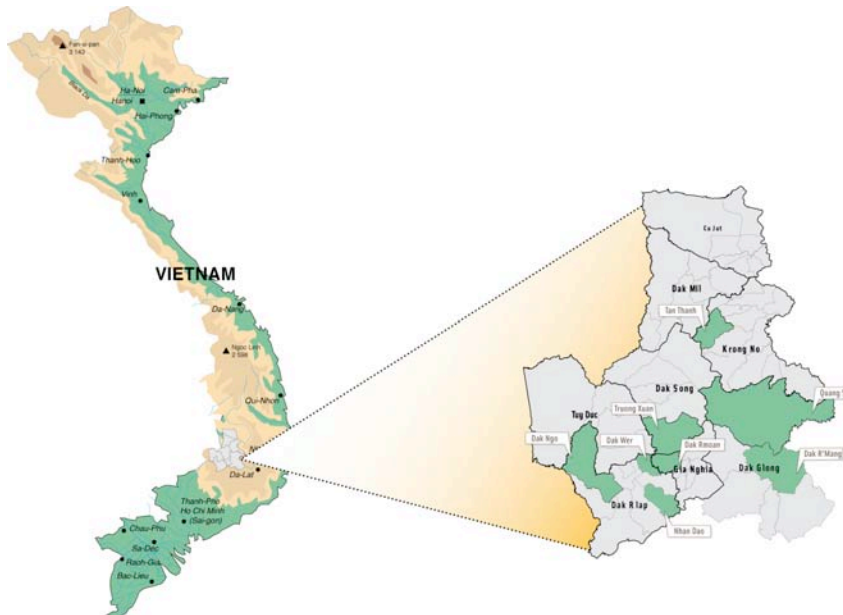


RESIREA

Renewable Energy Sustainable Programs for Intelligent Rural Electrification and Poverty Alleviation



Green electricity for 1 800 families in Dak Nong Province

European technical partners:



Local partner in Vietnam:



Financing partners:



DG Tren Programme Coopener



SYNTHESIS

The Programme “Green electricity for 1 800 families in Dak Nong Province” will give the access to electricity to 8 000 people, scattered in 26 villages identified in 8 communes of 6 districts in Dak Nong Province.

The following table presents an overview of the Programme:

| <i>Target Province</i> | <i>Nb of target villages</i> | <i>Nb of beneficiaries</i> | <i>Nb of domestic customers</i> | <i>Technologies adopted and capacity installed</i> | <i>Investment cost</i> | <i>Tariff rate</i> | <i>Nb of tons of CO2 avoided</i> |
|------------------------|--|----------------------------|---------------------------------|---|------------------------|----------------------------------|----------------------------------|
| Dak Nong | 26 (in 8 communes in 6 districts of the province) | 8000 | 1800 | 4 types of solar home systems , from 50 Wp to 600 Wp | 1 200 000 € | Users purchase equipments | 3145 over 20 years |

In Vietnam, the high commune electrification rate hides that some households from remote and sparsely populated areas are not foreseen for connection to the national grid.

The Programme aims to tackle this issue: 1 800 customers (households) will benefit from a sustainable electricity access, based on clean energies and at a lower cost than their traditional energy expenses (petrol lamps, candles, batteries, etc.).

CONTEXT

The Programme fits in the national strategy:

- to increase electrification of remote and rural communities;
- to promote the use of local renewable energy potentials in Vietnam;
- to improve living conditions of ethnic minorities.

In partnership with the Ministry of Industry and Trade (MIT), this Programme has been elaborated from 2007 up to 2009 in the frame of a European project called RESIREA, which associated the following partners:

- The Fondation Energies pour le Monde, in France;
- The Fraunhofer Institute for Solar Energy, in Germany;
- The Center for Agronomical Research of Wallonie, in Belgium.

The 1 800 households, scattered in 26 priority villages and well-disposed toward sustainable off-grid renewable-energy based electrification, were selected through the NORIA method. This expert tool, developed by the Fondation, is based on in-depth analysis of the local contexts, in partnership with the Provincial Authorities, the Communes People’s Committees and the Vietnamese association RERD.

MARKET ANALYSIS

Within the objectives of the Programme to supply families deprived of the national grid electrification, the whole market analysis only focused on households demand. During the households surveys, the current domestic electricity demand was identified.

Energy demand analysis:

The domestic energy demand has been segmented into 4 levels of services, using low-consumptions appliances. The estimated potential domestic market is as follows:

| | Applications | Number | Daily use (hours) | Power consumption (kWh/month) | % of the households | Potential domestic user customer base |
|------------------------|---------------------|--------|-------------------|-------------------------------|---------------------|---------------------------------------|
| Service level 1 | Lighting | 2 | 3 | 3,6 | 60% | 1080 |
| | Radio / tape | 1 | 2 | | | |
| Service level 2 | Lighting | 2 | 4 | 7,95 | 30% | 540 |
| | Radio / tape | 1 | 3 | | | |
| | Small color TV | 1 | 2 | | | |
| Service level 3 | Lighting | 3 | 4 | 14,4 | 9% | 162 |
| | Night light | 1 | 2 | | | |
| | Radio + Tape player | 1 | 2 | | | |
| | Hi Fi system | 1 | 0,5 | | | |
| | Medium color TV | 1 | 2,5 | | | |
| | DVD | 1 | 1,5 | | | |
| Service level 4 | Lighting | 4 | 5 | 48 | 1% | 18 |
| | Night lamp | 1 | 5 | | | |
| | Hi Fi system | 1 | 1,5 | | | |
| | Large color TV | 1 | 4 | | | |
| | DVD | 1 | 2,5 | | | |
| | Fan | 1 | 0,5 | | | |
| | Fridge | 1 | - | | | |
| | TOTAL | | | | | |

From the data on the population's capacity to pay and the feedbacks from local actors, the initial electrification rate of the households has been projected at 90%. The global energy consumption would be as the following:

| | Unit energy demand (kWh/month) | Number of customers | Total energy demand (kWh/month) |
|---------------------|--------------------------------|---------------------|---------------------------------|
| Service 1 | 3,6 | 974 | 3506 |
| Service 2 | 7,95 | 490 | 3896 |
| Service 3 | 14,4 | 145 | 2088 |
| Service 4 | 48 | 16 | 768 |
| TOTAL DEMAND | | 1625 | 10 258 |

TECHNICAL OPTIONS ADOPTED

The target population of the Programme is made of scattered households, located in remote areas and difficult to access. Therefore, only individual production options, solar home systems (SHS) and pico-hydro systems, could be considered for the electrification of the target populations.

A favourable solar potential, with an average irradiation of 4.2 kWh/m².day has led to the selection of solar home systems for all the target families. For few households, pico-hydro systems may be interesting. However, considering the few number of possible sites and the low investment cost and technical specifications, it was considered that this option could be developed in parallel with the Programme, at the initiative of the households or local authorities.

| Year | Capacity of the modules (Wp) | Number of customers | Total capacity installed (Wp) |
|-----------------|------------------------------|---------------------|-------------------------------|
| Service Level 1 | 50 | 974 | 48700 |
| Service Level 2 | 100 | 490 | 49000 |
| Service Level 3 | 200 | 145 | 29000 |
| Service Level 4 | 600 | 16 | 9600 |
| TOTAL | - | 1625 | 136 300 |

OPERATIONAL SCHEME

The orientation proposed in the Programme is based on the purchase of the equipments by the customers, with a financial and technical support from various partners. The option of a fee-for-service approach implemented by a private operator has not been considered as suitable because the dwellings are scattered.

Thus, the customer will contribute to the initial investment cost and will be then the owner of the whole solar home system. The supplier of the equipments will train the customer to a safe and sustainable management of the electricity system, and will sign a maintenance contract.

A local association will be associated to the project to facilitate and coordinate the implementation of the Programme.

ESTIMATION OF INVESTMENT AND RUNNING COSTS

Initial investments

The initial investment cost includes the SHS equipments, the installation and spare parts. It takes in the customs charges, VAT and maintenance contract.

The figures presented below give an overview of the global Programme cost.

| Service Level | INVESTMENT COSTS | |
|---|--|--------------------------------|
| | Total investment costs per SHS per service level | Total initial investment costs |
| Service Level 1 | \$600 | \$584 400 |
| Service Level 2 | \$1 200 | \$588 000 |
| Service Level 3 | \$2 400 | \$348 000 |
| Service Level 4 | \$7 000 | \$112 000 |
| TOTAL Investment Cost of the Programme | | \$1 632 400 |

Running costs

Each customer being the owner of its SHS, he will be in charge of the proper maintenance and the renewal of its equipments.

| RUNNING COSTS – Total provision per year per customer | | | |
|--|--|--|--|
| <i>Service Level</i> | Equipment renewal costs per year per customer | Maintenance costs per year per customer | Total provision for running costs per year per customer |
| Service Level 1 | \$53 | \$25 covering: * 5\$ for consumables *20\$ for Supplier's visits | \$78 |
| Service Level 2 | \$105 | | \$130 |
| Service Level 3 | \$201 | | \$226 |
| Service Level 4 | \$385 | | \$410 |
| Average annual provision for running costs per customer | | | \$110,2 |

The cost of maintenance of the system fits the average energy expenditure of connected households by abandoning their traditional energy practices (candles, oil, batteries) in favour of electricity from renewable sources.

| | |
|---|----------------|
| Average annual equipment renewal and maintenance costs per customer | \$110,2 |
| Average annual substitutable energy expenditures per household | \$112,8 |

ECONOMICAL ANALYSIS AND FINANCING PACKAGE**Analysis of the ability to pay the initial investment cost:**

The ability to pay for the initial investment reported by the surveyed households is given in the following table. As an indication, the initial cost of the SHS per level of service is also provided.

| | Service 1 | Service 2 | Service 3 | Service 4 |
|---|------------------|------------------|------------------|------------------|
| Amount that households are ready to pay to contribute to the initial investment | \$237 | \$563 | \$975 | \$1 083 |
| Initial investment cost | \$600 | \$1 200 | \$2 400 | \$7 000 |
| Ratio | 40% | 47% | 40% | 15% |

Contribution to initial investment:

Regarding the results of the previous section, the following contributions are proposed, bearing in mind the ability to pay of the families and the electrification rate objectives set for each category of domestic user:

| | Unit investment cost (\$) | Contribution of the customer (\$) | Ratio |
|------------------------|----------------------------------|--|--------------|
| Service level 1 | \$600 | \$100 | 17% |
| Service level 2 | \$1 200 | \$250 | 21% |
| Service level 3 | \$2 400 | \$550 | 23% |
| Service level 4 | \$7 000 | \$1 600 | 23% |

The total contribution expected from the customers is thus **\$326 480, which accounts for 20% of the total investment cost.**

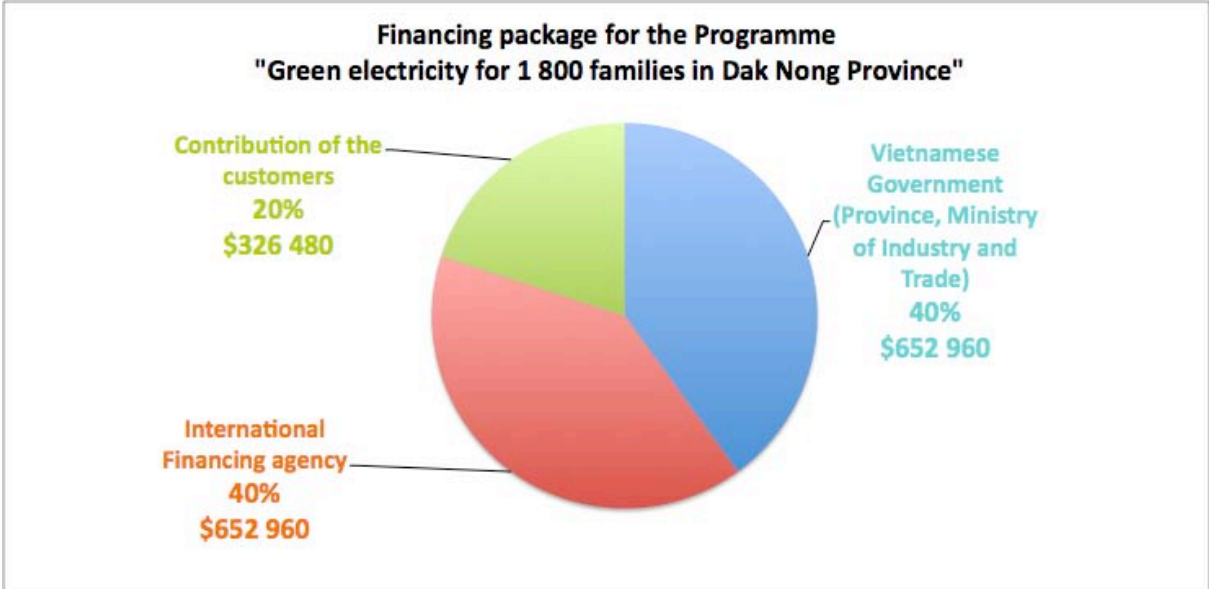
Financing the initial investment for the whole Programme:

Based on the previous results and discussions held with the Province’s authorities (People’s Committee, Department of Industry, Department of Science and Technologies), a suitable trade-off between international subsidies, contribution of the customers and subsidies from the Vietnamese government has been found out.

It is presented in the table below:

| | Financing package | |
|--|-------------------|-----------------------|
| | Allocation | Amount to be financed |
| Subsidy from the Vietnamese Government | 40% | \$652 960 |
| Subsidies from international agencies | 40% | \$652 960 |
| Contribution of the customers | 20% | \$326 480 |
| Total | 100% | \$ 1 632 400 |

The financing package for the global programme is given by the following graph.



EXPECTED IMPACTS

| | | |
|-----------------------------|--|---|
| Social impact | The short- and medium- term impacts of the access to electricity | <i>Provide clean energy to the population</i> |
| | Improving living conditions of ethnic groups | <i>Enhance education, health and the emergence of revenue-generating activities</i> <i>Kinh, M’Nong, Tay and Ede are the main ethnic groups of Dak Nong. The Programme largely targets these ethnic groups since they live in what has been defined as priority areas.</i> |
| Environmental impact | CO2 emissions avoided | <i>3 145 tons avoided over 20 years</i> |