

## INTERNATIONAL EXPERIENCE ON PRODUCTIVE USE OF ELECTRICITY IN RURAL AREAS



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## 1. BACKGROUND

The Area 6 component of the VSRE programme comprises awareness promotion of productive use of electricity in rural areas of Vietnam. Terms of Reference and scope of work have been agreed with the MOIT, Sida and the World Bank office in Vietnam. In contrast to other parts of VSRE, this component does not only focus on off-grid electricity supply but on distribution and use of electricity in rural areas in general.

The scope of work includes fact-finding and review of lessons learnt through a desk review on international experience of productive use, as well as field missions in six provinces, with the objective to identify and document case studies of productive use.

This paper summarises international experience on promotion of productive use of electricity in rural areas, both in Vietnam and in other countries. The study is primarily based on a review of reports and other documents from multilateral development banks and organisations, in combination with information from some bilateral donors and NGOs. The objective and scope is not to make a comprehensive description of international projects and engagements, but rather to briefly conclude key findings and lessons learnt. This will serve as inputs for design of awareness promotion material, which will be produced through Area 6 and disseminated through intermediary public organisations and other parties.

## 2. PRODUCTIVE USE

The concept “productive use” of electricity is usually defined as use in income generating activity, i.e. some kind of enterprise regardless of size in terms of investment or number of employees.

Electricity can obviously also be used for household consumption and public purposes, which indirectly (e.g. through lighting) can improve general conditions also for business activities. The focus here is still on direct applications of electricity in economic activities which generate income.

The use of electricity (or other forms of commercial energy) in the processing of raw materials and/or production of goods or services which can be sold on a market is stated to enhance productivity, increase cash income and improve living conditions from an economic and social point of view.

## 3. REVIEW OF INTERNATIONAL EXPERIENCE

3.1 UNIDO underlines in its paper “UNIDO Initiative on Rural Energy for Productive Use” (20) from 2002 the importance of promoting income generation through productive

uses as a means for rural development and poverty alleviation. Rural energy projects should therefore include components addressing income generating activities. Emphasis on productive use will contribute to the development of small, medium and micro enterprises dealing with e.g. food processing, water pumping, etc. Funding from GEF, UNDP and bilateral donors is used to co-finance UNIDO projects, but income generating activities are not eligible for funding by GEF. Establishment of a UNIDO trust fund for rural energy is suggested, which potentially could solve this issue.

**3.2** The GEF/FAO workshop in 2002 on productive uses (6) summarises lessons from cases of productive use.

- Productive use has not been adequately dealt with by rural energy projects in the past, but is now high on the agenda of many development agencies.
- Productive use projects should be treated as sector development projects rather than energy projects. Project set-up with development sector authorities supported by energy experts and participation by beneficiaries is suggested.
- Productive use projects should be “market demand pulled” rather than “energy technology pushed”, hence starting with demands for products and services.
- Sustainability and replication in productive use applications are critical issues.
- Entrepreneurship is a key element for productive use and income generation, sometimes more important than technical skill. Public agencies need to support entrepreneurship and facilitate access to micro-credits and other funding.
- Lack of access to cash markets limits the success of productive use projects. Small producers in isolated rural areas cannot access necessary markets, and hands-on support to solve this issue is needed.
- More fact-finding and analysis is needed on productive use applications. Sharing of experience: case studies, lessons, impacts of productive use, information on applications and technology choice, operation and maintenance.
- Guidelines and practical advice should be provided to target groups preparing for productive use. Demonstration of alternative business models is suggested, including cooperatives, franchising, privately owned enterprises, etc.

**3.3** A study published 2005 by the Asian Institute of Technology (AIT) on productive use (1) underlines the important role of small (S), medium (M) and micro enterprises (ME) in the economies of developing countries. MEs which often are home-based and with few employees and limited access to capital account for a third or more of the total labour force in low-income countries. Promotion of SMME is therefore an important part of economic development and poverty alleviation.

- Production levels and quality of manufactured goods are generally low. Energy access can provide new opportunities for SMME to develop, diversify and improve quality, hence increasing income and employing more people.
- Energy per se will not lead to establishment of new enterprises and alleviation of poverty. It is linked with factors of rural development, market demand and access, infrastructure and entrepreneurship.

- Benefits include improved productivity (e.g. longer working days due to lighting), increased value of the products (e.g. due to refrigeration) and reduced energy costs due to higher efficiency of electricity.
- Barriers could be of financial nature (lack of savings or micro-finance), information and awareness (reluctance to change old methods for modern technology) institutional and technical (know-how to acquire equipment, operation and maintenance).
- Success factors comprise access to markets, reliability and quality of electricity supply, access to soft micro-credits and other banking facilities, stable supply of raw materials, transportation infrastructure, entrepreneurship, training and other forms of capacity building to promote new business, knowledge on demonstration projects.

**3.4** A guideline on renewable energy for micro enterprises (12) published by the U.S. National Renewable Energy Laboratory in 2000 lists enabling factors for productive uses.

- Support to entrepreneurs in purchasing equipment for productive use.
- Availability of tools and machines.
- Training and other services.
- Reliable and affordable electricity supply.
- Credit facilities for fixed assets and working capital.
- Human resources.
- Market for increased quality and production.
- NGOs can be helpful in supporting entrepreneurs.

**3.5** A project paper on rural off-grid electrification in Nicaragua (16), published by the World Bank in 2001, addresses issues and lessons in connection with productive use.

- Traditionally, rural electrification, micro-finance and micro/small business development have been pursued separately, reflecting sectoral divisions within development institutions and governmental organisations. The paper instead outlines the first WB project where these three elements are combined, with the objective to develop productive use through private sector businesses.
- According to WB findings, electricity is a necessary condition for many productive uses, but it is not sufficient for development. Many projects have failed to pay sufficient attention to inputs other than energy.
- Electricity can be used to increase the productivity of rural businesses, generate higher incomes and improve ability and willingness to pay for electricity, thus ensuring sustainability of electricity services.
- Examples on productive use: water pumping for irrigation, drilling, sawing, milling, refrigeration, ice making, battery charging, etc.
- Micro and small business in rural areas tend to sell their products and services to low-income local customers. Business development support can assist in finding new customers and designing and producing new products with adequate quality to these new customers. Training, consulting and advisory services are provided to business owners.

- Experience from Asia shows the importance of micro-finance facilities at soft terms. Choice of partners for such services is essential to secure sustainability and genuine business interest.

**3.6** A survey on productive use in rural areas (17) published by the World Bank in 2003 identifies a number of projects with practical experience and lessons.

- Sample studies in the Philippines and India confirm the correlation between income generating activities and electricity supply, provided other conditions (e.g. transport, business climate) are on place.
- More than 900 cases from India comprise flour and oil mill, brick mill, stone crushing, irrigation pumping, carpentry, blacksmith, etc.
- A WB/GEF survey in Sri Lanka showed that 20 % of households used electricity for income generating activities. Unclear definition and individual perception of activities and income generation may affect the figures.
- A UNDP programme on rural energy in Nepal addressed income generation with positive results. Training was one of the inputs to promote establishment of bakeries, agricultural processing mills, sawmills, production of incense sticks, etc. More than 80 % of the trainees started some business.
- A conclusion is that income generating activities can be promoted, in combination with micro-credits and through organisations with strong community links.
- Reference is made to a WB project in Bolivia and a GEF project in Brazil, which both includes development of productive uses.
- Productive use development must be based on demand-pull rather than technology-push.
- Other conditions (apart from energy supply) for small businesses include knowledge and skill on how to use electrical and motive power in business activities, technical and management capacity, availability of micro-credits, institutional environment for business development, access to markets for new products available as a result of electricity being supplied, other infrastructure such as transport.

**3.7** An initial poverty and social assessment (IPSA) of a new ADB project in Vietnam (13) regarding renewable energy for remote islands and mountain communes has recently become available. The paper states that ADB's country strategy is aimed at reducing poverty through promoting pro-poor, business led economic growth. Provision of basic infrastructure is one of the pre-requisites for development. The proposed project will include a special feature to support productive use of energy.

**3.8** The Australian Business Council for Sustainable Energy published a report (14) about Vietnam in 2005. This paper presents an interesting overview and some key figures.

- 30 % of the population is considered to be below the poverty line.
- Rural population connected to the grid often receives a low quality of services, including low voltage and poor reliability.
- Per capita electricity consumption is amongst the lowest in Asia.

- Increased access to electricity is part of the strategy to reduce rural poverty.
- More attention is given to demand-side, including promotion of productive use.

**3.9** A workshop (18) organised by the APEC working group in 2004 presents relevant conclusions and lessons from various case studies on productive use.

- The focus of village power initiatives must be social and economic development, and not just on energy per se.
- Modern energy services are an essential element of infrastructure services needed for development. Development should be integrated with other sectors.
- By linking and integrating energy with productive uses, it is possible to support activities that improve productivity, increase incomes, enhance economic opportunities, etc.

**3.10** A study on the impacts of rural infrastructure in Vietnam (2) by the WB and Columbia University, published in 2002, summarises WB experiences in other countries.

- In India, electric water pumps were used for irrigation which led to more productive farming and move to higher yield crops.
- Common constraints in many countries are lack of access to credits for start-up and extremely low income levels. Lessons from Indonesia show that these factors may prevent the poor from benefiting from electricity supply. Expected benefits of electricity for certain productive uses could in such cases be overestimated. General conditions for development of economic activities must obviously also be met.
- An evaluation by USAID of rural electrification in Bangladesh shows effects in the form of increased income, lower rate of poverty, increased agricultural productivity, increased off-farm income and increased working hours and rate of commercial activities.

**3.11** A study on access to rural electrification (3), published by the WB in 2000, concludes the following.

- Modern forms of energy are a necessary input for economic development. However, access to improved forms of energy is not a sufficient condition for development. Poor people require energy for many different tasks (lighting, cooking, mechanical power, heating, cooling and communication) and multiple fuels. Electricity supply is not sufficient to match all forms of demand..
- Affordability and willingness to use cash income to pay for modern energy services is correlated with productive use activities.
- The state has an important role in providing an enabling environment for private sector investments in economic activities.
- The need for supplementary infrastructure includes roads, markets, buildings,, equipment, skilled staff, etc.
- Micro-credit schemes are well developed in Asia and in Vietnam the example of the Women's Union's work is mentioned.

- An FAO study is quoted, where it says that it is necessary to go beyond the light bulb to have an impact on income generation. Lighting can still generate positive effects for small scale business, e.g. more working hours, better efficiency and quality of work, better working environment and better security.
- Some recent UNIDO/GEF projects in Asia have been designed to focus on income generating uses of renewable energy. One project in the Philippines has identified opportunities for economic productive uses of renewable energy services.

**3.12** A paper on energy for the poor (4), published by DFID in the UK in 2002, concludes as follows: No country has substantially reduced poverty in modern times without massively increasing the use of energy, replacing human and animal labour. Energy facilitates increased productivity and income generation through improved agricultural development (irrigation, crop-processing, storage, access and transport to markets, communication) and through non-farm activities and micro-enterprises. Emphasis on productive uses of energy services is important.

**3.13** An article in World Power (5) in 2000 emphasises demand side aspects. Economic and social impacts of rural electrification are getting more attention by the WB and other development organisations. Productive uses of electricity also have positive effects on ability to pay tariffs and hence secure sustainability of the distribution company. Development of productive uses also requires awareness, training, micro-credits, etc. Reference is made to the Vietnam Women's Union and the Vietnam Bank for Agriculture and Rural Development which manage micro-credit schemes.

**3.14** An ESMAP/WB paper on productive uses of energy for rural development (9) from 2005 presents some lessons learnt.

- Although energy is a necessary condition for rural development, it is insufficient by itself to bring about the desired socio-economic impact.
- Electric-powered farm equipment has tremendous benefits for rural farm incomes. Water pumps, fodder choppers, threshers, grinders and dryers are some examples.

**3.15** A review of projects on productive uses of renewable energy in developing countries (10) presents a list of case studies.

- Food production and storage: water pumping, electric fences, aeration pumps, refrigeration, ice making, etc.
- Food processing: grain processing, grain milling, lighting, etc.
- Materials processing: gypsum processing, saw mills, etc.
- Cottage industry: brick making, carpentry, repair shops for electronics, handicraft, sewing, welding, wood working, bakeries, etc.
- Drinking water: desalination, pumping, etc.

**3.16** A report on role renewable energy for productive uses in rural Thailand (15), published by AIT in 2006, underlines the importance of identifying the activities that most

benefit the development of local communities. Traditions, know-how and locally available resources must be considered. Local communities should be directly involved in this process of identifying local needs.

**3.17** A paper (19) on UNIDO's views on sustainable development at the World Summit in 2002 states as follows.

- UNIDO will promote domestic entrepreneurship and in particular development of the entrepreneurial skills of disadvantaged groups.
- Development of agro-based enterprises contributes to poverty reduction while at the same time enhancing productivity.
- Building up and strengthening productive capacities through development of SMEs takes a central role.
- UNIDO will promote programmes in Asia oriented towards development of SME enabling framework and institutional support, cluster development, rural and women's entrepreneurship development, infrastructure for agro-industries and capacity building in new technologies to enhance productivity.

#### **4. SUMMARY OF INTERNATIONAL EXPERIENCE**

- i. No country has been able to reduced poverty in modern times without massively increasing the use of energy, replacing human and animal power. Energy can facilitate increased productivity and income generation through improved agricultural development (irrigation, crop-processing, storage, access and transport to markets, communication) and through non-farm activities and micro-enterprises.
- ii. Promotion of increased productive use can be addressed either from the point of view of **energy supply** or from the perspective of **economic development**. The second option is clearly preferred by international development actors.
- iii. Programmes on rural electrification, implemented by representatives of the energy sector and financed by international banks and other sources, often include a component to increase electric demand and hence income (and viability) of distribution companies. The responsibility and incentive for activities to promote economic activities (i.e. productive use) and increase demand often rests with the distribution company, particularly if this belongs to the private sector and operates under market conditions.
- iv. The alternative perspective is to regard electricity supply and increase of demand via productive use in economic activities as a tool and condition for economic development. Management and implementation of such activities often rests with authorities responsible for e.g. rural economic development, rather than with energy sectoral authorities. Focus is here on establishment and development of micro-, small and medium enterprises, household income levels and living

standards, employment and economic development rather than electricity demand and consumption as such.

- v. Promotion of productive use with the objective to stimulate economic development should go hand in hand with activities and instruments to support establishment and/or development of enterprises. This requires cooperation with many actors and provision of other conditions for entrepreneurship and business (e.g. micro-credits, bank loans, infrastructure, access to markets, raw materials, training, etc.).
- vi. Practically all identified documents from development organisations, banks and experts quote declarations of interest in productive use and the importance of more efficient programmes for cross-sectoral programmes to generate more efficient effects on productive use. UNIDO, UNDP, FAO, ESMAP, GTZ and ADB are some examples of development organisations that show interest in these matters.
- vii. Reports and documents on international experience include projects addressing promotion of productive uses. Still, more fact-finding and analysis is needed on productive use applications. The need for sharing of experience is emphasized, comprising case studies, lessons, impacts of productive use, information on applications and technology choice, operation and maintenance. Guidelines and practical advice should be provided to target groups preparing for productive use.
- viii. A key success factor for promotion of productive use is sustainability. Short-term and project related activities tend to be less effective. Continuous presence and dialogue with households, other investors and entrepreneurs is required to generate concrete and measurable effects. This kind of engagement must be planned for, responsibility be defined and funding be secured. Dissemination of information materials is not sufficient to meet the objective to generate tangible and sustainable results.
- ix. Energy per se will not lead to establishment of new enterprises and alleviation of poverty. It is linked with factors of rural development, market demand and access, infrastructure and entrepreneurship. Productive use development must be based on demand-pull rather than technology-push.
- x. Other conditions (apart from energy supply) for small businesses include knowledge and skill on how to use electrical and motive power in business activities, technical and management capacity, availability of micro-credits, institutional environment for business development, access to markets for new products available as a result of electricity being supplied, other infrastructure such as transport.
- xi. Success factors comprise access to markets, reliability and quality of electricity supply, access to soft micro-credits and other banking facilities, stable supply of raw materials, transportation infrastructure, entrepreneurship, training and other

forms of capacity building to promote new business, knowledge on demonstration projects.

- xii. Promotion of awareness regarding the benefits and examples of productive use has to address clearly identified target groups. Individual households in rural areas are one possible target group, cooperatives and existing small scale enterprises are another.
- xiii. It is also important to address the target group comprising authorities in central ministries, provinces, districts and communes, as well as public organizations such as Women's Union, Farmers' Association, Youth Union, etc. A fourth target group is donors, foreign NGOs and development organisations. These target groups can provide micro-financing programmes, training, infrastructure improvements, facilitation of market access, mentorship and advisors for new enterprises, etc.
- xiv. Examples on productive use includes:
  - Food production and storage: water pumping, refrigeration for storage, ice production, etc.
  - Food processing: milling, etc.
  - Materials processing: saw mill, gypsum processing, etc.
  - Small scale industry: bakery, brick making, carpentry, electronics repair, handicraft production, sewing, welding, wood working, workshops, etc.
  - Drinking water
- xv. Promotion of productive use must highlight conditions for successful operation of economic activities. This includes entrepreneurship, willingness to take risks, readiness to make sacrifices and to learn. Other conditions include a realistic business idea, well-defined market and reasonable demand, access to raw materials, savings for investments including the essential working capital, micro-credits or other loan facilities, workers with adequate skill, ability and know-how to buy production equipment, transportation means, reasonable cash-flow and profitability, etc.
- xvi. In order to succeed in developing economic activities in rural areas, concrete and efficient cooperation must be established between responsible authorities. The experience of NGOs is notable and should be used in this context. It is also noticed that rural economic development is a **priority** of most donors in their revised policies for foreign development aid.

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