during the project design phase[46], and there was a trend towards a more market-oriented economy in DPRK during the period 1999-2003[47], which may have induced the proponents of SWEDPRA to commit to such large sales figures. However, the observed lack of manufacturing capabilities, prime materials and available workforce demonstrates that DPRK is still far away from the massive production of SWES systems by rural workshops.

Barrier identification and analysis, critical for successful project design, was not well developed in the early GEF years. This problem has been recognized and methodological tools developed in response, such as the five-pillar framework[48], which identifies the following types of barriers: policy, information, technology, business skills and delivery mechanisms, and finance. Human capacity development and institution building can be viewed as transversal themes. Without pretending to be exhaustive, the application of this methodology to SWEDPRA may assist in understanding its intrinsic design flaws, as shown in the Table below.

The complexity of delivery mechanisms for renewable energy technology was not fully acknowledged in GEF programming in the years when SWEDPRA was designed. A more systematic barrier analysis would have shown that at least two main lines of action were required to reach the end-user: (i) technology development; and (ii) effective delivery mechanisms, including financing, decentralized production, and sustainable operation and maintenance. Based on this understanding, a motivated choice could have been made between a wind technology development project or a rural electrification project based on proven technology. The budget limitations and the chosen counterpart effectively transformed SWEDPRA into a technology development project[49].

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45 This lesson has been included in the GEF-5 programming by defining the Technology Development Cycle and Innovation Chain, specifically paragraph 66. See: GEF-5 Programming Document GEF/R.5/31/CRP.1, May 12, 2010 (p.18-19).

46 As expressed during meeting with NCC-E and SAOS, October 17, 2012.

47 Interview with UNDP-DPRK Resident-Representative, October 19, 2012.

48 See for example: Working Draft GEF Climate Change Strategy, document GEF/R.4/Inf.7 August 23, 2005.

49 In December 2011, international consultants assessed the viability of the project design and suggested UNDP to focus on wind resource and SWES design alone (source: "Consultation on Performance Evaluation of Locally-Made Small Wind Energy Systems UNDP-GEF SWEDPRA", German ProfEC GmbH, Germany, December 7, 2011 (p.12-25).

ANALYSIS OF SWEDPRA COMPONENTS IN RELATION TO GEF BARRIERS		
GEF Barrier	**SWEDPRA component design**	**Comments**
I. Energy policy	#7 energy policy and planning	Energy policy was not explicitly addressed and outside the scope of the Project.
II. Information	#1 wind resource assessment	The lack of information on the wind resources in DPRK is adequately addressed.
	#2 information and awareness	This component contributes to awareness raising but the proposed outputs are more relevant for large-scale wind projects than for SWES.
III. Technology	#4 SWES design improvement	The lack of technology is adequately addressed
	#5 SWES manufacturing improvement	The Project did not include a strategy to enable production by rural workshops and assumed that material resources were available and in place.
IV. Business skills and delivery mechanisms	#6 Demonstration	This component serves the double purpose of product (field) testing (addressing barrier III), and awareness creation (barrier II), which is not a good practice. However, demonstration should be embedded into a full-fledged delivery mechanism. The Project did not strengthen the business skills of local manufacturers as SWES promoters and agents for energy services.
	#7 Energy Planning	This component created some skills for evaluating wind energy projects (but was proposed to address the policy barrier).
V. Finance	not addressed	Financial constraints should be understood to determine product specifications (as input for barrier III) and delivery mechanisms (barrier IV). Ideally the Project should target supportive Government policy and incentives for end-users to purchase SWES. However, it is perhaps unfeasible for a GEF project in DPRK to act at this high level.

Table 2 Analysis of SWEDPRA components in relation to the barriers as defined in the GEF five-pillar conceptual framework.

According to the Evaluators, the choice not to address the policy and finance barriers was appropriate in the political context of DPRK. The relevance of wind map development and micro-siting is questionable for SWES development, but has certainly contributed to a solid knowledge base in the country and to catch up with internationally accepted practices.

4.2 Institutional set-up

In principle, the execution modalities UN Agency and DEX reduce the level of project ownership by the national counterpart(s). Simultaneously, the UNDP management arrangements have a larger influence on the course of a project. As a general appreciation, the Evaluators consider the institutional set-up and the choice of the counterpart (SAOS-SCST) as appropriate. However, the Project lost its grip on market development because of: (i) the lack of a clear proposition in terms of delivery models to reach rural end-users; (ii) the limited project resources and outputs allocated to market development in comparison to technology; (iii) the general underestimation of length and complexity of a technology development process; and (iv) the prolonged absence of strategic supervision due to the suspension period.

SAOS is at the level of a ministry in DPRK. It is not only responsible for R&D but also for the introduction, production and sales of developed technologies and products throughout the country. Activities nowadays extend to business and trade activities, alongside R&D. SAOS has the mandate to define and implement viable marketing strategies for SWES technology, even if this was not achieved under SWEDPRA. It is also recognized that SCST had not sufficiently been involved in the Project after 2009. As part of the project exist strategy, it is recommended to UNDP to discuss the mandate of SAOS and SCST in more detail with the Government (NCC-E) and identify why market development did not

materialize as expected.

During the evaluation mission, the local counterparts were found to be highly committed to the improvement of national SWES designs and the up-scaling of production.

4.3 Management arrangements

Although the time between project start-up and suspension was too short to draw firm conclusions, the Evaluators believe that the UN Agency modality by UNOPS was not the most appropriate one. A GEF "barrier removal" project does not only involve contracting of goods and services (UNOPS' core competence), but also a good understanding of the purpose of contracts, the timing and relevance of procurement in relation with counterpart activities (the "baseline project"), as well as overall strategic guidance. Such guidance might have been provided by the Project Steering Committee but this gathered only once. The UN Agency modality has likely played a role in the following issues:

(1) In 2006 UNOPS supplied a large batch of office equipment to national counterparts (CWERD and NCEDC), which seems not in proportion to the final objective and budget of the Project. The effectiveness of these procured goods was questioned by the Project Manager after resumption, as the budget could have been used in a more appropriate manner. However, it was not within UNOPS' mandate to make this type of judgements[50].

(2) In November and December 2006 two international consultants visited the Project, producing very useful recommendations[51]. In December 2006, CWERD assessed the field performance of a number of foreign and domestic SWES systems in DPRK[52]. The CWERD report reflects the valuable work done in the early stages of SWEDPRA and demonstrates national counterpart's acknowledgement of the limited production capabilities in rural workshops. The report further defines the choices made for the improved SWES model. Remarkably, there is no trace of this work in the reports of the international consultants; local activities and international consultancies appear to be not well integrated. This requires a level of overview that cannot likely be provided by UNOPS[53].

After resumption, in particular once a Project Manager was in place, the activities pursued under SWEDPRA became much better integrated. These experiences suggest that UN Agency execution through UNOPS is less suited for the implementation of a GEF "barrier removal" initiative; UNOPS may execute specific tasks under the guidance of a dedicated project team, however.

4.4 Project implementation and role of UNDP

As a general appreciation, SWEDPRA is being implemented adequately and at a steady pace – ignoring the long suspension period between March 2007 and May 2011, when the inception workshop was held. The disbursement of GEF funds until March 2007 was US$ 265,040 (equivalent to 37% of the budget). The funds were mainly spent on international consultancy (US$ 32,237 including travel), on training (US$ 116,874) and equipment (US$ 99,921). Also US$ 73,546 UNDP TRAC funds were disbursed (49% of the budget), predominantly for office equipment. In 2011, expenditures lag behind the agreed workplan (US$ 74,898 for UNDP and GEF combined, without encumbrance) but take off towards the end of the year. The combined UNDP-GEF expenditures over the period January-November 2012 are

[50] SWEDPRA's Combined Delivery Report 2006 (Project Year 1) states expenses on budget line "Machinery and Equipment (Atlas category 722xx") to an amount of US$ 99,921.35 (GEF funds) plus US$ 70,485.13 (UNDP TRAC funds). Allegedly, the GEF funds were largely used for purchasing equipment and tools for wind resource assessment and UNDP funds for office equipment. Under the current GEF guidelines, procurement to strengthen counterpart office facilities should be listed under Project Management (for which no reservations were made).

[51] See reports: "International Consultant for Wind Resource Assessment", Brendon Bateman, UNOPS 06-18641 (November 2006); and , "International Consultant for SWES Turbine Design Manufacture and Test Methodology", Bin. Y, UNOPS contract 06-18710, December 2006.

[52] Report "On the Performance Assessment of locally made and installed foreign SWES Units in DPRK under the Project titled Small Wind Energy Development and Promotion in Rural Areas", Centre of Wind Energy Research & Development, December 2006.

[53] The Evaluators believe that late 2006 was a critical moment for SWES development by CWERD, when SWEDPRA's technical assistance could have had a very high added value. With the imminent suspension of UNDP in DPRK, there was little opportunity to correct this situation and preserve the integrity of the Project.

US$ 217,027. The remaining project funds are then US$ 241,548, of which US$ 76,537 are committed[54]. This would imply that US$ 165,011 remains available (of which US$ 115,936 GEF resources, 16% of the budget)[55].

Between 2005 and 2007 four field visits were executed, of which three by international consultants. There is also a listing of the hardware and equipment supplied in this period. The mission reports provide valuable information, including an appreciation of energy use by rural households[56]. The contracted consultancies seem highly appropriate and of good value. The quantity of (office) equipment is generous, but without additional information regarding the purpose of these supplies, it is not possible to make further judgements. The equipment has been used to continue work on wind energy development by the national counterparts[57]. The Evaluators have not had access to documentation concerning the training activities and a study tour to Germany carried out in the pre-suspension period.

After resumption, UNDP CO took control of the implementation of SWEDPRA. Between September 2011 and August 2012, no less than 13 field missions were carried out, in some cases with representatives from UNDP's Regional Bureau for Asia and the Pacific (RBAP), and with external consultants. The mission reports demonstrate a strong commitment with SWEDPRA alongside UNDP's SRED programme. While the latter is focused on showcasing different, proven RET's (except wind) to end-users, SWEDPRA should yield information whether technology development is a viable strategy to contribute to UNDP's development objectives in DPRK. The concerns about the course of the Project and the delivery of verifiable impact among end-users are clearly reflected in the mission reports and the 2012 APR/PIR, and were also expressed by UNDP Senior Management during the inception meeting of the Evaluation[58].

The Evaluators value the commitment and ownership of SWEDPRA demonstrated by the UNDP Country Office in DPRK as highly positive. One must recognize that after the suspension period, the international staff was fully renewed. When SWEDPRA was resumed, the team had little information about the Project's background and the course it had taken – away from rural electrification. In 2010, a substantive revision of the Project Document was put through in order to align it with the latest UNDP format and content requirements[59]. However, the underlying assumptions were not scrutinized in order to redefine the Project's strategy and progress indicators according to more realistic objectives. One must also recognize that wind energy technology development requires highly specialized knowledge. According to the Evaluators, the judgements made –first during project design and revision, later during field missions- are by consequence not always fully appropriate. Notwithstanding, within less than a year after project resumption, the Office managed to get a firm grip on SWEDPRA, established constructive working relations with the counterparts, and sought specialist's support for assistance.

Efficiency and cost-effectiveness

A quantitative assessment of the efficiency and cost-effectiveness of SWEDPRA is outside the scope of this Terminal Evaluation. The following qualitative observations are made:

- The Evaluators could retrieve quotations and offers (original documents) presented for the provision of goods and services to UNOPS in the period 2005-2007. There is no information available about the applied qualification criteria but as a general appreciation, the provided services and goods under UNOPS are of good quality at an acceptable cost.
- Before the suspension period, substantial funding has been used to purchase office equipment. These funds may have been applied more effectively in relation to the Project's outcomes. This issue has also been raised by the Project Manager after resumption.

[54] According to the Project Manager, November 2012.
[55] Please refer to Annex F for an overview.
[56] Report "International Consultant for SWES Design / Manufacturing Improvement", Yundong, W., UNOPS contract 06-18150, July 2006.
[57] Letter from the National Project Director (SAOS) (redirected by the NCC-E Coordinator) to the Officer-in-Charge at UNDP-DPRK, May 19, 2011. Reportedly, equipment is being used by CWERD, the Research Institute of Geography, and NCEDC.
[58] Meeting with UNDP DPRK Deputy Resident-Representative, October 8, 2012.
[59] Source: Letter from UNDP Resident Representative a.i. in DPRK to the RBAP Division Chief for North East Asia and Mekong, August 6, 2010.

- In 2012, substantial project resources are used to supply the SAOS manufacturing workshop with more advanced and precise metal and wood machining tools. The provided equipment enables SAOS to manufacture more sophisticated wind turbine prototypes and to get acquainted with different production methods. However, these investments do not contribute to the removal of the barriers for the local production of SWES in DPRK.
- The Project has supported CWERD with professional equipment for wind resource measurements compliant with international standards, which has enabled national experts to acquire hands-on experience. Presently, SWEDPRA's added-value lies primarily in the backstopping and review of the work of the local experts by the retainer consultant, at a relatively low cost[60]. This demonstrates the importance of proper coordination and timing of GEF's "incremental action".
- Since March 2012, an international consultant specialized in wind resource measurements and performance assessment of wind turbines, is retained under a long-term agreement (LTA). The LTA is renewed by 13 September 2012. The duties described in the Terms of Reference[61] refer to technical backstopping for the formulation of future tenders for materials and services. The included list of subjects is outdated however, and the contract sum is not justified in relation to the remaining project funds. It is recommended to request well-defined services under this retainer contract to guarantee the effective use of the available project funds.[62]
- The international situation of DPRK has a negative impact on Project efficiency since procurement and control mechanisms generate more overhead than usual. Since SWEDPRA has no resources allocated for Project Management, these costs are fully borne by UNDP CO. The bilateral sanctions also reduce the response to calls for tender or quotation; while the remaining offerers tend to increase prices. The national counterparts complain that the delivery of goods has become very slow after the resumption of the Project.

As a general appreciation, the Evaluators consider that SWEDPRA has been implemented efficiently, taking into account the country context and the long suspension period. In view of the original objective of the Project (i.e. to deliver energy services to rural families) however, SWEDPRA's strategy has not been effective; by consequence it cannot be cost-effective either.

Coordination among stakeholders

The Evaluators could assess coordination between stakeholders only indirectly. No information is available about the actual involvement of stakeholders during the design and negotiation phase of SWEDPRA (1999-2005), in spite of the long list of stakeholders identified. The long communication lines between international staff and local counterparts make it difficult to understand the internal arrangements and work relations within Government entities. There is no evidence of involvement of the line Ministries as foreseen in the Project Brief. The Evaluators assume that SAOS does not have the mandate to involve energy policy makers to prioritize SWES manufacturing by local factories. Higher-level issues could be dealt with at the Tripartite Review[63]. However, the suspension cut off the opportunities for UNDP to encourage coordination between national stakeholders and keep the Project (albeit unrealistic) focused on rural end-users. Without UNDP, SAOS continued working on wind energy technology within its mandate.

The Evaluators raise the question whether it is possible for an international agency to effectively promote coordination between such a large number of national entities. A project[64] can be seen as a complex process consisting of sub-processes that can be assigned to different stakeholders, which ideally assume full ownership thereof. The Project Brief includes a large number of stakeholders but does not assign specific roles or tasks to them. This omission is rather common in earlier development projects, in which stakeholders were often included as a proof of country commitment. It is good practice however, to identify the stakeholders necessary for achieving project objectives during the design phase and assign

60 Skype interview with retained technical consultant, October 10, 2012.
61 Contract No. INDI-2012-19.
62 Interview with UNDP Procurement Officer, 9 October 2012.
63 In fact, the PSC/TPR meeting on November 16, 2006, urged to involve the Ministry of Coal and Electricity in the Project.
64 Roughly defined as an autonomous set of interventions within a limited time horizon.

specific sub-processes to them. This exercise is also helpful to verify if their designated roles are in line with the institutional mandates.

The Evaluators have the impression that SAOS' activities are not always integrated into the SWEDPRA project. The national counterparts are sometimes hesitant to share information and in other cases, claim activities that are not programmed under the Project (such as continued support to field installations of "old" SWES models). It is suggested to UNDP to discuss this issue with SAOS and NCC-E to better understand each other's positions and to define a common goal and work agenda; such a dialogue may provide valuable lessons for future collaboration. In the experience of the Evaluators, government entities are not always acquainted with project logic and not commonly familiar with the rationale for GEF involvement.

Project documentation and financial reporting

Under guidance of the Project Manager since 2011, SWEDPRA has produced abundant information for UNDP in the form of quarterly and annual reports, PTC and PSC minutes, and back-to-office-reports after field visits (BTORs). The minutes of PTC meetings and field visits sometimes reflect personal impressions and conclusions that are not formally endorsed. When these are attached to the PSC minutes and annual/quarterly reports for informational purposes, this can lead to misinterpretations about their status[65]. Wording is also not always accurate[66]. It is suggested to the Project Team to limit the content of PSC minutes to the agenda and the decisions made (1-2 pages) and not to attach other documents but refer to them instead[67]. It is good practice to separate informal discussions (during PSC and PTC meetings) from formal meeting minutes and to limit BTORs to verifiable observations and judgements. Personal reminders can be recorded in a notebook and used as input for discussion. A systematic approach in the preparation of reports can help boost quality and save time.

Being SWEDPRA a medium-size project, the number of contracts issued is relatively small. The Evaluators reviewed some of the contracts from the period 2005-2007 (UNOPS) and from 2011 onwards. As a general appreciation, the selection criteria and contracting processes after resumption are very well documented and transparent. The Combined Delivery Reports for 2006-2007 do not specify expenditures per project component. Movement of budget across project components is inevitable given the deficient Project structure, but hard to trace and understand. The workplan and budget as included in the 2005 Project Document are summarized in the following Table.

SWEDPRA BUDGET LINES AND WORKPLAN (IN US$, 2005 PRODOC)									
Source of funds	**ATLAS Code**	**Description**	**Year 5**	**Year 4**	**Year 3**	**Year 2**	**Year 1**	**Totals**	
UNDP	72200	Equipment & Furn	0	60,000	40,000	20,000	0	120,000	*80%*
	74500	Misc – Training	0	0	10,000	20,000	0	30,000	*20%*
	Total		**0**	**60,000**	**50,000**	**40,000**	**0**	**150,000**	
			0%	*40%*	*33%*	*27%*	*0%*		
GEF	71200	International Consultant	23,000	95,002	79,159	30,841	7,000	235,002	*32%*
	71600	Travel	7,500	10,437	7,000	5,000	0	29,937	*4%*
	72200	Equipment & Furn	51,200	55,080	31,419	0	0	137,699	*19%*
	74100	Professional services	30,000	0	0	10,000	0	40,000	*6%*
	74500	Miscellaneous	1,300	1,900	1,981	2,778	500	8,459	*1%*
		Misc – Training	78,288	66,600	49,311	18,000	8,000	220,199	*30%*
	75100	Facilities & Admin (8%)	15,303	18,322	13,509	5,329	1,240	53,703	*7%*
	Total		**206,591**	**247,341**	**182,379**	**71,948**	**16,740**	**724,999**	
			28%	*34%*	*25%*	*10%*	*2%*		

Table 3. Distribution of GEF and UNDP TRAC funding over the main budget categories as proposed in the 2005 Project Document.

[65] See for example, the BTOR by the Regional Technical Advisor of May 29, 2012, attached to the 2nd Quarterly Report (1 April- 30 June 2012).

[66] For example the wording "fund misuse" in the 3rd PSC Meeting minutes, February 29, 2012, p.3.

[67] Concise reporting may open up the possibility for an additional check on veracity and consistency by Senior Management, without creating an administrative burden.

Based on the available CDRs for 2006, 2007, 2011; and CDR 2012 (not consolidated), the Evaluators attempted to compare actual expenditures per budget line with the distribution of Project budget over the main categories as specified in the work plan[68]. This exercise (see Annex F) did not provide satisfactory insight in the actual spending, as the Atlas codes in use deviate from the original ones. A complicating factor is the use of budget line 74500 (Miscellaneous) for training activities in the 2005 Project Document. Training costs should have been specified further, which was already observed by UNDP NY during the project preparation phase[69]. The Evaluators have found drafts from 2005 of the Project Document in the SWEDPRA files, in which this was already corrected. It remains unclear why these corrections were not included in the final version signed on August 3, 2005. The "unusual level of miscellaneous costs" in SWEDPRA was also noticed by the auditors supporting the preparation of the "Nemeth Report"[70]. Excluding training, the genuine budget for "Miscellaneous" is approx. 1%, which is very acceptable. The Evaluators suggest UNDP to use the distribution of expenditures per budget category as an instrument to monitor the "character" of a project and to judge the effect of budget movements on the project strategy.

Government co-funding is not recorded in the CDRs. UNDP has insisted in obtaining financial statements from the national counterparts. The Project Document and work plans do not specify the allocation of the committed co-funding resources, but the table at p. 29 of the Project Brief can provide guidance. Detailed agreements concerning the use of co-funding, and tracking thereof, were usually not made before GEF-4.

Monitoring and evaluation

UNDP has a number of instruments at its disposal for project monitoring and steering, as well as for evaluating progress and results, including:

1) Project inception workshop and report;
2) Annual reporting (APR, PIR);
3) Quarterly progress reports;
4) Annual work plans and budgets;
5) Steering Committee meetings;
6) Tripartite review meetings (TPR);
7) UNDP field visits to the project;
8) Mid-term and final evaluations; and
9) Ad-hoc evaluations and expert missions.

As a general appreciation, UNDP CO has made effective use of the available tools for monitoring, especially field visits. The effectiveness of annual work plans and budgets, as a tool for monitoring and planning, was greatly reduced as a result of SWEDPRA's suspension and the time gap between formal resumption (August 2010) and effective re-start (inception workshop in May 2011). APR/PIRs were produced in 2011 and 2012. The Country Office received backstopping from UNDP RBAP in Bangkok, which visited the Project twice. The 2010 Project Document foresees the execution of a mid-term evaluation but in agreement with RBAP it was decided to skip this[71]. In Autumn 2011, a Monitoring Plan was agreed upon with the national counterparts. In the interpretation of the Evaluators, the purpose of this plan was primarily verification of the status of project sites and results of SWEDPRA.

[68] Including International Consultancy (71200), International Travel (71600), Equipment & Furniture (72200), Professional services (74100), Miscellaneous (74500), and Facilities & Administration (75100, which covers 8% fee for UNOPS services).

[69] Email correspondence concerning "SWEDPRA request for financial clearance PIMS 751", April 11, 2005, 4:09, asking for a breakdown into "for example: travel, equipment rental, publications, printings, stationary, etc".

[70] "Nemeth Report", p.162 and 164. This report gives suggestions for Atlas codes to be used for training. According to UNDP staff, the costs for training in the 2006 CDR are booked as sundries (US$ 91,804.05), while US 24,754.07 is booked as learning costs.

[71] The Project Manager duly highlighted this issue in a letter to UNDP Senior Management (26 February 2011).

4.5 Project results

For the purpose of a qualitative assessment[72] of the Project's achievements, the Evaluators have grouped the components of SWEDPRA into three categories of "Results", as follows:

I. Wind Resource Assessment (Component 1: "Wind Energy Resource Assessment");
II. Small Wind Technology Development (Component 4: "SWES Design Improvement", Component 5: "SWES Manufacturing Improvement", and Component 6: "SWES Technology Demonstration"); and
III. Market Development (Component 2: "WE Technology Information and Awareness Enhancement"; Component 3: "Development of Domestic and Overseas Market for Locally-made SWES"; and Component 7: "Energy Planning and Policy Formulation").

Evidence of project outputs and results exists in the form of consultancy reports produced under SWEDPRA, descriptions of training events, and mission reports describing visual inspections carried out by the Project Team. The Evaluators have directly reviewed the content of a number of reports financed under SWEDPRA; visited (a) the CWERD manufacturing workshop at SAOS; (b) the CWERD test field for small wind energy systems at SAOS; (c) a hybrid wind/PV system at the Scientists hospital (Unjong County); (d) the Sukchon Daily Necessities workshop; (e) "old model" SWES installations at Hanchon Ward. The Evaluators further assisted in the installation of a "new model" 300 W SWES system at the UNDP premises in Pyongyang.

Result I: Wind Resource Assessment

SWEDPRA has enabled a group of CWERD staff to participate in international training courses[73]. In turn, CWERD staff have transferred their knowledge to other nationals[74]. Data analysis methods were explained during the in-country courses, which suggest that national participants have a generally strong background in mathematics. More practical tools and software[75] were also demonstrated. In the period 2005-2007, one study tour was held (to Germany) and at least one in-country training on wind resource assessment was conducted. CWERD experts carried out wind resource assessments in Cholsan County, Unryul County, and Yangdok County (2009)[76] and Ryong-o-ri (2012)[77]. CWERD is presently initiating wind measurements at the SWES test site near the institute, which was visited by the Evaluators.

The international wind energy experts contracted under SWEDPRA in November 2011, stressed the importance to work according to international standards (MEASNET). The experts state that the wind tower installation, measurements and data analysis by CWERD conforms to international standards[78]. The team would benefit from additional field practice and from backstopping with regard to reporting. Reportedly, CWERD is providing support to the Government of DPRK for developing large-scale wind farms. The Evaluators have not had access to studies that can confirm this statement. A detailed assessment of the wind measurements and data analysis is outside the scope of this Evaluation.

The Evaluators are convinced that SWEDPRA has made an important contribution to create hands-on capacity in DPRK (through CWERD) for performing good-quality wind energy resource assessments. At least 4 wind assessments have been carried out and CWERD is attaining international standards. In parallel, the Institute of Earth Environmental Sciences has produced a meso-scale wind map (10 m height values) for DPRK, based on existing meteorological and satellite data. The realized outputs and

[72] Please refer to section 4.6 for the evaluation of the Project's results based on the defined indicators.
[73] Training course from October 17-30, 2011 at Longyuan Bailu Wind Power Vocational Training Centre, Suzhou City, China.
[74] In-country Training Courses "Wind Resource Assessment" (under SWEDPRA), 9-13 and 16-20 August 2011. In-country Training Course of CDC-based wind mapping under SWEDPRA, 20 – 23August, 2012. Training on wind resource analysis was further given 21 November – 2 December 2012 by ProfEC consultants, Germany (contract RLA-2011-02).
[75] Including industry-standard commercial software such as WindPro, WaSP, WindSim (Denmark), which requires a software licence.
[76] In Cholsan, measurements carried out at 10, 30, 50 and 70 m from 2 June 2008 – 31 May 2009; in Yangdok, at 10, 20, and 30 m (in 2006-2007, to complement existing weather station data); in Unryul, at 60 m, from 1 September 2008 – 31 August 2009. Please note that these assessments were conducted during the suspension of SWEDPRA, using DPRK resources.
[77] In Ryong-o-ri, at 10, 30, and 40 m, from July 2011 to June 2012; SWEDPRA contract INST-2011-5 "Wind energy resource assessment in Ryong-o ri, Mundok County, South Pyongan Province (2011 to July 2012)".
[78] Skype interview with retained consultant, 10 October 2012.

capacities constitute a good starting point for the future deployment of wind energy in the country, which is a valuable achievement.

The Evaluators believe that the added-value of SWEDPRA resources primarily lies in the supply of industry-standard measuring equipment (sensors, data loggers) and technical backstopping for their use. The main barrier for executing accurate wind resource assessments is access to reliable, high-resolution hardware; national staff has ample theoretical skills, but was not able to translate this into practical measurement methodologies. SWEDPRA has contributed to taking this hurdle. However, CWERD has little financial resources for procuring additional measurement systems and spare parts. Important supporting facilities, such as a wind tunnel for sensor calibration, are not available in the country.

In-country capacity to assess wind resources is the basis for any wind energy technology development in the country. SWEDPRA has contributed to strengthening this capacity. However, its applicability is primarily for large-scale wind farm development; for site selection and performance prediction of small wind energy systems, it is less relevant.

Result II: Small Wind Technology Development

This result is critical for SWEDPRA in order to produce impact in terms of GHG benefits, electric energy production, and improved living conditions for rural households. SWEDPRA's strategy was to supply workshops with a range of improved, tested SWES designs that can be reproduced with the manufacturing equipment locally available. After an assessment of the performance of several foreign and domestic SWES models, it was decided to start with a new 300 W model[79]. Soon after, SWEDPRA was suspended and in the following years, the CWERD staff started the development of the new model based on the publicly available designs for a home-built wind generator by Hugh Piggott (based in the UK)[80]. In the course of 2011, UNDP caught up with the CWERD team to provide support for the design process. Yet, the link between CWERD's work on the new model and the units produced by local manufacturers, remains unclear.

a) Field installations of SWES

After the visit by the Regional Technical Specialist, UNDP CO prepared a very solid and detailed questionnaire as a basis for the systematic appraisal of installed SWES units in the field[81]. The Project Manager, accompanied by UNDP staff and Senior Management, visited local factories and installed SWES units on 20-21 June, 25-30 June, and 2 July 2012. A summary of the findings of these visits is included in Annex D for reference. According to the local manufacturers, a total of 805 SWES units have been produced since 2006.

The Evaluators have seen two SWES installations in the field, at Hanchon Ward. The field visit on 15 October 2012 gives rise to concern about the design, manufacturing quality, and energy production of the "old model" wind generators, as illustrated by the photograph below. The base model with flat-plate blades (with the spokes soldered at the wrong side of the blade), is "improved" by adding wooden blades, roughly put into shape. The rotor diameter is already small given the prevailing low wind speeds. Will this device at any moment generate enough electrical power to charge a battery? Inquiries whether the generator coiling was adapted to adjust the output voltage to the lower tip speed ratio (due to the increased blade number) remained unanswered. The blades, the yawing mechanism[82] and cabling do not produce confidence that this device can operate autonomously over a longer period. It is also doubtful whether this generator type can reach a sufficiently high voltage at low wind speeds, using normal (not rare earth) permanent magnets[83].

[79] As documented in the report "On the Performance Assessment of locally made and installed foreign SWES Units in DPRK under SWEDPRA", CWERD, December 2006.

[80] See: http://www.scoraigwind.com/.

[81] Attached to 2nd Quarterly Report 1 April – 30 June 2012, p. 21-24.

[82] This is the mechanism to align the wind generator with the (varying) wind direction.

[83] By itself, this generator design can be very cost-effective, as it uses standard electric motors in which the rotor is replaced by a new one, equipped with permanent magnets. Even second-hand, worn-out motors can be used. However, the stator coils must be rewired or rewound using thinner copper wire (for low speeds). The small diameter is a disadvantage (therefore, the

According to the Evaluators, the Project (or the local manufacturers) should provide the evidence to demonstrate that these wind generators are a reliable source of energy for the end-users and can produce useful amounts of electricity when needed. The Project team did not provide such evidence during the evaluation mission. The information provided to UNDP during the June 2012 field visits is too general to make quantitative judgements about the actual energy production of the installed SWES systems. To the opinion of the Evaluators, reliable information about the energy output of small wind turbines can only be collected by systematic measurement of technical parameters over a sufficiently long time period. Under field circumstances, small wind turbines tend to produce much less power than expected based on wind tunnel data[84]. Wind speeds vary according to season. During which months was adequate power available, and when not? Power cut-offs are frequent, but batteries may well be recharged while grid power is available. It is unlikely that refrigerators, as present during the visit to a household at Hanchon Ward, can actually be powered by these small wind systems[85]. Visual inspection of the visited SWES systems does not give any confidence about the energy performance and structural integrity of the "old model" designs. Within the context of a technology development project like SWEDPRA, one would expect CWERD staff to perform detailed measurements of technical parameters such as load currents, battery status and energy consumption patterns, analyze system performance and present the results to the Evaluators.

Figure 1. "Old model" small wind turbine installed to provide electric power to the community building at Hanchon Ward.

Figure 2. Audiovisual appliances (2 televisions, one VCR, voltage inverter operated on a 12V/4Ah motorcycle battery. In front: hand-operated generator to provide electric power if no wind is available[86].

"improved model" uses a disc generator), but this can be compensated for by using high-flux permanent magnets (made from rare earth material, such as neodymium).

84 This has been shown by recent tests in UK and the Netherlands. See, for example: http://www.warwickwindtrials.org.uk.

85 As a rough estimate, a wind generator of this size may produce about 200-300 Watt-hour per day. A 12V/45Ah battery has a theoretical energy content of 540 Watt-hour and can only be recharged on a very windy day. A moderately efficient, modern refrigerator has a daily energy consumption of 350-600 Watt-hour.

86 It is doubtful whether this generator can be effective, since untrained humans have difficulties to operate manual devices for

b) Improved SWES development

The new model 300 W wind generator is equipped with an axial-flux permanent-magnet disc generator and has a three-bladed rotor with a diameter of approx. 1.8 m. In the course of 2011, SWEDPRA reviewed the status of CWERD's work on this model. An assessment was made of the status of the prototype, the manufacturing capabilities at the CWERD workshop, and the inputs needed to attain international quality standards[87]. Recommendations were given for follow-up, and a list was compiled of needed workshop tools and equipment for precision machining[88]. Between May and August 2012, this equipment was procured under SWEDPRA[89]. Most equipment could be procured from a DPRK trading house at a competitive price including in-company training for the CWERD workshop staff. When the Evaluators visited the workshop, the equipment was found installed and in use.

In July 2012, a measuring system, including wind sensors, electric power meters, and a data logger was purchased in Germany for equipping the wind turbine performance test field near the SAOS institute in accordance to international standards[90]. The Evaluators found this equipment installed in the 10-m high, fully equipped wind measurement tower with the data logger provisionally placed inside the service building (an old water pumping station). Close to the wind measurement tower, a prototype SWES system was installed on top of a second tower.

The Evaluators could appreciate the following steps in the manufacturing process of the "new" SWES model in the CWERD workshop: blade production, blade balancing, generator assembly, and generator performance testing. Since the wood copier had recently arrived, blade production was still done manually. As a general appreciation, the wind turbine production is labour intensive. Safety and health conditions could be improved, an issue also raised by the retained consultant. The generator was tested by measuring the voltage at different loads (current), while it was driven by an electric motor equipped with a torque meter (generator test bench). In the workshop, the Evaluators asked for the output-load characteristics of the disc generator, but these could not be provided.

a longer time if the demanded mechanical power exceeds 50 watts. It might work if operated with the legs, like a bicycle.

87 "Consultation on Performance Evaluation of locally made Small Wind Energy Systems", contract number RLA-2011-1, ProfEC Consultants, Germany (7 December 2011).

88 Including a CNC (microprocessor) controlled lathe, a crank press, a CNC drill, a radial drilling machine, a wood copier, an oscillograph, and an air-plasma metal cutting machine.

89 Purchase orders PRK10-0000001206/1207, 24 May 2012. Only the wood carver was procured from China (purchase order PRK10-0000001248, 16 August 2012.

90 Purchase order PRK10-0000001231, 6 July 2012.

Figure 3. The new 300 W turbine at the CWERD test field with the MEASNET-conform wind mast.

Figure 4. Top section of the new model 300-W SWES with the axial-flux permanent-magnet disc generator before installation at the UNDP premises.

On Thursday 18 October 2012, the CWERD team erected a complete "new" 300-W SWES unit, equipped with a car battery and charge controller, on top of a 12-m tower in front of the UNDP premises in Pyongyang for exhibition devoted to UN Day celebration (25 October 2012). The finalized wind turbine looked well-finished and attractive; its reliability and performance can only be demonstrated through long-term testing however. The tower was installed on a concrete socket with the help of a large mobile crane. In rural areas, the tower is tilted in place with a winch. The Evaluators wonder why a fixed tower is used. A hinged tower may facilitate installation and inspection, and enable the system to be lowered in case of a typhoon. The CWERD team appeared well integrated and acquainted with the assembly of the wind generator and the tower; for deployment in the rural area such a large team is not cost-effective however. Safety during the installation could be better, especially the placement of the wedges to put the tower vertically exposes the hands to severe risks. In the absence of wind that day, the Evaluators could not see the system actually producing power.

The described achievements demonstrate that CWERD is able to reproduce and install a modern 300-W wind generator using materials available in DPRK. The charge controller is a national design; only the car battery is of Chinese origin. The workshop staff looks confident about their skills and is now manufacturing the SWES in a batch production process. With the new equipment in place, machining tolerances can further be improved. The Project Team is also aware of the need to adjust design parameters (basically the blade angle and the rotor diameter) to the local wind conditions in order to improve the energy output. The test field can play an important role in this process; but optimization can also be achieved by monitoring SWES units in the field. The Evaluators coincide with the valorisation made by the retained consultant that CWERD is "approaching international standards"[91]. However, without successful long-term field tests (1-2 years) the produced SWES model cannot be considered a

[91] Skype interview retained consultant, 10 October 2012.

mature product ready for commercial distribution. The Evaluators have not seen a systematic approach to product development that departs from an identified demand and user profile. Would SWEDPRA not have been suspended for several years, more progress might have been made in this respect.

c) Local manufacturing of SWES

As part of the field visits by the Project Manager and UNDP staff in June-July 2012, five manufacturing workshops were visited[92]:

- Sukchon Daily Necessities Factory, Sukchon County, South Pyongan Province;
- Hoeryong Ironware Factory, Hoeryong City, North Hamgyong Province;
- Kim Chaek Small Wind Turbine Factory, Kim Chaek City, North Hamgyong Province;
- Pyongsong Plant of Automation Devices, Pyongsong City, South Pyongan Province;
- Daean District, Nampo City[93].

The following table provides an overview of the production volume of SWES units claimed by the local workshop during the field visits[94]:

REPORTED PRODUCTION VOLUMES OF SWES BY SAOS WORKSHOP AND 5 LOCAL MANUFACTURERS[95]							
	CWERD/SAOS Workshop	Sukchon Daily Necessities Factory	Hoeryong Ironware Factory	Kim Chaek Small Wind Turbine Factory	Pyongsong Plant of Automation Devices	Daean District of Nampo City Factory	Total production 2006-2012
Start of SWES manufacturing	2006	2008	2012	2007	2009	n/a	
Total produced SWES units	200	300	45	110	150	n/a	805
Availability of documentation	n/a[96]	n/a	n/a	n/a	n/a	n/a	
Direct staff	20	15	26	80	25	n/a	166
Indirect staff	n/a	5	3	5	n/a	n/a	13
Staff who received training	20	n/a	26	90	20	n/a	156

Table 4. Reported production volumes of small wind energy systems by the SAOS/CWERD workshop and five local factories.

The Evaluators only visited one factory, the Sukchon Daily Necessities Factory not far from Pyongyang. This workshop consists of one large metal working room and a smaller place for wood working (carpentry). The workshop has 3 lathes, 2 of which had not been in use for a long time. During the visit, all workers were gone, reportedly to assist in repairing the damages caused by the recent flooding in DPRK. Drawings of an "old model" wind generator were present, and one such system was installed outside for demonstration purposes, but it was not turning. A large ventilator exists in front of the building, reportedly for blade testing. The Evaluators do not believe that any useful data about the aerodynamics and the performance of a wind turbine can be obtained with this device. As can be seen in Table 4, the Sukchon Factory has reportedly produced 300 wind generators since 2008.

The description of the other factories does not allow drawing any conclusions concerning the production output of SWES units in relation to available workshop equipment. The Kim Chaek Factory is reportedly equipped with 50 lathes and drills, but only produced 110 SWES units. The Pyongsong plant would have 25 staff dedicated to SWES production, which translates into production levels of less than one SWES system per worker per year. In the opinion of the Evaluators, CWERD must urgently define the required

[92] See 2nd Quarterly Report 1 April – 30 June 2012, p. 4. The Project Managers expresses his surprise when he is informed about the existence of these workshops. This demonstrates that the integration of SWEDPRA with the SAOS' base activities could be better.

[93] An attempt was made to visit this factory on 2 July 2012, but the place could not be reached due to bad road conditions.

[94] Ibidem, p. 6-7.

[95] Information in the table as provided by managers of the factories.

[96] SAOS has promised to provide scanned information on the geographical distribution of turbines.

inputs for SWES production, in terms of basic tools, advanced equipment, working tolerances, workers' skills, input materials, and the productivity per machine and per worker. These requirements should be discussed with the local manufacturers to identify where additional investment is needed. Without a rational approach to the use of workshop equipment and staff, it is not possible to determine realistic output capacities and production costs per produced SWES, and to identify potential measures to enhance production capacities and reduce the final product costs.

In the absence of a rational production approach one cannot determine whether the upgraded CWERD workshop should be taken as a "model" for replication; but most likely it is not. In fact, the Evaluators believe that local workshops can produce the new SWES model in considerable volumes using simpler tools, if certain design details are optimized and critical tolerances avoided as much as possible. Such an optimization process is a normal step in product engineering, with the objective to eliminate unnecessary parts and details, to reduce costs and shorten production time. At an annual production level of 100 units during 10 years, the investment of US$ 100,000 in advanced workshop equipment (as in the CWERD workshop) would raise the cost per SWES unit with US$ 100,- (excluding capital costs), which is substantial.

In itself, the upgrading of the CWERD workshop as done under SWEDPRA has been an important step forward as it provides flexibility to try different production methods and enables the production of prototype components that actually meet the defined tolerances. In view of the Evaluators, this support fundamentally serves the purpose of SWES prototype development, but it is not directly supportive to prepare the production of SWES systems at a larger scale. It must also be noted that CWERD does not have the financial means for repair or replacement in case of a machine breakdown (which cannot be discarded given the deficient supply of electric power). Under a rational approach, product sales should generate the necessary revenues for repair and replacement when a machine reaches the end of its economic life. Without such revenues, the production of SWES cannot be considered as sustainable in the long term. Altogether, the Evaluators consider that one of the main outcomes pursued under SWEDPRA, to enable the local production of reliable and functional SWES systems in DPRK, has not yet been achieved.

Result III Market Development

According to the APR/PIR 2006, a National Renewable Energy Information Centre (NREIC) started activities on 2 October 2005. Several publications on wind energy were issued and some promotional events prepared or executed, including a "First Exhibition of Local SWES in Pyongyang"[97]. The Evaluators have not had access to direct evidence supporting these statements. The representative of SCST has verbally confirmed the existence of the NREIC within NCEDC. NCEDC is also mentioned as one of the recipients of office equipment in 2006.

After resumption, SWEDPRA did not deliver new outputs to support market development. In December 2011, the contracted German consultants recommended to focus on the technology components alone. In May 2012, the Regional Technical Specialist highlighted the need to reintegrate NREIC into the Project, to verify the actual use of NREIC's wind energy data base, to define an action plan for promotion, and to obtain objective data with respect to field performance and impact of installed SWES. The mission report[98] also makes clear however, that better integration of national stakeholders requires a level of coordination that is out of control of SWEDPRA. No progress has been made since then.

Based on the interviews carried out, the Evaluators conclude that the concept of market introduction (as pursued by the GEF[99]) is not closely adhered to by the national counterparts. Produced SWES units are sold to families who can afford them, but there is not something like a product philosophy (design and production in function of a defined customer profile), geographical clustering to optimize marketing, O&M and after-sales services. The monitoring visits by UNDP do not show a commitment of local manufacturers to obtain user feedback and improve product quality and performance; manuals or procedures for quality assurance were not found. The Evaluators believe that the causes behind this

[97] Minutes of Tripartite Review (TPR) Meeting, 16 November 2006, Annex III (APR/PIR 2006), p.13-21.

[98] Back to Office Report, Regional Technical Specialist UNDP, Regional Bureau Asia Pacific, 29 May 2012.

[99] Which is based on establishing efficient delivery channels for products that are made attractive and affordable for end- users, including continuous support and after-sales services.

attitude are systemic; the modest outputs proposed under SWEDPRA are insufficient to address them.

The Evaluators conclude that SWEDPRA has generated some minor outputs to promote market development during the period 2005-2007, but that the anticipated outcomes did not materialize. The Project did not define a viable marketing strategy, negotiated and agreed upon with appropriate market actors; the resources available to this purpose were also highly insufficient. The objective to sell national SWES designs on foreign markets was not realistic; no progress was made in this respect.

4.6 Rating of the result indicators

The Evaluators have assessed the accomplishment of the defined indicators with respect to the targets set forth at the start of the Project in 2005. The results are shown in the following Table.

SWEDPRA - SIMPLIFIED LOGICAL FRAMEWORK (BASED ON PRODOC 2010)					
Component		**Indicator**	**Target**	**Achieved**	**Comments**
1	**Wind Energy Resource Assessment**				
		No. of wind energy resource assessments conducted in the country.	5	5	completed
		No. of wind maps produced.	5	5	completed
2	**WE Technology Information and Awareness Enhancement**				
		No. of successfully conducted information dissemination and awareness raising activities for WE system users, developers and manufacturers in the country.	5	5	activities mentioned in APR/TPR 2006; no activities after resumption
		No. of WE systems users, developers and manufacturers in the country that are planning to implement WE projects.	100	n/a	no information available
3	**Development of Domestic and Overseas Market for Locally-made SWES**				
		No. of local SWES manufacturers in the country.	6	5	During 2012, SAOS informed UNDP of existence of 5 local manufacturers
		Average annual local volume of sales of SWES units (US$)	150,000	n/a	there is no SWES model with a defined price ready for commercialization
4	**SWES Design Improvement**				
		No. of local SWES designs that meet international design and performance standards.	3	1	300 W model advanced but not finalized
		No. of local SWES manufacturers that are qualified to produce internationally-accepted SWES designs.	2	0	CWERD workshop may qualify in near future
5	**SWES Manufacturing Improvement**				
		No. of locally-made SWES units that meet internationally-accepted manufacturing standards.	1,000	0	manufacturing standards not yet attained
		No. of local manufacturers that are qualified and capable to produce export quality SWES units.	6	1	CWERD workshop may qualify in future; no progress could be observed in the other 5 workshops (4 visited)
6	**SWES Technology Demonstration**				
		No. of installed optimally designed and manufactured SWES demo units that are successfully in operation.	6	2	300-W model installed at UNPD and CWERD test field; performance and reliability tests still required
		Cumulative collective electricity generation from installed SWES demo units (kWh).	34,000	n/a	The technical availability and energy performance per unit could not be determined within an acceptable uncertainty margin. The total number of installed units could not be verified.
7	**Energy Planning and Policy Formulation**				
		No. of NRE projects developed and designed by NCEDC.	3	0	There is no evidence of SWES projects pursued by NCEDC that has been communicated to the SWEDPRA team.
		No. of energy planning activities carried out by NCEDC	5	0	There is no evidence of

SWEDPRA - SIMPLIFIED LOGICAL FRAMEWORK (BASED ON PRODOC 2010)					
Component		**Indicator**	**Target**	**Achieved**	**Comments**
		each year.			energy planning (related to SWES) by NCEDC that has been communicated to the SWEDPRA team.

Table 5 Rating of the Project's results based on the indicators in the logical framework.

Table 5 demonstrates that Component 1 has been concluded satisfactorily; positive results are also achieved under Component 2 (although there is little information available to verify actual impact). The Components 3 and 7 were not actively pursued by SWEDPRA after resumption. The Evaluators consider the following indicators as less appropriate given the actual status of the Project:

- "Average annual local volume of sales of SWES units (US$)." This indicator is only applicable if (a) SWES systems are being produced and commercialized; (b) systems are technically proven; and (c) realistic cost and sales price can be defined. This is presently not the case.
- "Number of local SWES manufacturers that are qualified to produce internationally-accepted SWES designs." Using UNDP and GEF resources, SWEDPRA upgraded the CWERD workshop at SAOS, which still does not attain international standards. Given the Project's limited budget, it was not feasible to prepare another factory for qualification. This indicator is not a measure for gauging design improvement.
- "Number of locally-made SWES units that meet internationally-accepted manufacturing standards." This indicator is only applicable if qualifying SWES models exist and are being produced. The CWERD "modern" 300-W model does not yet meet international quality standards; production has started in small batches.
- "Cumulative collective electricity generation from installed SWES demo units (kWh)". In the absence of verifiable performance data, this indicator cannot be determined. There is no baseline information available.[100]

Significant results have been obtained under Component 4 (but this is not reflected by the indicators). The achievements under the Components 5 and 6 fall behind the expectations. This is primarily a consequence of the fact that the optimized SWES model is not ready yet. Progress under Component 6 is still within reach, if CWERD manages to finalize the optimization of the new model 300 W SWES and demonstrate it for testing and verification purposes. The consecutive development of two larger SWES models as proposed in the Project document (3 kW and 5 kW) should only be pursued once the performance and production quality of the 300 W model are fully under control; which may take a few more years. According to the Evaluators, no relevant progress has been made to transfer SWES technology to the manufacturers other than CWERD.

4.7 Project impact and benefits

The impacts expected from SWEDPRA were:

- reduced GHG emission (100 kton CO2eq);
- annual growth in installed SWES in the rural areas (30%); and
- cumulative installed SWES capacity in the rural areas (700 kW)[101].

[100] Such a baseline could be established by submitting the "old model" and "new model" SWES to a systematic test protocol (at the CWERD test field) and determine their reliability and performance. These data, obtained under controlled conditions, can then be compared with the energy performance (load current) of some units installed at rural households. Applying some assumptions with respect to local wind speeds, differences in quality, and maintenance status of installed units, one can estimate the energy production of the total population (installed SWES units) with some level of confidence. Based on the visual inspection of the "old model" systems during the site visits, the Evaluators expect the technical availability of the total population to be very low.

[101] As a baseline level for installed SWES capacity, the Project Document provides a value of 70 kW. The origin of this

The Evaluation has not yielded information to assess the "annual growth rate" of SWES installations, if any. A total of 805 "old model" SWES units has reportedly been installed over the period 2007-2012. Assuming a rated generator capacity of 300W (0.3 kW), the cumulative capacity would be 240 kW, which is approx. 35% of the target value. It must be stressed that installation of the "improved" model has just started and the manufacturing capabilities for its production are uncertain[102]. The Evaluator's interpretation of the Project Brief is that only improved SWES designs should be considered as Project impact, but one can argue about this. The Evaluators also did not find evidence that technology developed under SWEDPRA was actually transferred to the local manufacturers to improve the product quality of "old model" systems, raise production volumes, or strengthen local production capabilities.

No verifiable quantitative information has been provided to assess the actual energy production by the installed 300-W SWES units (both old and improved models). An educated guess is of the order of 200-300 Wh/day, equivalent to around 100 kWh/year[103]. The installed 805 units would produce approx. 80,000 kWh/yr. Assuming an indicative emission intensity of 1.0 kg CO_2eq/kWh generated by fossil generation[104], the avoided emissions would be around 80 tonnes CO_2 per year, or 800 tonnes CO_2 over a 10-year period[105]. Although SWEDPRA falls short on the delivery of verifiable emission reductions by SWES systems, it must be noted that the target value for GHG emission reductions (100 kt CO_2) is not based on realistic energy production figures[106]. This was also observed by the Project Manager and the Project Team[107].

An unexpected, positive contribution to national GHG reductions, is the support by CWERD experts to large-scale wind energy developments. The indirectly achieved GHG benefits that can be ascribed to SWEDPRA as a result of large-scale wind development in DPRK are of the order of 82 kton CO_2 per year[108]. This impact, albeit non-intentionally, translates into a significant contribution to the GEF-CC objectives.

During the field visits in June-July 2012 some positive effects due to the availability of electricity were observed, but there is no certainty whether this electricity is actually delivered by the installed "old model" SWES units. Quantitative data are needed to assess the impact of SWEDPRA on rural households, which are the ultimate beneficiaries of the Project. In the absence of a plan for decentralized manufacturing and promotion, scaling-up will take off very slowly (if any). The Project's resources for policy and market development were also insufficient to generate significant impact in terms of energy access by end-users in the rural areas.

4.8 Overall rating of Project achievements

In Table 6, the Evaluators have rated the SWEDPRA Project on key criteria in correspondence to the

assumption is not unknown.

[102] Which means that only CWERD has proven, but limited production capacity, while no production strategy (including investment in machinery) is in place to extend production to the other manufacturers.

[103] The effective energy output (E) of small wind energy systems translates into an overall efficiency (F) (from wind to useful energy) of 3-5% of the nomimal power output (P). E is calculated as: E (kW) = P(W) * 8760 hours * F / 1000. In the present case, P=300W.

[104] The Evaluators have not been able to find a reliable figure for the GHG-intensity of the national power sector in DPRK. Given the very low efficiencies of the operating thermal power plants (< 25%), a value of 1.0 kg CO_2e/kWh is used.

[105] According to GEF guidelines for emission calculations, GHG benefits as a result of "market transformation" can be claimed up to a period of 10 years after project termination.

[106] Interpreting the 100 kton target as achievable over a 10-year period, this would be 10,000 tonne CO_2e per year; equivalent to the displacement of 10,000 MWh of fossil-based electricity production (at 1.0 kg CO_2e/kWh). At an average energy production of 100 kWh/y, this would require a total of (10,000 MWh /0.1 MWh) = 100,000 SWES units installed in the field, equivalent to a total installed capacity of 30 MW. The project proponents assumed an installed SWES capacity of around 1.2 MW to generate the expected 100kt CO_2 reductions.

[107] See minutes 3rd PSC Meeting, 29 February, 2012.

[108] Applying a top-down approach, it is assumed that average installed capacity over the 10-year period is 137.5 MW (this volume is expected to be technically viable given DPRK's wind conditions and within the country's (limited) financing capabilities). Assuming a capacity factor of 34%, the produced electricity is about 410,000 MWh of electricity per year, or 4,100,000 MWh over a 10-year period. The avoided emissions are of the order of 410 kt CO_2/y. Assuming a minor impact of the GEF project on this achievement ("20% GEF causality factor"), the indirect emission reductions that could be claimed would be of the order of 82 kt CO_2e per year, or 820 kt CO_2e over a 10-year period.

UNDP/GEF guidelines.

RATING OF PROJECT ACHIEVEMENTS AND IMPACTS[109]			
Description		**Rating**	**Comments**
1. Monitoring and Evaluation		**S**	
	M&E design at entry	MS	Initial monitoring plan (logframe) highly activity-oriented; not well suited to monitor Project's overall strategy.
	M&E plan implementation	S	During execution, M&E plans were adjusted and results closely monitored. A substantive revision would have been appropriate upon resumption, but was not pursued.
	Overall quality of M&E	S	PM and UNDP highly committed to track and verify project outputs and possible impacts.
2. IA & EA Execution		**S**	
	Quality of UNDP implementation	HS	Highly committed and responsible project team. Outputs efficiently delivered.
	Quality of Execution – Executing Agency	S	Responsive; in a learning process to understand and execute donor-funded programmes.
	Overall quality of implementation / Execution	S	Responsible and accurate. Implementation of SWEDPRA affected by UNDP's suspension in 2007.
3. Assessment of Outcomes		**MS**	
Relevance		**R**[110]	The envisaged outcomes are relevant for wind energy and energy access by rural end-users. However, it is generally not recommended to pursue this through a technology development initiative.
	Stakeholder participation	S	National stakeholders responsive; suspension period negatively affected communication.
	Design	U	Project strategy and targets were overambitious; assumptions not always validated; sequential project design (from product development to successful market deployment) risky and not realistic given the time and budget constraints.
	Replicability	MS	Some elements of the Project can be replicated (capacity building, policy and market development). Prototype development is not well suited for replication; technology transfer to local manufacturers should be pursued instead.
Effectiveness		**MU**	
	Accomplishment of performance indicators and targets	MS	Of three main results (I: Wind Resource Assessment; II: SWES Development; III: Market Development), I has been attained and II is advancing. Acknowledging the flaws in project design and the modest budget, this result is moderately satisfactory.
	Risk mitigation	U	The underlying assumptions were not validated, resulting in a high risk profile for this project. Market development was not addressed.
Efficiency		**S**	
	M&E system	HS	PSC in period 2005-2007 appeared highly involved; after resumption, very close monitoring by UNDP CO and Project Team.
	co-financing	S	DPRK has committed US$ 545,000 at GEF approval. This budget has not been formally tracked. However, this value appears justified by the wind resource assessments, training activities and management support by SAOS, NCC-E and SCST in the period 2005-2012.
	institutional arrangements	MS	Arrangements were not effective to reach rural end-users. SAOS proved an effective and committed partner for technology development. It also has the mandate to trigger SWES production by rural workshops but this did not happen. It is recommended to UNDP and the project partners to identify the reasons why.
4. Sustainability (Overall likelihood of sustainability)		**MU**[111]	Acquiring new technological concepts and skills in itself is sustainable. The sustainability of SWES production by CWERD is not guaranteed

[109] According to the scale HS/S/MS/MU/U/HU as described in footnote 5.
[110] R: Relevant.
[111] Sustainability rated according to the scale: L: Likely; ML: Moderately Likely; MU: Moderately Unlikely; U: Unlikely. N/A: Not Applicable; U/A: Unable to Assess.

RATING OF PROJECT ACHIEVEMENTS AND IMPACTS[109]			
Description		**Rating**	**Comments**
			due to financial constraints.
	Financial resources	MU	CWERD depends on external inputs to continue wind resource assessments. The sustainable use of CWERD workshop machinery is not guaranteed. The Government would need to allocate resources. The international sanctions have an adverse impact on access to foreign hardware and technology.
	Socio-political	U	Household electricity supply is subordinated to productive uses and not considered as a national priority. National priorities also tend to withdraw resources (staff, equipment, raw materials) from rural workshops, thereby effectively interrupting local production processes. The underlying decision-making processes are out of control of the Project's direct counterparts. By consequence, local manufacturers are not in a position to focus on the production of SWES models.
	Institutional framework and governance	L	Although SWEDPRA did not establish delivery channels for SWES, the institutional framework NCC-E, SAOS, SCST seems to provide a solid basis for CWERD to continue. It also appears to be a stable platform for dialogue.
	Environmental	L	No significant environmental benefits or issues have been identified. Once SWES are in place, GHG emission benefits from mitigation are accrued. Battery use and disposal may produce negative effects for the environment. The Evaluators have not collected specific information related to this issue.
5. Impact		**M**[112]	
	establishment of outcomes	M	The Project has achieved some of the envisaged outcomes in the field of capacity building and technology development. Direct environmental benefits (CO_2 reductions) and socio-economic benefits (for end-users) were not significant.
	indirect benefits	S	CWERD staff trained under SWEDPRA is contributing to the development of large-scale (25 MW) wind energy in DPRK, which can translate into substantial GHG reductions as a result of market transformation. Other positive benefits exist in terms of strengthening the exchange of information with the international community. Many useful lessons can be drawn from this first GEF experience in DPRK, from which UNDP, GEF and other international agencies, as well as DPRK (NCC-E) can benefit.

Table 6 Qualitative assessment of the overall achievements of the SWEDPRA project on key aspects.

5. Conclusions and Recommendations

Conclusions:

1. The UNDP/GEF Project SWEDPRA has been implemented efficiently and is approaching closure in the anticipated time (50 months). The overall throughput time, however, has been greatly affected due to the suspension of UNDP operations in DPRK between 2007 and 2009. After resumption, the execution modality was changed from UN Agency to Direct Execution. As a result, the period in which SWEDPRA was effectively delivering was: September 2005 to March 2007; and May 2011 till date.

2. The disbursement rate of the GEF resources as of 9 November 2012 is 84%; expenditures are mainly on hardware (manufacturing tools, wind measuring systems, and office equipment), preparation and organization of training events, and international consultancy. Based on the available evidence (mission reports, purchase orders, descriptions of training events), the Evaluators conclude that these outputs have been delivered as reported; as a general appreciation, the procured goods and services are of good value. The Evaluators have seen the procured wind measurement equipment and workshop machinery installed

[112] Impact rated according to the scale: S: Significant; M: Minimal; N: Negligible.

in agreement with their purpose.

3. SWEDPRA aimed to: (i) strengthen in-country capacities for wind resource assessment; (ii) design and manufacture small wind energy systems (SWES) for off-grid electricity production[113]; and (iii) promote these systems in DPRK and abroad, and actually have a substantial number of SWES installed to supply households in the rural areas of DPRK with electric energy. The path from product development to successful commercialization proved to be much longer and more complex than assumed at project design stage. The objectives of SWEDPRA were overambitious in relation to the short timeframe and modest budget of a GEF medium-sized project. There was no clear proposition for delivering SWES systems to rural families and the actors for achieving this were not properly identified.

4. By consequence, SWEDPRA only achieved part of the anticipated outcomes. SWEDPRA has made a critical contribution to establish in-country capacities for wind resource assessment by providing state-of-the-art wind measurement equipment and by training and technical backstopping. Building upon the (already well-developed) theoretical skills of counterpart staff at SAOS, the Project introduced internationally accepted methodologies and practices for wind measurements, data analysis and reporting. At end-of-project, national experts have demonstrated capacity to work conform these international standards, are endowed with high-quality (although limited) hardware for wind measurements, and are reportedly involved in large-scale wind energy development in the country. This is a very good achievement in the context of a GEF medium-size project.

5. SWEDPRA also made a substantial contribution to the development of efficient small wind turbines in the country. At end-of-project, a "new model" 300 W wind generator for battery charging is produced in small batch series. However, this product must still be subjected to long-term trials to determine its performance and durability. The wind generator is not yet optimized in terms of matching the local wind conditions and production capabilities. A mature product that can be commercialized on the national markets, may be achieved within 1-2 years. The original objective to design and produce three different classes of wind generators is out of reach of the Project.

6. SWEDPRA contributed to the development of the "new model" wind generator by training courses (in China and DPRK), the procurement of manufacturing equipment for the CWERD workshop, and by financing a test field for performance measurements of small wind systems at CWERD. The newly equipped workshop at CWERD enables the production of prototypes and system components with improved precision and to experiment with different manufacturing techniques; it should not be viewed as a "model workshop" for replication in the rural areas however. At the time of this Terminal Evaluation, the hardware at the test field was recently installed, but not in permanent operation yet. As a result, quantitative data on the energy performance of the "new model" SWES is not yet available.

7. SWEDPRA could not deliver on the outcome to put improved SWES designs into production at the rural workshops. Besides some training events executed by CWERD, the Project did not have the outputs and resources assigned to enable local SWES production. There was no clear proposition how to deliver SWES products to the end-users, and underlying assumptions were not validated. The observed general shortage of raw materials and equipment, and the low occupation levels of rural workshops are caused by systemic barriers that cannot be removed by a project such as SWEDPRA. The Project also lacked a detailed strategy to promote end-user demand for SWES systems. During the suspension period, CWERD's on-going work was primarily focused on technology development; there was no strategic guidance to preserve SWEDPRA's overall strategy.

8. SWEDPRA did not achieve the overall objective to install improved small wind turbines among rural end-users, to establish decentralized production chains for SWES manufacturing, and to deliver direct global greenhouse gas (GHG) benefits. The UNDP country office made a valuable effort to visit installed "old model" systems and assess their status and impact, but systematic, quantitative measurements are

[113] The development of mechanical wind mills (such as for water pumping) was originally also considered but never pursued. It may be a valid option for low-head water pumping, such as in the rice paddies.

needed to draw firm conclusions with respect to their performance and effectiveness[114]. The Evaluators did not identify a significant relation between the Project's inputs and the installed "old model" devices[115]. The defined targets for GHG reductions were also not realistic. However, SWEDPRA made a substantial contribution to the development of large-scale wind energy in DPRK[116].

9. Although CWERD's "modern" 300 W wind generator may reach maturity in the near future, the Evaluators observe that this design is not based on an explicit product philosophy[117]. Critical choices during the product conceptualization process were taken by the counterpart during the suspension of UNDP DPRK. A user-oriented approach to product design, which is common in market-based economies, is less developed in DPRK. Substantial experience exists in other countries with respect to the design and delivery of energy solutions in function of local demands and financial and technical constraints. Due to the suspension of SWEDPRA, the Project could not transfer these experiences to the national partners.

10. The Evaluators do not fully grasp the purpose of SWEDPRA's energy policy and planning component. Project development and energy planning are key elements for large-scale wind energy development, but are less relevant for small-scale systems[118]. Rather than energy projects, markets for SWES products were to be developed. A more successful approach might have been, to collaborate more closely with rural development organizations and cooperatives, rather than energy sector stakeholders. The Evaluators expect that such an approach would have provided substantial input information with regard to sales mechanisms, maintenance, energy demand, and cost constraints. Notwithstanding, SWEDPRA has generated some exposure for wind energy at the level of ministries.

11. The Evaluators found the local counterparts and the UNDP Country Office highly committed to the SWEDPRA Project. SAOS continued activities on wind energy development with the limited resources available during the suspension period; UNDP made a great effort by assigning office staff and financial resources to support Project implementation after 2009. In spite of the complex country context, the Evaluators observed constructive working relations between UNDP and the national counterparts NCC-E, SAOS, SCST and CWERD. As expressed by the counterparts, SWEDPRA enabled the development of a modern small wind turbine in DPRK, although at a slower pace than was hoped in 1999. The Project also generated positive useful learning experiences such as working in a project context with time-bound objectives and commitments, and the interaction with international experts. Hopefully, future international cooperation programmes can capitalize on this first GEF experience in DPRK.

Recommendations:

1. In order to devise a successful exit strategy for the Project, the Evaluators recommend focusing first on the consolidation and eventual enhancement of the current achievements. These are: a capable wind resource assessment team at CWERD; an advanced prototype of a modern 300 W wind design; established batch production capacity at the CWERD workshop. While communication exists between SAOS and SCST, and the local manufacturers, very little has been done to actually demonstrate the

[114] Verification of field installations of small wind systems, and the impacts thereof on local living conditions, is difficult in DPRK because of: (i) lack of reliable baseline data; (ii) logistics with regard to field visits; (iii) difficult road access to remote areas; and (iv) lack of monitoring of system performance under field conditions. In order to generate such field data, a comprehensive measurement programme of wind turbines in the rural areas is required. The local counterparts are in a better position that UNDP to implement such a programme. A comprehensive approach to rural energy use should involve other technologies, as done under the UNDP SRED initiative.

[115] CWERD staff provided training to local manufacturers but the Project did not contribute directly to improving the design or performance of the "old model" units. There is also no information how many of the 805 produced units are actually installed and operating.

[116] In terms of a market transformation towards low-emission, renewable energy technologies by DPRK's electricity sector, indirect GHG benefits can be ascribed to SWEDPRA of the order of 100 kton CO2eq/yr.

[117] Which should include cost/price, production, performance, operation and maintenance considerations.

[118] Simplifying matters somewhat, one can view large-scale wind turbines as capital investments that are added to a national power system, while small-scale systems are rather consumer goods. Market strategies, financing and risk management therefore require a very different approach.

achievements of the Project to these and to the potential end-users. In view of the Evaluators, these elements should be reviewed and discussed with the national counterparts and brought to a well-defined termination.

2. The national wind resource assessment team has already acquired adequate skills but could benefit from more practice and periodic technical feedback by the international wind energy expert. This can be done by performing wind assessments at different sites, which basically involves the transport and reinstallation of measuring towers and proper data analysis and reporting. The role of the international wind expert would be to ensure that work and reporting is done in conformity with the international standards and to promote a professional work attitude. In order to guarantee the availability of hardware (sensors and data loggers) during this process, SWEDPRA may consider procuring some spare parts. However, the Project cannot create the conditions for access to hardware on the longer term; this barrier must be addressed by DPRK.

3. In order to secure the development of the "modern" 300 W wind turbine, the following issues need to be addressed: (i) characterization of the power-load curve of the electric generator; (ii) determination of the energy production of the wind turbine at the test field; (iii) long-term tests under field conditions to assess the reliability of the mechanical construction and obtain inputs for design improvement. All tests should be carried out according to accepted engineering practices and possibly, in compliance with the pursued international standards. It is recommended to establish a detailed test protocol to this purpose, agreed upon by CWERD and UNDP DPRK with support from an international expert. The measurement data should be shared with UNDP and a final test report compiled. The Evaluators would like to see a 1-page summary of this test report –once available- attached to this Terminal Evaluation as a proof that SWES design under SWEDPRA has been successful.

4. The hardware for the items (i) and (ii) is already available at CWERD. The Evaluators suggest UNDP to consider the procurement of some basic data loggers, anemometers, and electric power meters for long-term field tests (item iii) if sufficient funds are available[119]. After successful completion of the test programme, the 300 W wind turbine can be considered a valid and proven base model. With this achievement in place, CWERD can start adapting the wind charger to local wind conditions and market needs, and embark on prototype development of larger-scale models.

5. As a second element of the exit strategy, it is recommended to install the tested 300 W wind turbine at each of the identified five local workshops. This activity would re-establish the link with the original strategy towards decentralized production and market development. The presentation of the 300 W model to the rural markets would define a logical end point for the SWES design process. If properly planned, this can still be achieved. Support to the local manufacturers to start production themselves is out of reach of the Project, but they can act as agents to distribute the units produced at CWERD. The indicated steps would enhance SWEDPRA's delivery on the outcome "SWES design". In addition, it would increase interaction between national stakeholders, which may generate useful information for market strategies in the future.

6. As a third (and last) element of the exit strategy, it is suggested to use the remaining GEF funds for the procurement and installation of mature small wind technology systems to supply rural households, farms or community buildings with high-quality, electric energy. Such systems can vary in size from 300 W to 5 kW. Since mature technology is not yet being produced in DPRK, it is strongly recommended to import such systems from established foreign manufacturers. The successful deployment of these systems will bring direct benefits to rural end-users, will contribute to create interest and demand from the public, and reduce greenhouse gas emissions compared to the baseline scenario[120]. Please refer to Annex H for a

[119] Field verification of system performance is also relevant for the SRED project. It is recommended to analyze the needs for data acquisition hardware for SWEDPRA and SRED jointly. The Evaluators recommend a practical approach and focus on effective monitoring methods, rather than sophisticated and costly hardware.

[120] The Evaluators recognize that this suggested procurement no longer builds upon the knowledge on wind technology created during the Project. However, the alternative would be to use the remaining funds for equipping local workshops. This is not feasible in a short timeframe given the absence of a SWES design adapted to rural workshop capacities, the need for

tentative description of the activities and costs to implement the depicted SWEDPRA exit strategy.

7. With respect to future programming, it is recommended not to focus on small wind energy technology for electricity generation alone. Mechanical wind mills can be a cost-effective option for pumping drinking water, low-head irrigation, and drainage. Experience with these "wind pumps" is available in many countries in Asia and production can usually be done in simple workshops. Solar-PV panels can drive electrical pumps without the need for costly battery back-up, and can also pump water from deep wells. Alongside electric centrifugal pumps and conventional pistons pumps, rope pumps are a very cost-effective means for small-scale watering and can easily be adapted to local production and repair[121]. Mechanical wind pumps were included in the original project design of SWEDPRA, but not pursued.

8. Project ownership has been identified as an underlying issue during the execution of SWEDPRA as the national counterparts and UNDP seem not fully share the overall project goal. Obviously, the long suspension period has played a negative role in this. Other causes can be the unfamiliarity of national staff to work in the context of an international project; and a lack of understanding of each other's roles and responsibilities. The Evaluators suggest that UNDP and NCC-E take time to analyze the Project's implementation in detail and identify elements to make future interventions more effective. At a more technical level, it is recommended to include SAOS and SCST in this dialogue.

9. In function of the outcomes of this dialogue, the Evaluators would suggest to shape the steps (i-iii) recommended for finalizing the 300 W "new model" SWES, in the form of a "mini-project". This implies the detailed definition of objectives, preparation of a workplan, time frame, responsibilities, identification of required inputs, delivery of final results, and verification thereof. This exercise will not only contribute to the success of the depicted exit strategy, but may also strengthen the basis for the successful design and implementation of future donor-funded programmes in DPRK. Other activities under the proposed exit strategy include the procurement and installation of (imported) SWES systems for rural end-users. In function of the workplan, it may be convenient to extend the project until December 2013[122].

10. The Evaluators do not recommend to pursue technology development as part of a project if the final objective is the delivery of energy benefits among end-users. The overall process becomes too long and subject to many risk factors, and usually fails. Product development can hardly be underestimated. With a view on UNDP's Energy and Environment programme in DPRK, this would suggest to focus more on the delivery of proven energy solutions for rural households and on strengthening local delivery mechanisms and business models, for example for battery charging, water supply and cooking. There is also ample scope for energy supply for agricultural processing. Besides equipment as supplied under the SRED project, this also requires strengthening and repair of presently disrupted production and supply processes in the rural areas.

6. Lessons learned

The Evaluators have identified the following lessons that can be drawn from the SWEDPRA project:

1. Successful GEF project design depends on an adequate analysis of barriers in function of the problem statement and scope. This scope must be realistic in relation to the available resources and timeframe. If the scope is too general, many external factors exist which cannot be controlled. It is not sufficient to identify these as potential risks. Instead, a project must be able to actually mitigate these risks and this

adequate training of workshop staff, and the apparent difficulties to control the production chain. This alternative would also not directly benefit the rural population. The estimated budget for the procurement and installation of commercial SWES systems can be about US$ 100,000, around 60% of the remaining project funds (US$ 165,011)

[121] See, for example, www.ropepumps.org.

[122] Considering that winter conditions are a major impediment for sites assessments and SWES installation in the period November – March. The period January-March 2013 could be used to prepare the procurement documents and select feasible project sites. For the selection of – and the communication with – the beneficiaries, UNDP may draw on the experiences gathered with the SRED program.

should be verified. If not, one should reconsider the design and scope of the Project.

2. Project strategy and scope must have a direct relation with the chosen beneficiaries. The main counterpart must have a functional relation with the beneficiaries. If the objective of a project is, to deliver a service to end-users (such as energy to rural households), logical counterparts can be local businesses or public entities promoting delivery mechanisms. If the objective is more high-level, appropriate counterparts can be research institutes (to address a technology barrier), of governmental agencies (to address a policy barrier).

3. The experience with SWEDPRA suggests that the DIM/DEX and NEX modalities are more appropriate for the execution of a GEF Climate Change project, than the UN Agency modality. Although UNOPS proved efficient in the delivery of goods and services, it does not cover the function to keep a project aligned with the envisaged strategy. Timing and complementary actions are crucial for barrier removal; a properly working Steering Committee supported by a dedicated Project Manager, can perform this task more adequately.

4. The context for international agency programmes in DPRK is not easy. Notwithstanding, the experiences with SWEDPRA show that positive results can be achieved. National counterparts are generally committed and well-prepared but communication processes are slow; there is a lack of familiarity with project-based working processes. Procurement is delayed and costly as a consequence of international embargoes, affecting overall performance. Impact verification and sharing of information with international counterparts is also an issue. Project ownership therefore deserves special attention during preparation and start-up phase. Project indicators should be based on a previously agreed monitoring and verification plan.

Annex A Terms of Reference

July 11, 2012

1. INTRODUCTION

In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP support GEF financed projects are required to undergo a terminal evaluation upon completion of implementation. These terms of reference (TOR) sets out the expectations for a Terminal Evaluation (TE) of the Small Wind Energy Development and Promotion in Rural Areas (SWEDPRA) in DPR Korea (PIMS #751).

The essentials of the project to be evaluated are as follows:

2. PROJECT SUMMARY TABLE

Project Title:	Small Wind Energy Development and Promotion in Rural Areas in DPRK			
GEF Project ID:	PIMS #751		*at endorsement (Million US$)*	*at completion (Million US$)*
UNDP Project ID:	#.00076431	GEF financing:	0.725	0.725
Country:	DPR Korea	IA/EA own:	0.15	0.15
Region:	East Asia and Pacific	Government:		
Focal Area:	Climate Change	Other:		
FA Objectives, (OP/SP):	CCM-3: Renewable Energy (GEF 5)	Total co-financing:		
Executing Agency:	UNDP	Total Project Cost:	0.875	0.875
Other Partners involved:	UNOPS	ProDoc Signature (date project began):		October 2005
		(Operational) Closing Date:	Proposed: April 2013	Actual: April 2013

3. OBJECTIVE AND SCOPE

The DPR Korea energy sector is characterized by a heavy reliance on coal and coke (over 60% of demand in 1990). Petroleum, all of which is imported, accounted for only 7% of supply in 1990, electricity another 7% and biomass provided an estimated 24%. Industrial demand accounts for nearly half of all consumption, residential about a third (half of this contributed by wood and biomass). The remaining sectors (agriculture, military, transport, commercial and non-energy) all contributed about 3 to 5% to demand. The DPR Korea in the 80s built a heavily industrialized, energy intensive economy, which because of reliance on coal and older technology are now energy-inefficient, . produce far below demand and contribute to atmospheric pollution and climate change.

Since 1990, the economy has suffered. Much of this can be related to energy supply and demand causes i.e. increased demand against lack of capital investment in energy, worn out technology and increased energy losses. . Vital infrastructure, such as that for electricity generation, transmission, and distribution and transport, has declined drastically as a result. The decline has been felt nowhere more than in the agricultural sector. Moreover, electricity shortages have caused an estimated 25% reduction of irrigation capability in 1996 compared to 1990 levels. Irrigation is essential for rice production in the temperate climate of DPR Korea. Rural households as well have experienced an estimated 50% drop in service. Rural clinics, hospitals and schools suffer these same shortages. This has brought about declining standards of living.

The goal of Small Wind Energy Development and Promotion in Rural Areas (SWEDPRA) is the reduction of the annual growth rate of GHG emissions from fossil fuel use, particularly coal. The objective of the project is removal of barriers to widespread application of small wind energy systems (SWES) in DPR Korea by assisting the nascent wind energy sector on the road to increased quality and

standards and full-scale commercialization and improving the domestic market (particularly in the rural areas), as well as the potentially viable foreign market, for locally manufactured SWES.

The SWEDPRA project supports the Government Policy on Science and Technology which was adopted in1991. This policy promotes the research and development activities in the area of renewable energy such as solar and wind energy, to widen utilization of renewable sources of energy. In the year 1993, The Government issued the National Action Plan for Agenda 21 focusing on a transition to sustainable development. This document has featured development of renewable energy, in particular wind energy as one of the three priorities. Later in 2002, as part of the First National Communication Report (FNCR) to the UNFCCC, the DPR Korea has reiterated its commitment to developing and disseminating wind energy technologies.

In order to achieve the project objective, the following project key Components and Outcomes were identified: .

Component 1: Wind Energy (WE) Resource Assessment. Outcome 1: Regular conduct of assessment of the wind characteristics and energy potentials in the country.

Component 2: WE Technology Information and Awareness Enhancement. Outcome 2: The feasibility and benefits of wind energy technology applications are widely known to potential users in the country.

Component 3: Development of Domestic and Overseas Market for locally Made SWES. Outcome 3: Fully established and promoted market for locally made SWES units both domestically and abroad.

Component 4: SWES Design Improvement. Outcome 4: Locally made SWES units comply with internationally acceptable quality and performance standards.

Component 5: SWES Manufacturing Improvement. Outcome 5: Improved manufacturing of locally made SWES units towards internationally accepted production practices and standards.

Component 6: SWES Technology Application Demonstration. Outcome 6: Successful showcasing of the installation, operation and monitoring of optimally designed and manufactured SWES units.

Component 7: Energy Planning and Policy Formulation. Outcome 7: Energy planning and policy making becomes part of the country's development planning system.

This is a medium sized project with project implementation duration of 50 months, and funded by the Global Environment Facility (GEF) and UNDP. The project was initially signed in August 2005, and implemented for 18 months from October 2005 – March 2007 before its suspension. During this period, the project was executed by UNOPS. After restart of UNDP operations, SWEDPRA project was reviewed and signed in August 2010. Since then, the project is being implemented under UNDP Direct Execution (DEX) until its revised planned closing date of April 2013, which is about 32 months.

The TE will be conducted according to the guidance, rules and procedures established by UNDP and GEF as reflected in the UNDP Evaluation Guidance for GEF Financed Projects.

The objectives of the evaluation are to assess the achievement of project results, and to draw lessons that can both improve the sustainability of benefits from this project, and aid in the overall enhancement of UNDP programming.

4. EVALUATION APPROACH AND METHOD

An overall approach and method[123] for conducting project terminal evaluations of UNDP supported GEF

[123] For additional information on methods, see the Handbook on Planning, Monitoring and Evaluating for Development Results, Chapter 7, pg. 163

financed project has developed over time. The evaluator(s) is(are) expected to frame the evaluation effort using the criteria of **relevance, effectiveness, efficiency, sustainability, and impact,** as defined and explained in the UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects. The international consultant will be the team leader and coordinate the evaluation process to ensure quality of the report and its timely submission. The national consultant will provide supportive roles both in terms of professional back up, translation etc. The evaluation team is expected to become well versed as to the project objectives, historical developments, institutional and management mechanisms, activities and status of accomplishments. Information will be gathered through document review, group and individual interviews and site visits. A set of questions covering each of these criteria have been drafted and are included with this TOR (Annex C). The evaluator/s is/are expected to amend, complete and submit this matrix as part of an evaluation inception report, and shall include it as an annex to the final report.

The evaluation must provide evidence-based information that is credible, reliable and useful. The evaluator is expected to follow a participatory and consultative approach ensuring close engagement with government counterparts, in particular the GEF operational focal point, UNDP Country Office, project team, UNDP GEF Technical Adviser based in the region and key stakeholders. The evaluator is expected to conduct a field mission to Pyongyang, including the project sites (*TBI*). Interviews will be held with the following individuals and organizations at a minimum, but not limited to:

- National Project Director (NPD)
- Project Technical Manager (PTM)
- Project Manager (PM)
- Project Administrative Assistant
- UNDP Programme Support Unit
- UNDP Financial Officer
- UNDP Procurement Officer
- Project Steering Committee Members
- Relevant project stakeholders, and personnel, but not limited to:
- National Coordination Committee on Environment (NCC-E)
- State Academy of Science (SAOS)
- State Commission of Science and Technology (SCST)
- Non-Conventional Energy Development Centre (NCEDC)
- Ministry of Land and Environment Protection.
- International Project Consultant(s), where applicable (possibly use Skype interview)
- Research institutions and Experts in the country, where applicable
- Relevant personnel at UNDP Country Office in DPR Korea and Program Analyst in-charge of the Project

The evaluator will review all relevant sources of information, such as the project document (two versions), inception workshop report, annual work and financial plans, project reports – including Annual APR/PIR (2011 and 2012), project budget revisions, quarterly reports, Minutes of Project Technical Committee/Project Steering Committee meetings, Back-to-Office Reports of UNDP staff (if any), Study reports/Conference proceedings/government guidelines, etc., midterm review, progress reports, GEF focal area tracking tools, project files, national strategic and legal documents, and any other materials that the evaluator considers useful for this evidence-based assessment such as terms of reference for past consultants' assignments and summary of the results; past audit reports (if any). A list of documents that the project team will provide to the evaluator for review is included in Annex B of this Terms of Reference.

5. EVALUATION CRITERIA & RATINGS

An assessment of project performance will be carried out, based against expectations set out in the Project Logical Framework/Results Framework (see Annex A), which provides performance and impact indicators for project implementation along with their corresponding means of verification. The

evaluation will at a minimum cover the criteria of: **relevance, effectiveness, efficiency, sustainability and impact.** Ratings must be provided on the following performance criteria. The completed table must be included in the evaluation executive summary. The obligatory rating scales are included in Annex D.

Evaluation Ratings:			
1. Monitoring and Evaluation	***rating***	**2. IA& EA Execution**	***rating***
M&E design at entry		Quality of UNDP Implementation	
M&E Plan Implementation		Quality of Execution - Executing Agency	
Overall quality of M&E		Overall quality of Implementation / Execution	
3. Assessment of Outcomes	**rating**	**4. Sustainability**	**rating**
Relevance		Financial resources:	
Effectiveness		Socio-political:	
Efficiency		Institutional framework and governance:	
Overall Project Outcome Rating		Environmental :	
		Overall likelihood of sustainability:	

6. PROJECT FINANCE / COFINANCE

The Evaluation will assess the key financial aspects of the project, including the extent of co-financing planned and realized. Project cost and funding data will be required, including annual expenditures. Variances between planned and actual expenditures will need to be assessed and explained. Results from recent financial audits, as available, should be taken into consideration. The evaluator(s) will receive assistance from the Country Office (CO) and Project Team to obtain financial data in order to complete the co-financing table below, which will be included in the terminal evaluation report.

Co-financing (type/source)	**UNDP own financing (mill. US$)**		**Government (mill. US$)**		**Partner Agency (mill. US$)**		**Total (mill. US$)**	
	Planned	**Actual**	**Planned**	**Actual**	**Planned**	**Actual**	**Actual**	**Actual**
Grants								
Loans/Concessions								
• In-kind support								
• Other								
Totals								

7. MAINSTREAMING

UNDP supported GEF financed projects are key components in UNDP country programming, as well as regional and global programmes. The evaluation will assess the extent to which the project was successfully mainstreamed with other UNDP priorities, including poverty alleviation, improved governance, the prevention and recovery from natural disasters, and gender.

8. IMPACT

The evaluators will assess the extent to which the project is achieving impacts or progressing towards the achievement of impacts. Key findings that should be brought out in the evaluations include whether the project has demonstrated: a) verifiable improvements in ecological status, b) verifiable reductions in stress on ecological systems, and/or c) demonstrated progress towards these impact achievements.[124]

9. CONCLUSIONS, RECOMMENDATIONS & LESSONS

The evaluation report must include a chapter providing a set of **conclusions**, **recommendations** and **lessons**.

10. IMPLEMENTATION ARRANGEMENTS

The principal responsibility for managing this evaluation resides with the UNDP CO in DPR Korea. The UNDP CO will contract the evaluators and ensure the timely provision of per diems and travel arrangements within the country for the evaluation team. The Project Team will be responsible for

[124] A useful tool for gauging progress to impact is the Review of Outcomes to Impacts (ROtI) method developed by the GEF Evaluation Office: ROTI Handbook 2009

liaising with the Evaluators team to set up stakeholder interviews, arrange field visits, coordinate with the Government etc.

Throughout the period of evaluation, the evaluation team will liaise closely with the UNDP Resident Representative/Deputy Resident Representative/Programme Analyst/Senior M&E Adviser/Project Manager, the concerned agencies of the Government, any members of the international team of experts under the project and the counterpart staff assigned to the project. The team can raise or discuss any issue or topic it deems necessary to fulfil its task, the team, however, is not authorized to make any commitments to any part on behalf of UNDP/GEF or the Government.

Logistics

The team will conduct a mission visit to Pyongyang and selected project sites, to meet with relevant project stakeholders. This visit will also include meetings with the officials of UNDP, the Implementing Partner, stakeholders from other institutions and ministries related to the project.

After the initial briefing by UNDP Resident Coordinator/DRR/Programme Analyst/Project Manager, the review team will meet with the National Project Director, the officials of NCC-E, and GEF Operational Focal Point as required.

11. EVALUATION TIMEFRAME

The total duration of the evaluation will be 21 days according to the following plan:

Activity	Timing	Completion Date
Preparation	2 days	*date*
Evaluation Mission	12 days	*date*
Draft Evaluation Report	5 days	*date*
Final Report	2 day	*date*

12. EVALUATION DELIVERABLES

The evaluation team is expected to deliver the following:

Deliverable	Content	Timing	Responsibilities
Inception Report	Evaluator provides clarifications on timing and method	No later than 2 weeks before the evaluation mission.	Evaluator submits to UNDP CO
Presentation	Initial Findings	End of evaluation mission	To project management, UNDP CO
Draft Final Report	Full report, (per annexed template) with annexes	Within 3 weeks of the evaluation mission	Sent to CO, reviewed by RTA, PCU, GEF OFPs
Final Report*	Revised report	Within 1 week of receiving UNDP comments on draft	Sent to CO for uploading to UNDP ERC.

*When submitting the final evaluation report, the evaluator is required also to provide an 'audit trail', detailing how all received comments have (and have not) been addressed in the final evaluation report.

13. TEAM COMPOSITION

The evaluation team will be composed of 1 international and 1 national evaluator[125]. The individual experts in the team needs to have good technical knowledge of the wind energy, renewable energy and climate change projects and national context of wind energy project and program implementation in DPR Korea, possess good evaluation experience, and writing skills to carry out the assignment. The consultants shall have prior experience in evaluating similar projects. Experience with GEF financed projects is an advantage. International evaluator will be designated as the team leader and will be responsible for quality and timely submission of the report. The allocation of tasks in the execution of this TOR shall be decided mutually between the International and National consultants. The evaluators selected should not have participated in the project preparation and/or implementation and should not have conflict of interest with project related activities.

[125] Also called consultant

The international consultant must present the following qualifications and professional background:

- Minimum of ten years accumulated and recognized professional experience in renewable energy and climate change projects Knowledge of UNDP and GEF;
- Minimum of five years of project evaluation and/or implementation experience in the result-based management framework, adaptive management and UNDP or GEF Monitoring and Evaluation Policy;
- Technical knowledge in the targeted focal area(s);
- Post-Graduate in Engineering, Management or Business;
- At least 3 years of technical experience in wind energy and process engineering or operations. Experience in specific to small wind energy systems (SWES) development and wind resource measurement in wind energy industry is advantageous;
- Demonstrated ability to assess complex situations, succinctly, distils critical issues, and draw forward-looking conclusions and recommendations;
- Ability and experience to lead multi-disciplinary and national teams, and deliver quality reports within the given time;
- Familiar with developing countries context or regional situations relevant to that of DPR Korea;
- Experience with multilateral and bilateral supported renewable energy and climate change projects;
- Comprehensive knowledge of international renewable energy industry best practices;
- Very good report writing skills in English.

The evaluation team shall conduct debriefing for the UNDP Country Office, Project Manager, and NCC-E in Pyongyang towards the end of the evaluation mission. The international consultant shall lead presentation of the draft review findings and recommendations. Lead drafting and finalization of the terminal evaluation report. The evaluation team shall review the tracking tool. If it is not available, review the required information to complete the tracking tool as required for climate change mitigation projects.

14. EVALUATOR ETHICS

Evaluation consultants will be held to the highest ethical standards and are required to sign a Code of Conduct (Annex E) upon acceptance of the assignment. UNDP evaluations are conducted in accordance with the principles outlined in the UNEG 'Ethical Guidelines for Evaluations'

15. PAYMENT MODALITIES AND SPECIFICATIONS

%	Milestone
20%	At contract signing
30%	Following submission and approval of the 1ST draft terminal evaluation report
50%	Following submission and approval (UNDP-CO and UNDP RTA) of the final terminal evaluation report

16. APPLICATION PROCESS

Mandatory documents to be included in the submission of technical and financial proposal:
Interested individual consultants are required to submit the following documents/information to demonstrate their qualifications, which is mandatory.

(a) Technical Proposal
(i) Explaining why the individual consultant (IC) is most suitable for the work
(ii) Provide a brief methodology on the IC will approach and conduct the work
(iii) P11 form duly signed (attached below)

(b) Financial proposal
(i) Professional rate per day, total days, total professional cost, and travel costs (includes travel, lodging,

and per diem) to Pyongyang from hometown and travel for field visits (TBI) for 5 days. Please include the information in the form "*OFFEROR'S LETTER TO UNDP CONFIRMING INTEREST AND AVAILABILITY FOR THE INDIVIDUAL CONTRACTOR (IC) ASSIGNMENT"* attached to this Procurement Notice.

(c) Personal CV

Including past experience in similar projects and at least 3 MOST RECENT references (with their full contact details, including e-mail, phone numbers)

Special instructions for completing financial proposal

(a) Lump sum contracts

The financial proposal shall specify a total lump sum amount, and payment terms around specific and measurable (qualitative and quantitative) deliverables (i.e. whether payments fall in instalments or upon completion of the entire contract). Payments are based upon output, i.e. upon delivery of the services specified in the TOR. In order to assist the requesting unit in the comparison of financial proposals, the financial proposal will include a breakdown of this lump sum amount (including professional rate, travel, per diem, and miscellaneous in the number of anticipated working days).

(b) Travel

All envisaged travel costs must be included in the financial proposal. This includes all travel to join Pyongyang and return travel to home country. In general, UNDP should not accept travel costs exceeding those of an economy class ticket. Should the IC wish to travel on a higher class he/she should do so using their own resources.

In the case of unforeseeable travel, payment of travel costs including tickets, lodging and terminal expenses should be agreed upon, between the respective business unit and IC, prior to travel and will be reimbursed.

Evaluation of the proposals

IC proposals will be evaluated based on the following criteria:

Cumulative analysis:

The award of the contract will be made to the Consultant whose offer has been evaluated and determined as:

a) Responsive/compliant/acceptable, and
b) Having received the highest score out of a pre-determined set of weighted technical and financial criteria specific to the solicitation.

* Technical Criteria weight; [70%]
* Financial Criteria weight; [30%]

Only candidates obtaining a minimum of 70% would be considered for the Financial Evaluation

Criteria	Weight	Max. Point
Technical		
• Qualification of the Consultant	20	20
• Relevant work Experience	25	25
• Proposed Work Plan for undertaking the task	20	20
• Time Line for completion of the Task	05	05
Financial	30	30

Annex B Mission Agenda

The agenda for the terminal evaluation mission is presented in the following table.

TIME	ACTIVITY	PLACE
DAY 1 – Monday, 8 October (Pyongyang)		
09.30 - 10.00	Meeting SPA	UNDP
10.00 - 10.30	Meeting UNDP Senior Management	UNDP
10.45 - 12.30	Meeting PM, national Project Team, Evaluation team	Project Office
12.30 - 14.00	*lunch*	
14.00 - 18.00	Review of documentation, questions	Project Office
DAY 2 – Tuesday, 9 October (Pyongyang)		
09.30 - 12.00	Plenary meeting with NCC-E, SOAS, Science Commission and Project Team	Yanggakdo Hotel
13.00 - 14.00	*lunch*	
14.00 - 16.00	Meeting with UNDP Procurement Officer	Project Office
16.00 - 17.30	Meeting national Project Team	Project Office
17.30 - 19.00	Meeting PM, SPA	Project Office
DAY 3 – Wednesday, 10 October (national holiday)		
10.00 - 12.00	Office work with PM	Project Office
12.00 - 13.30	*lunch*	
14.00 -15.00	work session Evaluation team	Project Office
14.00 -15.00	Skype conference call with UNDP Regional Technical Specialist	Project Office
16.15-18.00	Skype conference call with retained SWEDPRA consultant	Project Office
DAY 4 – Thursday, 11 October (Pyongyang)		
09.00 - 12.00	Review of documentation, questions	Project Office
12.00 - 14.00	*lunch*	
14.00 - 17.00	work session Evaluation team	Project Office
DAY 5 – Friday, 12 October (field mission)		
09.00-15.00pm	SAOS and CWERD workshop	
	Earth environmental informatics	
	Scientists Hospital with 5 KW turbine	
	Wind turbine performance test field	
16.00 - 17.00	*lunch*	
17.00 – 19.00	desk work	Project Office
DAY 6 – Monday, 15 October (field mission)		
09.00-12.00	Sukchon Daily Necessities Factory	
	Hanchon Ward village -Visit RET installations	
13.00 - 14.30	*lunch*	
16.00 – 19.00	Meeting UNDP Senior Management, PM	UNDP
DAY 7 – Tuesday, 16 October (Pyongyang)		

TIME	ACTIVITY	PLACE
09.00 - 12.00	Review of documentation, questions	Project Office
12.00 - 13.00	*lunch*	
13.00 – 14.30	work session Evaluation team	Project Office
14.30 – 17.00	meeting UNDP Programme Analyst	Project Office
17.00 – 17.45	meeting UNDP Procurement and Financial Officer	UNDP
DAY 8 – Wednesday 17 October (Pyongyang)		
10.45 – 12.30	Briefing NCC-E, SOAS, Science Commission and Project Team on general findings	Yanggakdo Hotel
13.00 – 14.00	*lunch*	
14.00 – 15.00	Incorporation of comment and observation	Project Office
15.00 – 17.00	Meeting representative EUPS-Unit 3	Project Office
DAY 9 – Thursday 18 October (Pyongyang)		
10.00 - 12.00	Presentation of Findings to Project Team, UNDP Senior Management, SPA, PM	UNDP Conference room
12.00 -13.30	*lunch*	
13.30 - 15.00	Preparation knowledge session	Project Office
15.00 – 16.30	Knowledge session on RET in DPRK- Prospects and Opportunities	UNDP Conference room
16.30 – 19.00	Installation SWES by CWERD Team on premises UNDP	UNDP
DAY 10 - Friday, 19 October (Pyongyang)		
09.00 - 10.30	Debriefing of UNDP Senior Management	UNDP Office
10.30 - 11.30	Debriefing with PM	Project Office
11.30 - 12.30	Informal meeting with World Food Programme Deputy Director	WFP Office, Pyongyang
12.30-13.30	*lunch*	
13:30-14:00	Meeting with SPA on completion Terminal Evaluation process	UNDP
15.30	Departure for Airport, national consultant, UNDP Project Assistant	

Annex C Table of Disbursed Co-financing

The following table summarizes the co-financing resources that materialized during the implementation of the SWEDPRA project, as of 9 November 2012.

Co-financing (type/source)	**UNDP own financing (mill. US$)**		**Government (mill. US$)**		**Partner Agency (mill. US$)**		**Total (mill. US$)**	
	Planned	**Actual**	**Planned**	**Actual**	**Planned**	**Actual**	**Planned**	**Actual**
Grants	150,000	100,925	300,000	n/a			450,000	100,925
Loans/Concessions								
• In-kind support	n/a	n/a	245,000	245,000			245,000	245,000
• Other								
Totals	150,000	100,925	545,000	n/a			695,000	345,925

Please note that the purpose of the Government in-cash funding was been described in the Project Brief and that these resources have not been tracked. Government counterparts however, have spent significant resources to construct wind measurement towers, and to transport and install them. Other co-funding (in-kind) are the plot of land for the test field, computer facilities and skilled staff. The DPRK counterparts have continued project-related activities during the suspension period. After suspension, UNDP made a large effort to restart SWEDPRA and made available a Project Manager with resources from the SRED project, which is TRAC funded. These resources are not reflected in the table.

Annex D Findings Monitoring Visits by UNDP June-July 2012

The following tables summarize the findings of the visits to installed "old model" SWES systems by the SWEDPRA Project Manager and UNDP DPRK staff, in June and July 2012. According to verbal information given by the local manufacturers, the total number of units produced in DPRK is 805.

Visit to Ryangdam-ri (20 June 2012)				
Questions	**Household 1. Farmer Mr. Jang Chan Ho**	**Household 2 Farmer Ms. Jong Yong Sun**	**School Principal Mr. Jong Sun Sahs**	**Kindergarten Ms. Jang Sun Hwy**
SWES Commissioned	**Autumn, 2007**	**September, 2010**	**October, 2007**	**April, 2009**
Overall SWESS working condition	**Functional. Batteries were charged and its work has been demonstrated.**	**Functional.**	**Functional.**	**Functional.**
Capacity of batteries	**65 and 60 Ah/ 12V**	**45 Ah/ 12 V**	**60 Ah / 12 12V**	**80 ah, 120 Ah / 12 V**
Capacity of rectifier	**300W, 12 V**	**400W, 12 V**	**400W, 12 V**	**400W, 12 V**
Total connected load to SWES	**2 bulbs, TV and DVD**	**2 bulbs, TV,DVD, Tape recorder**	**Multimedia training, Laptop.**	**2 bulbs, TV**
How many hours these connected load used per day in hours?	**Light – 6h, TV – 4-6 h**	**Light – 6h, the rest -6h.**	**Laptop – 5-6h.**	**Light 2h. TV – 5h.**
Capital Cost of SWES	**180 USD**	**180-200 USD**	**Provided by local authorities. Does not know price.**	**Provided by local authorities. Does not know price.**
Annual Maintenance cost	**5 USD basically for fixing and painting wooden blades.**	**5 USD basically for fixing and painting wooden blades.**	**3-5 USD basically for fixing and painting wooden blades.**	**Does not know as maintenance done by local authorities.**
Number of people with access to energy service and investments mobilized due to SWES installation.	**3 people; TV, fan and education of children.**	**3 people; support marriage of one daughter and participation in sport team of another one.**	**650 students.**	**118 kids and 14 staff.**
Number of women and girls being benefited.	**3 and 2.**	**1 woman.**	**43% girls from total 650 students.**	**14 and 63.**
In the absence of current use for energy from SWES what would be primary fuel being used?	**Charged battery from cooperative diesel motor and spent 2 kg of motor oil every 3 days. Cost is 1.1 euro per 1 kg.**	**1.5 L of diesel per 2 h for charging batteries. It was 6-7 times per month.**	**n/a**	**n/a**

Visit to Samsan-ri (21 June 2012)						
Questions	**Household 3 Mr. Yun Jung Choe**	**Household 4 Mr. O Song Chol**	**Household 5 Mr. Kim Kum Chol**	**Household 6 Ms. Pak Sum Hui**	**Household 7 Ms. Jang Chun Ok**	**Household 8 Mr. Kang Jong Chol**
SWES Commissioned	**July, 2010**	**September, 2006**	**January, 2008.**	**January, 2009.**	**December, 2007**	**December, 2007.**
Overall SWESS working condition	**Functional. Battery was charged two days ago. Once change blade.**	**Functional.**	**Functional.**	**Not functional from beginning of June due to cracked blade.**	**Functional. Once change blade.**	**Not functional since June 2012. Expected that it will be fixed in 10 days. Was not properly maintained and due to wobbling the generator fails.**
Capacity of batteries	**100 Ah/12 V. Very big locally**	**30 Ah/12 V. Small Chinese**	**60 Ah /12 V**	**60 Ah /12 V**	**Does not know**	**Small Chinese motorcycle**

Visit to Samsan-ri (21 June 2012)						
Questions	**Household 3 Mr. Yun Jung Choe**	**Household 4 Mr. O Song Chol**	**Household 5 Mr. Kim Kum Chol**	**Household 6 Ms. Pak Sum Hui**	**Household 7 Ms. Jang Chun Ok**	**Household 8 Mr. Kang Jong Chol**
	made batteries.	**motorcycle batteries. Originally he had bigger batteries.**				**batteries. Currently he charges using neighbours generator.**
Capacity of rectifier	**Made in Nampo. 400W, 12 V.**	**Made in Nampo. 400W, 12 V.**	**400W/12V**	**Does not know. Her husband is working in maintenance team and she relays on him.**	**Does not know**	**400W/12V, but we have not seen it due to its location under the roof.**
Total connected load to SWES	**2 bulbs, TV, DVD.**	**2 bulbs, TV, DVD.**	**2 bulbs, TV.**	**2 bulbs, TV, DVD, karaoke, fan.**	**2 bulbs, TV, DVD, 3 torch lights**	**3 bulbs and TV**
How many hours these connected load used per day in hours?	**Light and TV - 6-7 h**	**Light and TV – 3h**	**Light and TV - 6h**	**In average 6h.**	**Does not know**	**6-7h**
Capital Cost of SWES	**300 USD. Expensive batteries.**	**300 USD**	**300 USD**	**Does not know as it was purchased by her husband.**	**Does not know as it was purchased by her husband.**	**280 USD**
Annual Maintenance cost	**5 USD.**	**5 USD**	**4.5 USD**	**3-4 USD**	**Does not know**	**10 USD for fixing current problem.**
Number of people with access to energy service and investments mobilized due to SWES installation.	**5 people. Collar TV.**	**6 people. 2 bicycles. 1 set of furniture.**	**4 people. I kitchen set.**	**3 people. Collar TV, mirror.**	**5 people.**	**5 people**
Number of women and girls being benefited.	**2 women.**	**2 women.**	**2 women.**	**1 woman and I daughter.**	**2 women and 2 girls.**	**2 women and 2 girls.**
In the absence of current use for energy from SWES what would be primary fuel being used?	**Before he charged small batteries manually. It took 3 h to charge one battery.**	**This is only place where we have seen a refrigerator. Not functional as in the past when grid connection was available he could use it. Than he charged batteries in cooperative diesel – 1 kg of oil per 7 days.**	**Used manual generator during watching TV. In addition charged small batteries on cooperative diesel generator for 2 bulbs – 300 g of oil per day.**	**She knows that her husband was charging batteries.**	**Used oil for lighting. Did not used TV due to often cuts.**	**Used torch light.**

The systems at Hanchon Ward (next table) were visited by the Evaluators on 15 October 2012. The indicated charging times are very short for the average energy output of a small wind generators. The Evaluators consider that quantitative, verifiable data is required to assess the actual energy performance of the installed "old model" SWES. These can only be obtained by measurements according to generally accepted engineering practices.

Visit to Hanchon-ward, Pyongwon county of South Pyongan province (3 July 2012)			
Questions	**Management Office Mr. Yang Kil Nam, chief of 10th work team, Hanchon-ward**	**Household 1. Mr. Ri Chum Uk, Farmer Hanchon-ward**	**Household 2. Mr. Kin Yong Ki, Farmer, Hanchon-ward**
SWES Commissioned	**June, 2010. It was the first generator installed in the ward.**	**2010.**	**Spring, 2010.**
Overall SWESS working condition	**Functional. Once blade was broken. Every 6 months manufacturing company is checking condition of the turbine.**	**Functional.**	**Functional. First 3 blades generator was changed in 2011 for 5 blades generator for free by manufacturer.**
Capacity of batteries	**Local. 105 Ah/ 12V**	**China, 60 Ah/12 V.**	**Local – 12Ah/12 and China, 88Ah/12V**
Capacity of rectifier	**Installed within the generator with capacity of 400W, 12 V**	**Installed within the generator with capacity of 400W, 12 V**	**Installed within the generator with capacity of 400W, 12 V**
Total connected load to SWES	**TV and light for technical trainings. Per day approximately 4 people charge their batteries.**	**2 bulbs, TV, torch.**	**2 bulbs, TV, DVD, karaoke, amplifier.**
How many hours these connected load used per day in hours?	**Charging time 6-7h. It can work from 15-20h.**	**Charging time 6h. Fully charged battery can work 7 days.**	**Charging take 3-4h. Depending on size of battery: 3-4 days and 7 days.**
Capital Cost of SWES	**250 USD. Cost of generator is 150 USD.**	**192 USD. Cost of generator is 145 USD.**	**250 USD. Cost of generator is 150 USD.**
Annual Maintenance cost	**5 USD**	**n/a**	**n/a**
Number of people with access to energy service and investments mobilized due to SWES installation.	**200 people. In addition 4 neighbouring families ask him to charge their small batteries, torches. He does it for free.**	**2 people in the family. Improved quality of life and access to energy while he needs it.**	**6 people in the family. 1-2 neighbours per day request charging batteries. Improved quality of life and access to energy while he needs it.**
Number of women and girls being benefited.	**100 women.**	**1 woman.**	**4 women in family.**
In the absence of current use for energy from SWES what would be primary fuel being used?	**Diesel motor generator to charge batteries. Grid connection is very bad as in summer time energy is given only for water pumping. In winter time there is no grid connection.**	**Charged manually as soon as he stops it was no energy. Per day it took 2-3 h.**	**Charged batteries by diesel generator. As he know owner it was done for free.**

Visit to Sinhung-ri (27 June 2012)		
Questions	**Household 1. Worker from forest Management enterprise Mr. Kim Han Ho**	**Management Office of Sinhung-ri Manager Mr. Jong Myong Hak**
SWES Commissioned	**January, 2012**	**November, 2011.**
Overall SWESS working condition	**Functional. Batteries were charged and its work has been demonstrated.**	**Functional.**
Capacity of batteries	**China. 60 Ah/ 12V**	**China. 80 Ah/ 12 V**
Capacity of rectifier	**Made by himself: 400W, 12 V**	**Local production: 400W, 12 V**
Total connected load to SWES	**2 bulbs, TV and DVD, Amplifier, karaoke**	**3 bulbs, telephone Exchange Machine, Sound Equipment.**
How many hours these connected load used per day in hours?	**7h during 7 days**	**4h per day.**
Capital Cost of SWES	**250 USD**	**250 USD**
Annual Maintenance cost	**n/a**	**Painting wooden blades by him.**
Number of people with access to energy service and investments mobilized due to SWES installation.	**3 people; amplifier and karaoke. In addition 20 neighbouring families ask him to charge their small batteries, torches. He does it for free.**	**20 subscribers for telephone service and 5 broadcasting points linked to sound cable allowing serving 300 households of the ri and in total approximately 1200 people.**
Number of women and girls being benefited.	**3 and 2.**	**50% of population is women and girls.**
In the absence of current use for energy from SWES what would be primary fuel being used?	**Used candles and had no regular TV. Access to grid from spring to autumn occasionally and almost no grid access in winter time. Candles costs were 1.6 USD per month.**	**3 kg of diesel per day for charging batteries.**

Visit to Rimmyong-ri (28 June 2012)		
Questions	**Household 1** **Farmer Mr. Pak Man Baong**	**Household 2** **Farmer Mr. Kim Hak Chol**
SWES Commissioned	**October, 2006**	**July, 2007**
Overall SWESS working condition	**Functional. Once change blade.**	**Functional. Once change blade.**
Capacity of batteries	**180 Ah/12 V. Very big locally made batteries.**	**130 Ah/h. China.**
Capacity of rectifier	**Convertor made in China. 500W, 12-220 V.**	**Convertor made in China. 500W. 12 -220V.**
Total connected load to SWES	**3 bulbs, TV, DVD, type recorder, 2 torches.**	**2 bulbs, TV, DVD, torch.**
How many hours these connected load used per day in hours?	**Charging time is 6-7 h. Wind always available and only 2-3 h per day is still period.**	**It was recognized that previously this question was translated wrongly and we collected data on charging time. Used 20h per day. Charging time 6-7h. It should be noted that in all other previous interviews it was charging time. Due to experts it can work from 15-20h depending on size of battery.**
Capital Cost of SWES	**300 USD.**	**300 USD**
Annual Maintenance cost	**5 USD.**	**5 USD.**
Number of people with access to energy service and investments mobilized due to SWES installation.	**4 people. Fell that quality of life is improved. Neighbours ask to charge small batteries and torches – approximately in winter time 5 people per day and in summer time 2 people.**	**4 people. Improvement of livelihood. Per day 3-4 neighbours ask to charge small batteries and torches.**
Number of women and girls being benefited.	**1 woman.**	**1 woman.**
In the absence of current use for energy from SWES what would be primary fuel being used?	**Before used carbide candles – approximately 3 USSD/Month, but restricted access to TV as very bad connection to the grid.**	**Before used oil for light. Approximately 120 grams per day.**

Annex E Project Institutional Set-up

The following diagrams reflect the institutional arrangements for SWEDPRA at project start (2005) and after resumption (2010).

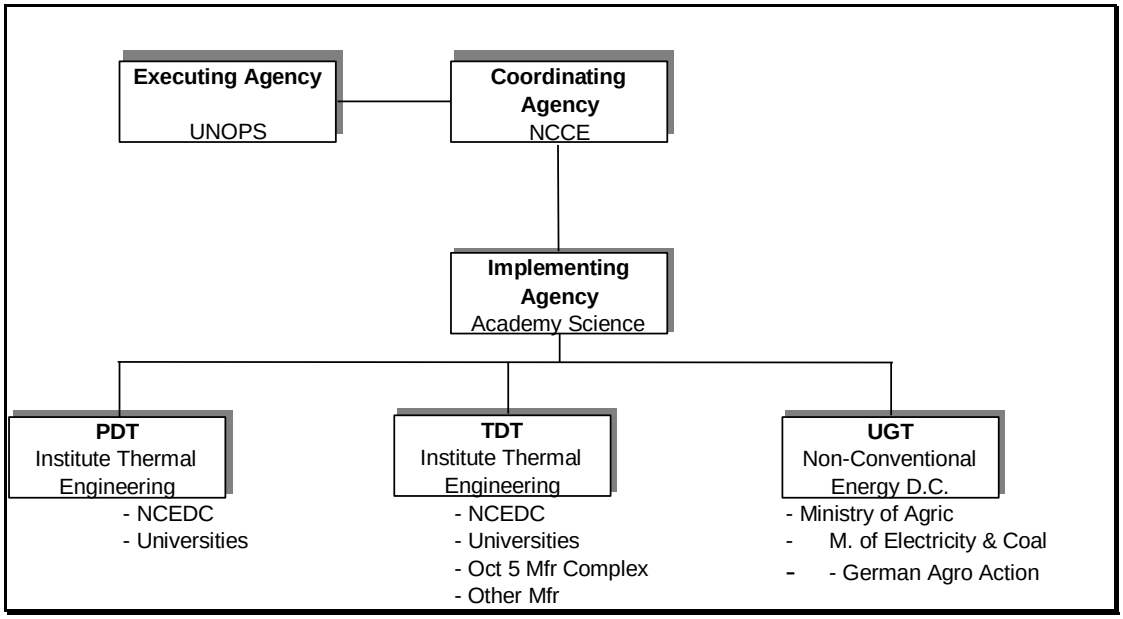

Figure 2. SWEDPRA institutional setup ProDoc 2005.

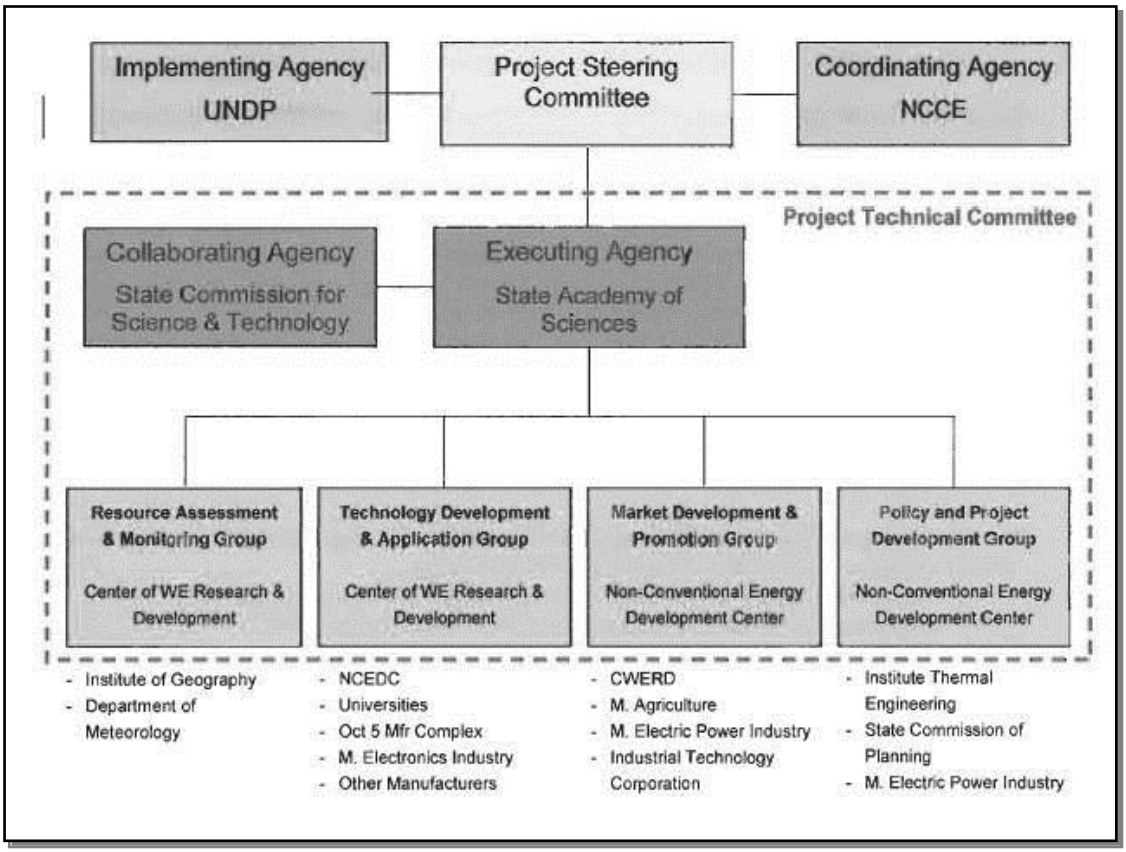

Figure 3. SWEDPRA institutional setup ProDoc 2010.

Annex F Expenditures as of 9 November 2012

UNDP 76431 – PIMS 751 CC MSP – SWEDPRA																	
Data from CDR by Activity with Encumbrance																	
		TOTAL (%)		**TOTAL**		**2013**		**2012 (partial)**		**2011**		**2007**		**2006**			
ATLAS budget code (category)		**UNDP**	**GEF**	**UNDP**	**GEF**	**UNDP**	**GEF**	**UNDP**	**GEF**	**UNDP**	**GEF**	**UNDP**	**GEF**	**UNDP**	**GEF**		
		04000	62000	04000	62000	04000	62000	04000	62000	04000	62000	04000	62000	04000	62000		
		(%)	*(%)*														
712xx	International Consultants	0%	8%	**0.00**	**58,536.65**				37,411.99				468.92		20,655.74		
714xx	Service Contracts								4,075.00								
716xx	International Travel	0%	3%	**0.00**	**23,722.86**				12,141.13						11,581.73		
721xx	Consultant	0%	7%	**0.00**	**47,288.79**				3,085.47		35,168.14				9,035.18		
722xx	Machinery and Equipment	**61%**	**14%**	**91,952.13**	**100,618.91**			21,467.00	697.56					70,485.13	99,921.35		
723xx	Other material and Goods	0%	**15%**	**0.00**	**111,781.90**				111,781.90								
727xx	Hospitality	0%	0%	**0.00**	**324.74**						324.74						
735xx	Supplier Services	0%	0%	**304.86**	**1,062.96**									304.86	1,062.96		
741xx	Capacity assessment	0%	1%	**0.00**	**10,000.00**								-0.01		10,000.01		
745xx	Miscellaneous	**5%**	**12%**	**7,408.56**	**89,189.42**			1,115.36	1,184.09	630.00	411.88		-4,527.12	5,663.20	**92,120.57**		
757xx	Learning	1%	8%	**1,259.39**	**61,164.14**				24,060.26	1,259.39	37,103.88						
761xx	Realized loss	0%	0%	**0.00**	**7.45**				7.45								
634xx	Learning Costs	0%	3%	**0.00**	**24,754.07**										24,754.07		
	Subtotal	**67%**	**73%**	**100,924.94**	**528,451.89**	**0.00**	**0.00**	**22,582.36**	**194,444.85**	**1,889.39**	**73,008.64**	**0.00**	**-4,058.21**	**76,453.19**	**269,131.61**		
						REMAINING		**end YEAR 4**		**end YEAR 3**		**end YEAR 2**		**end YEAR 1**		**PROJECT START**	
						UNDP	**GEF**	**UNDP**	**GEF**	**UNDP**	**GEF**	**UNDP**	**GEF**	**UNDP**	**GEF**	**UNDP**	**GEF**
						49,075.06	**192,473.11**	**49,075.06**	**192,473.11**	**71,657.42**	**386,917.96**	**73,546.81**	**459,926.60**	**73,546.81**	**455,868.39**	**150,000.00**	**725,000.00**

*) All amounts in US$.

Annex G Photographs[126]

Vertical drill machine, CNC lathe and CNC drill machine installed at the SAOS/CWERD manufacturing workshop.

Manual drill equipment.

Control panel of the CNC vertical drill machine.

[126] Please note at the time of taking these photographs, the machines were not all provided yet with the applicable UNDP and GEF logos, and the appropriate safety information. This situation has been corrected.

Commercial 5-kW wind turbine as part of a hybrid (wind-PV) electricity backup system for the hospital at Unjong County.

Annex H Tentative Workplan and Budget SWEDPRA Exit Strategy

The following table provides a tentative breakdown of the inputs to implement the proposed exit strategy for SWEDPRA.

SWEDPRA EXIT STRATEGY – TENTATIVE LIST OF INPUTS AND COSTS					
(1-a) Consolidation of wind resource measurement and data analysis capacities					
Wind Energy Resource Assessment (SRF 1)	continued wind measurements and data analysis conform MEASNET standards, with technical backstopping by international consultant				
		US$	budget line		
	international consultant	7,500	71200		
	local consultant	5,000	72100		
	hardware (wind measurement sensors)	5,000	72200		
	subtotal	**17,500**			
(1-b) Secure the development of the CWERD "modern" 300 W wind turbine					
SWES Design Improvement (SRF 4)	determination of load curve, energy production test and long-term energy production according to agreed test protocol at the CWERD test field				
		US$	budget line		
	international consultant	10,000	71200		
	consultant	5,000	72100		
	other materials	2,500	72300		
	hardware (data loggers and accesories)	5,000	72200		
	subtotal	**22,500**			
(2) Installation and demonstration of tested 300 W model at five manufacturing workshops					
SWES Technology Demonstration (SRF 6)	installation and promotion of the developed and successfully tested CWERD "modern" 300-W SWES at the premises of the five identified manufacturing workshops in the rural areas				
		US$	budget line		
	consultant	5,000	72100		
	promotion material	5,000	74500		
	subtotal	**10,000**			
(3) Procurement and installation of mature SWES technology for selected end-users					
	procurement and installation of foreign SWES systems for selected end-users, such as rural cooperatives , community buildings, medical posts, and households				
		US$	budget line		
SWES Technology Demonstration (SRF 6)	international consultant	15,000	71200		
	consultant	5,000	72100		
	other materials and goods	10,000	72300		
	equipment (wind turbines, batteries, invertors, solar PV back-up, etc)	85,011	72200		
	subtotal	**115,011**			
TOTAL		**165,011**			

Annex I Comments by Stakeholders