



Rethinking Rural Electrification

Global Leaders Programme – Hong Kong & Lao PDR
December 2014

Table of content



Section	Pages
Executive Summary	3
Background	6
Rethinking Rural Electrification	12
Rural Enterprise Development	26
Policy Recommendations	36
Investment & Implementation	45
Case Study: Luang Prabang Province	51
Conclusion	57



Executive Summary

Executive summary 1/2



- Over 1.4 billion people worldwide including 620 million in the Asia Pacific region lack access to electricity. One billion more suffer from unreliable or unaffordable electricity services due to poor infrastructure or inefficient and expensive technology.*
- Since the 1960s, development initiatives using rural electrification to promote economic development and improve livelihoods have had mixed success but they continue to rank highly on the agendas of governments, NGOs and aid agencies as electrification is viewed as a key trigger out of the poverty trap.
- The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), is pioneering a new approach to electrification using renewable energy which leverages cross-sectoral expertise and involves the community as a key stakeholder called **Pro-Poor Public Private Partnership (5P)**. The 5P model has seen a success in Indonesia and is now being applied in Nepal and Lao PDR.
- This report, prepared by professionals from 20 nationalities representing over 15 organisations from the private sector, civil sector and academia sets out an approach to **rethink rural electrification** as a means to promote economic development.
- It proposes a new conceptual framework that places the emphasis on rural enterprise development to serve as the catalyst for rural electrification and the associated investments to boost national economic growth, nurture entrepreneurial initiatives, self-sufficiency and thereby provide stable and affordable electricity to rural communities.
- The report also makes a business case for developing and attracting rural enterprises as anchor consumers of electricity which makes investment in electricity generating capacity more attractive thus incentivising extension of the national grid and promoting local rural economic development.

*Source: *The United Nations Development Programme, 2014*

Executive summary 2/2



- To support the proposed framework key policies are recommended to attract independent power producers (IPPs) and private sector investors, such as:
 - Preferential feed-in-tariffs (FiT) and concession periods for projects which allow for community ownership, promote stewardship of natural ecosystem services and act as “systems fringe boosters” for the outer reaches of the grid;
 - Support for a **rural development fund** which specifically targets SMEs, entrepreneurs and MFIs contributing to rural economic development and into which all IPPs receiving preferential FiT would be required to contribute.
- The framework is substantiated through a case using Luang Prabang Province in Lao PDR to calculate the investment in electricity infrastructure required to support provincial economic growth and potential rural enterprises that could benefit from this approach. The analysis shows that a decentralised small-scale solar and hydropower energy systems totaling 7MW would require investment in the order of US\$23.8 million to fill the existing electricity gap and support GDP growth through 2018 based on current economic assumptions.
- To analyse the attractiveness to IPPs of this framework, a financial model has been built for a small-scale hybrid system of 20kW (solar) & 40kW (hydro), with a total generating capacity of ~250MWh and a total investment of US\$230,000. Assuming a preferential FiT the project would have an expected return on investment of 11% over 8-9 years to be shared among the developer (90%) and community (10%).
- The model is based on 300 households. In order to scale up to serve 5% of the population in Lao PDR an investment of US\$160 million would be required to provide a power generating capacity of ~181GWh.
- This is a suggested approach for the Asia Pacific region. The analysis and recommendations based on Lao PDR and Luang Prabang are used simply to demonstrate its viability.
- Note: the recommended FiT, which is high in comparison to the current FiT rates, has been recommended to attract private sector investors into rural areas. Alternative funding mechanisms and approaches can be considered to lower the FiT, which is not fixed for the financial model to be feasible.



Background

Who we are



The **Global Institute For Tomorrow (GIFT)** is an independent pan-Asian think tank focused on advancing a deeper understanding of global issues including the shift of economic and political influence from the West to East, the dynamic relationship between business, government and society and the reshaping of the rules of global capitalism.

The **Global Leaders Programme (GLP)**, GIFT's flagship leadership programme, brought together 35 professionals from the private sector, civil society and academia and from 20 different countries to address the issue of rural electrification in Lao PDR and in the region.



Programme partners



The GLP in Lao PDR (Dec 2014) was organised in partnership with:

- **United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)**, the regional development arm for the United Nations for the Asia Pacific region;
- **UNESCAP's Pro-Poor Public-Private Partnership (5P)**, a flagship approach to leverage the strengths of the government, the technical and financial advantages of the private sector, and the socio-economic development interests of rural communities;
- In Lao PDR, under the Ministry of Energy and Mines (MEM), the **Institute of Renewable Energy Promotion (IREP)** responsible for promoting renewable energy and conservation.



Partners from the public and civil sectors with expertise in international development and energy promotion

Lao PDR: Country overview



- Landlocked country in Southeast Asia bordering China, Myanmar, Vietnam, Thailand and Cambodia. Approximately the same size as the United Kingdom.
- Population 6.8 million of which 70% is rural (Source: UNDP, 2013)
- GDP growth rate: 8.1% in 2013 and 7.6% over the last 5 years (Source: World Bank, 2014)
- Subsistence agriculture provides 80% of employment with rice and coffee as main crops. Less than 5% of land is arable. (Source: FAO, 2008)
- Economy growth since 1990s has reduced poverty levels from 46% in 1992 to 25% by 2015 (Source: OECD, 2014)
- Country heavily reliant on foreign aid and investment to fund basic infrastructure and foster growth in agriculture, transportation and tourism (Source: OECD, 2014)

High potential for economic self-sufficiency but still heavily donor-reliant

Lao PDR: Energy landscape

- Abundance of natural resources including forestry and mineral such as gold, copper, zinc and lead.
- High renewable energy generation potential from including ~20,000 MW from hydropower (Source: Min. Energy and Mines of Lao PDR, 2011)
- Country exports 69% of energy produced to neighbouring countries.
- Current electrification rate stands at ~85% (Source: ESCAP, 2014)
- Country suffers from transmission and distribution losses of 12% due to a centralised grid structure and low voltage along long-distance transmission lines. Electricity loss in neighbouring countries range from 6% in China to 28% in Cambodia.
- National target of 90% electrification by 2020 but due to issues mentioned above even connected communities do not always enjoy reliable access.
- Despite electrification rates above 85%, one quarter of Lao people live below the poverty line of US\$1.25/day (Source: World Bank, 2012)



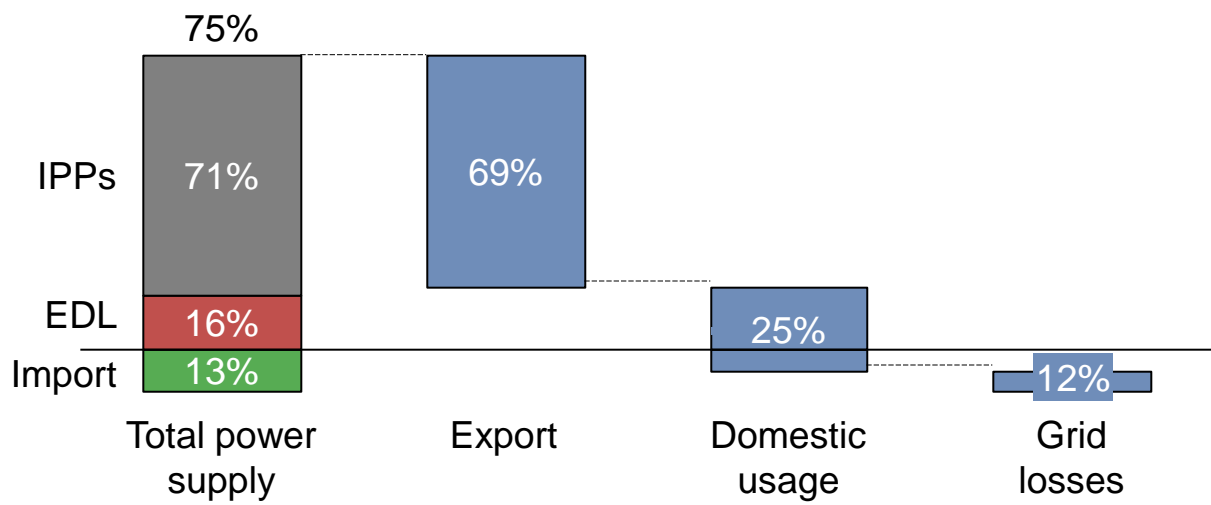
Images courtesy of Sunlabob

As illustrated in Lao PDR, electrification alone does not always lead to increased GDP per capita and improved livelihoods



Lao PDR: Energy sector profile

- ~71% of electricity supply generated by foreign Independent Power Producers (IPPs).
- 69% is exported to neighbouring countries.
- State power company Electricite du Laos (EdL) covers ~51% of domestic usage but also relies on electricity imports (at a higher price) to service border areas.
- 12% of electricity is currently lost due to centralised grid structure and low wattage for transmission (2013 data).



Source: MEM/DEPP
Electricity Statistics
Yearbook 2010

Investments in rural decentralised electricity production can help overcome limitations of the national grid system



Rethinking Rural Electrification

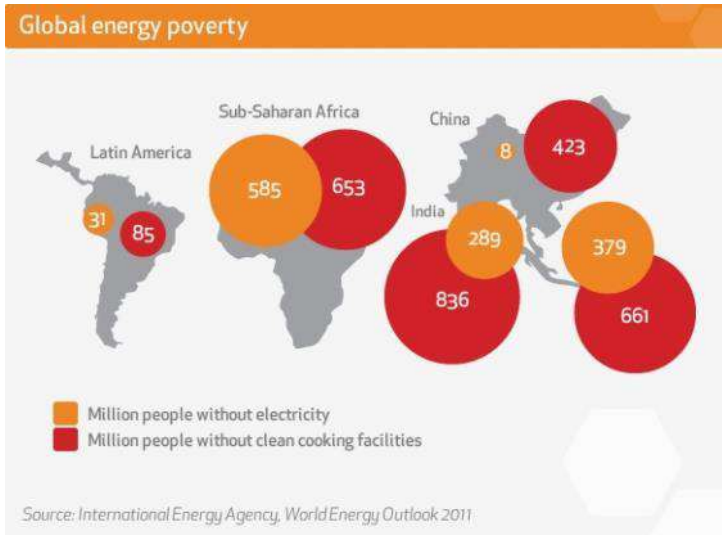
Summary



- Over 620 million people live without electricity in the Asia Pacific region, even in resource-rich countries.
- Traditional development approach to rural electrification assumes provision of lighting will kick start a virtuous cycle out of poverty through increased economic activity.
- These programmes are typically donor-led, especially in countries where governments cannot fund rural electrification or become donor dependant, and are small-scale. This makes them unattractive to private sector investment and also unable to support increased economic activity and often do not stimulate the needed entrepreneurial activity for a stable rural economy.
- Access to electricity is a necessary step out of poverty, but in isolation is not sufficient to improve people's livelihoods and lift them from the drudgery of life.
- This section proposes rewriting the narrative and rethinking the purpose of rural electrification and its intrinsic relationship with rural enterprise development. Only once favourable conditions are created to attract investment into rural areas (for economic activity) can the benefits of electrification be harnessed to empower communities to take control of their economic futures.

Traditional approaches to rural electrification

- “Energy poverty” affects over 1.3 billion people worldwide (620 million in the Asia Pacific region) and globally 84% of those without electricity live in rural areas.
- Traditional development approaches suggest that:
 - Electricity for lighting and cooking helps households move up the energy ladder from traditional, expensive and often unhealthy fuel systems (wood and kerosene) to alternative energy systems that will stimulate economic development;
 - Electricity increases attendance and performance at school by enabling schools to use computers and basic appliances such as fans and allowing children to study after dark at home;
 - Access to electricity increases productivity as work activity such as agricultural processing, weaving and tailoring can take place after dark;
 - Demand for electricity will naturally increase from household use to productive use of energy for village industries, attracting investment and spurring growth.
- The reality is that even when electrified, many rural communities still suffer from unreliable and unaffordable energy services due to poor infrastructure, ill-maintained equipment and price discrepancies between national tariffs and tariffs from decentralised energy systems.



Electrification alone, without the necessary attention given to enterprise development cannot uplift rural communities

Limitations of traditional approaches (1/3)

- A majority of rural electrification projects are funded by donor agencies due to government inability to cover high set-up costs and the cycle of dependence.
- Those affected by energy poverty are mostly located in areas with poor accessibility due to terrain and low population density, making it cost-ineffective to extend the national grid.
- Consequently, decentralised mini-grids using renewable energy sources to provide basic lighting facilities to communities are gaining popularity globally.



New ideas are needed to promote sustainable and commercially viable rural electrification projects

Limitations of traditional approaches (2/3)

- Although many business models for decentralised mini-grids are being developed, a number of limiting factors prevent these models being scaled up:

Profitability

- High upfront costs and low fees make it difficult to see a return on investment.
- Operational and administrative costs outweigh the revenues generated from low-income households with low energy consumption.
- Development-funded projects frequently run as “pilot sites” that are focused on bringing basic services such as lighting and are thus not scalable or sizeable enough to attract investment and stimulate the rural economy.



Affordability

- Electricity tariffs for decentralised off-grid systems usually exceed subsidised national tariffs as developers try to make a return on their investment.
- These systems target the remote poor and their ability to pay under current economic circumstances is limited.
- Meter-based systems have encountered various difficulties such as customers racking up high bills which they are simply unable to pay.



Traditional projects too small to attract private sector investment or support significant productive use of electricity for economic activity

Limitations of traditional approaches (3/3)



Economic sustainability

- No sense of ownership and lack of technical expertise among local community can lead to inadequate maintenance at household and system level over time.
- In the case of donor-funded systems, hardware often selected to meet donor agencies criteria rather than local requirements and thus spare parts may be difficult or expensive to source.
- Limited capacity and inability to increase capacity (i.e. through modular systems) make it hard to meet increased demand.
- Increase in electricity demand usually driven by desire for more household appliances rather than by productive use of energy. This can result in undesirable consequences such as unmanageable debt and erosion of local culture.
- Once the community is connected to the grid, decentralised energy systems become obsolete unless built to national grid specifications thereby falling into disrepair and/or failing to offer returns on investment to developers.



Image courtesy of Helvetas

Energy access is a first step towards improving quality of life, but alone is insufficient to drive economic development and self-sufficiency

Poverty despite access to electricity

- Despite widespread electrification efforts in Asia many electrified rural communities have been unable to lift themselves out of poverty through an increase in economic activity.

Five years after its installation, a donor-funded mini-grid in Ban Phakeo, Lao PDR, which was subsequently handed over to the local authorities has resulted in very little productive use of electricity. This is mainly due to the limited capacity of the system and the fact that development of the mini-grid was not linked to rural enterprise development from the outset.



Image courtesy of Sunlabob

Country	Electrification Rate (%)	Un-electrified Population (Million, approx.)
Myanmar	26.0	44.4
Cambodia	24.0	10.6
Laos PDR	78.0	1.4
Indonesia	73.7	62.4
Total ASEAN-4	53.8	118.8
Philippines	89.7	9.5
Vietnam	97.3	2.1
Thailand	99.3	0.5
Malaysia	99.4	0.2
Brunei	99.7	0.0
Singapore	100.0	0.0
Total ASEAN-6	95.6	12.3
Total ASEAN-10	73.9	131.1

Source: ACE, 2012

Electricity alone will not result in increased economic activity and improved livelihoods for remote and rural poor

Why electricity? The need for a new narrative

- A new narrative is required to question the purpose of electrification and its role as a catalyst for economic development. The premise for electrification should not be simply to provide lighting but to create the conditions for economic activity through enterprise development and motivate communities to create their own economic purpose.

From labor-intensive low productivity...



...to better product quality and quantity...



... to SMEs providing employment and access to markets such as rice mills ...



... as well as sustainable small-scale rural enterprises requiring electricity.



Vibrant rural economies



Reduced rural-urban drift



Access to energy and markets



Improved quality of life



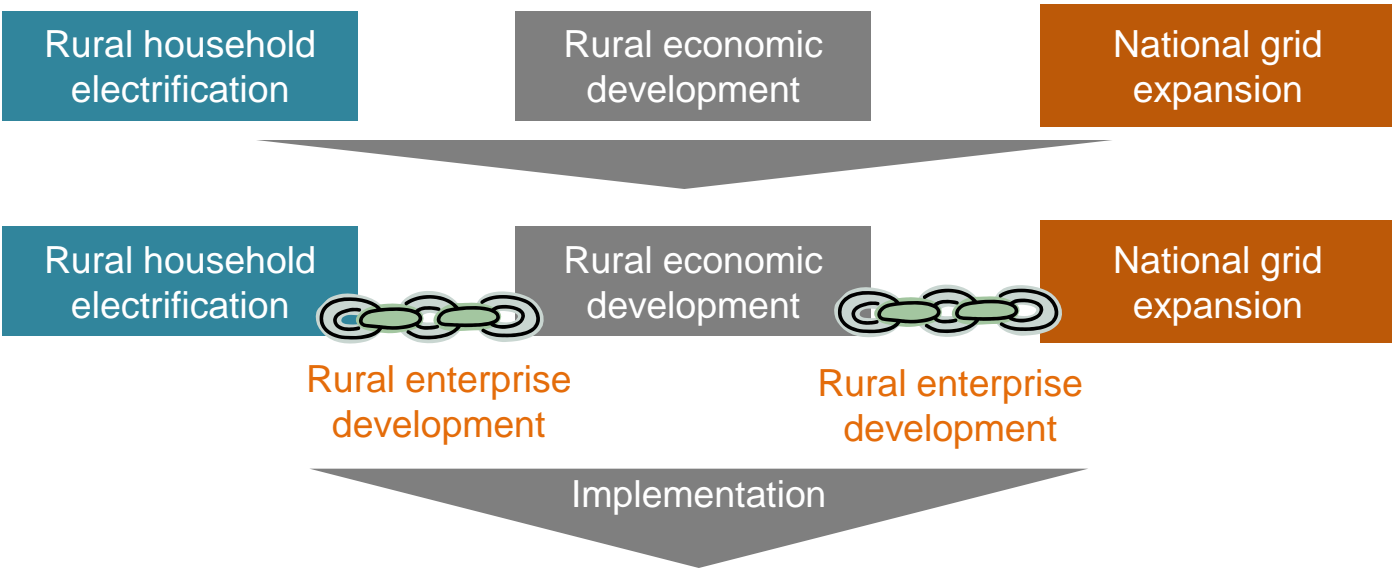
Refocus efforts on a rural enterprise strategy which requires electricity



Rural enterprise development must be at the heart of any new approach to electrification for the poor

- Rural enterprise development not only stimulates rural economic activity but also helps meet national goals for development and electrification.

Development pillars



- Inclusive**
Focus on community participation and ownership
- Self-sufficient**
Move away from donor funding to long-term financial viability
- Efficient**
Motivation for IPPs and private sector investors to get involved
- Effective**
To spur economic growth, social and environmental impact
- Sustainable**
Off-grid prices that internalise eco-system services thus offering attractive off-grid pricing

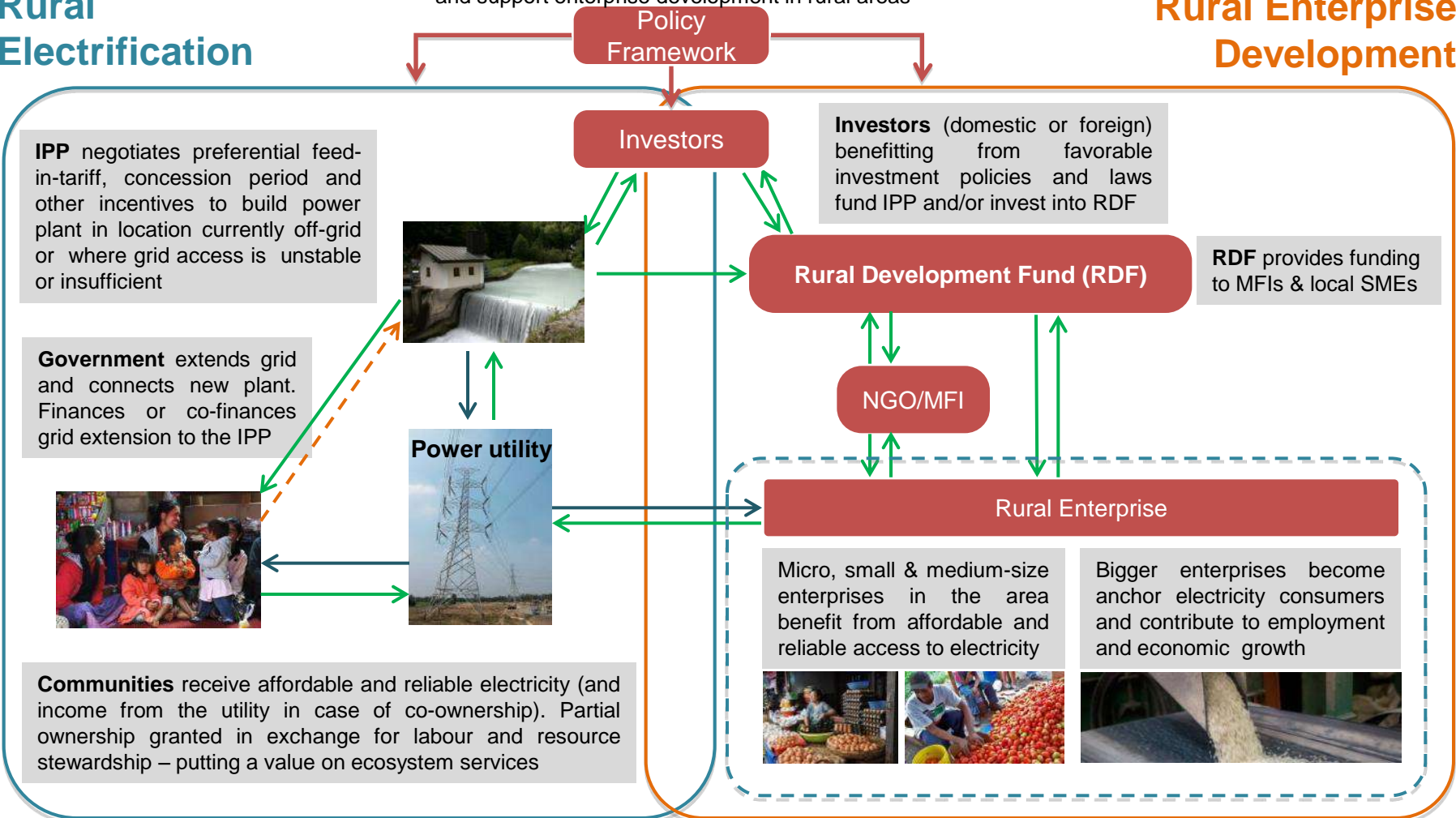
Linking rural electrification with rural enterprise development



Rural Electrification

Rural Enterprise Development

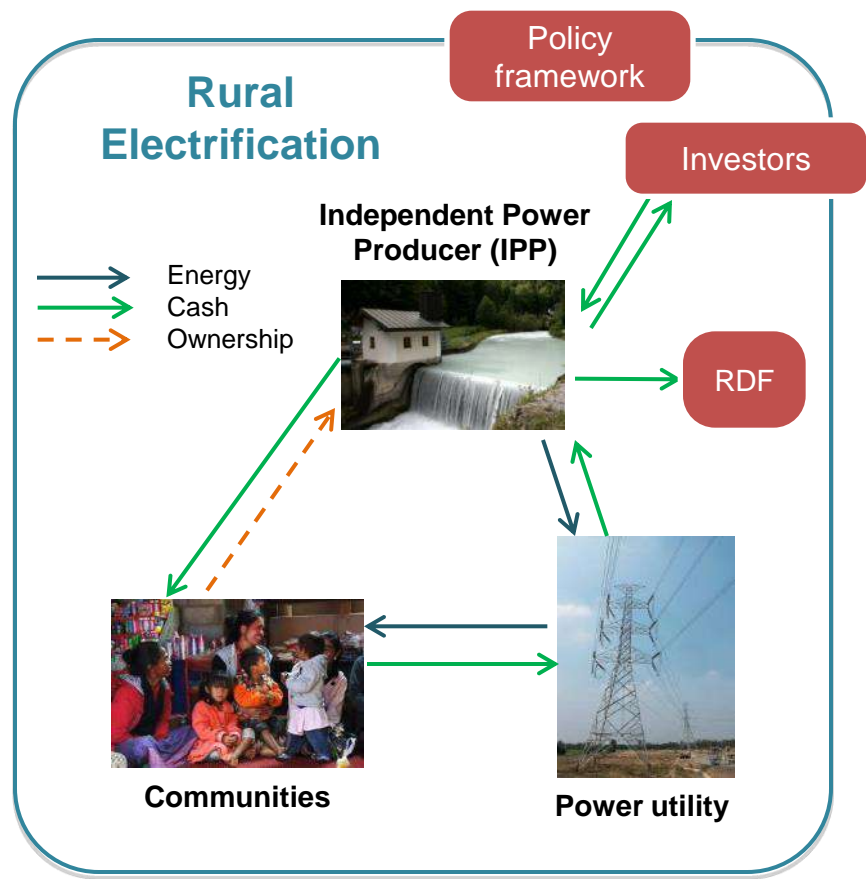
Government enacts supportive policies to attract investors & IPP and support enterprise development in rural areas



- Energy
- Cash
- Ownership

NGO: Non-Government Organisation
MFI: Micro-Financing Institution

Rural electrification framework



Independent Power Provider (IPP) offered premium Feed-in-Tariff (FiT) as a long-term price guarantee and other incentives to invest in rural electrification providing it:

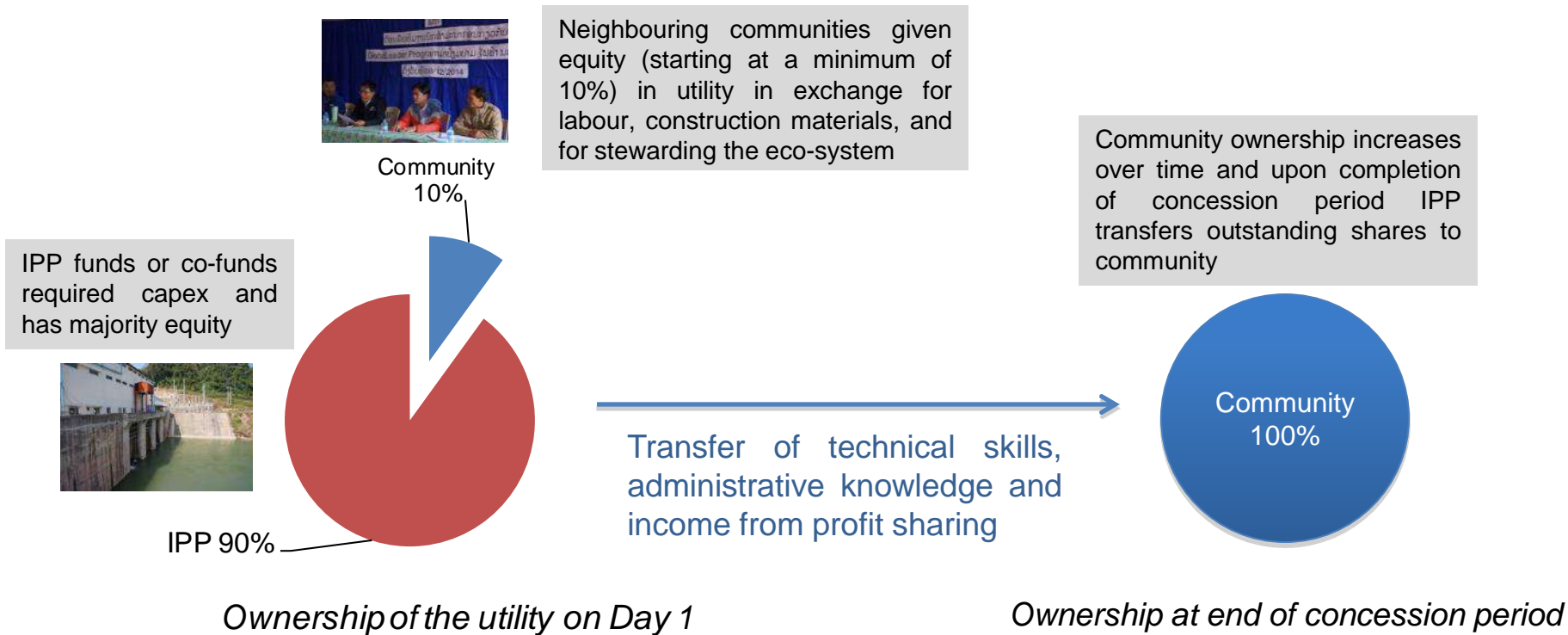
1. Builds a power station where there is currently no grid or where electricity supplies are unstable;
2. Generates sufficient power from renewable energy sources to meet needs of local communities and businesses in the area;
3. Develops system in line with government specifications which when connected to the grid acts as a “systems fringe booster”;
4. Based on terms of agreement potentially co-fund grid extension and connection of local households;
5. Contributes a small portion of its income to the Rural Development Fund to support SME development in the area;
6. Where applicable, grants partial ownership to community in which the plant is located in return for access to their eco-system services and their protection, and provides employment and knowledge/technical skills transfer to local labour;
7. Transfers full ownership to the community upon completion of the concession period.

Model attracts investment in small to medium scale rural electrification

Community ownership for project sustainability



- Terms of license granted by government requires IPP to engage communities from start of the project period, offering “sweat equity” in the utility, employment opportunities and an incentive to be stewards of the surrounding natural ecosystems services.



Community ownership ensures rural utility becomes a rural enterprise

Benefits to the community



Transfer of technical skills

- Community members to be employed at the utility and receive training to operate, manage and maintain the site.

Income from sale of electricity to the grid

- Local entity formed to hold shares in utility. Income channeled into a community development fund, to support local socio-economic development projects i.e. education, sanitation, infrastructure, healthcare, etc. Partnership with NGOs to ensure community is equipped to manage and deploy income in inclusive manner.



Being environmental stewards

- Community charged with stewardship of local ecosystem, which in the case of hydropower projects is vital to the effective operation of utilities. Basic principles include forest maintenance around the catchment area for soil cover and water retention.

Transfer of ownership

- At the end of the concession period, full ownership to be transferred to the community.



Access to affordable and reliable electricity from the grid

- Sufficient for household use and by micro and small enterprises.

Enables communities to utilise their human capital and natural resources to create sustainable economic value

Example of energy business factoring in the true cost of ecosystem services: NusaTerang, Indonesia



Previous GLP proposal for **NusaTerang**, a holding company in Indonesia with ownership stakes in small hydropower project companies facilitated by the first 5P project partner and renowned Indonesian NGO IBEKA. Aims to execute mini hydropower projects in partnership with local communities, and generate financial, social and environmental returns to benefit communities, investors and Indonesia as a whole.



Community preserves the forest

The river is the **bloodline** of the forest



Community operates the power plant



Community involved in project construction



Community enjoys economic benefit

Community and environment integral to this approach to rural electrification



Rural Enterprise Development

Summary



- Small and Medium Enterprises (SMEs) make up 90 percent of businesses and between 60-80% of jobs in Asia. Yet the IFC reports a US\$2.1-2.5 trillion funding gap for SMEs in non-OECD Asia alone. *(Source: IFC)*
- The model proposed in the previous section provides the energy needed to power rural enterprise but does not overcome the issue of funding.
- This section presents an idea for an innovative rural development fund that provides access to capital and is recommended **in parallel to rural electrification** in order to promote rural economic development.
- The rural enterprise development strategy also applies to the energy sector: small-scale utilities are enterprises themselves and can transform a location from being an energy consumer to a power generator thereby generating revenue for the investor and the community.
- Lao PDR is one of the poorest countries in the region despite its high electrification rates and abundance of natural resources. Supportive policies and investment frameworks vis-a-vis infrastructure development, electrification and SME funding can together boost economic activities in rural areas, especially in the agricultural sector.

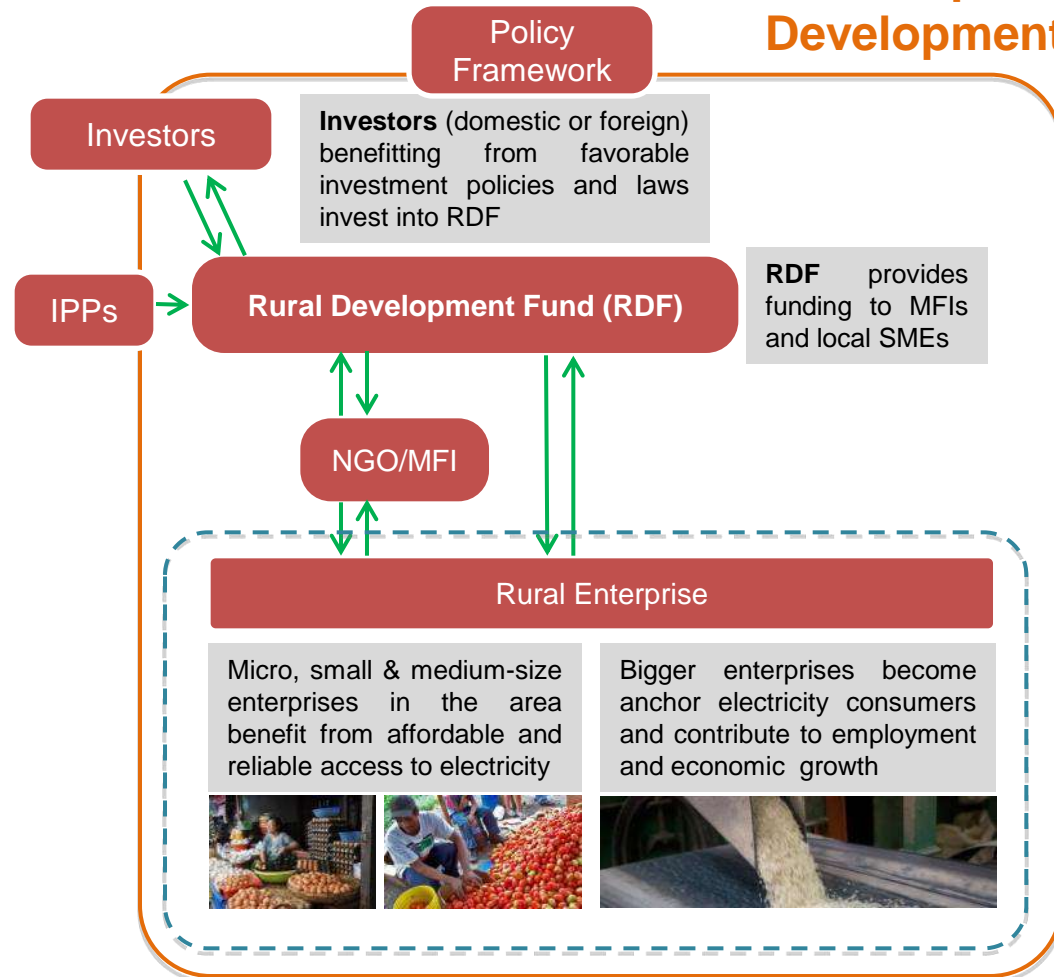
Rural enterprise development framework (1/2)



Rural enterprise development to boost rural income generation

1. Local businesses to boost economic activity drawing on local resource advantages in a location where there is no/unreliable electricity. Contribute to raising income levels for communities and drive demand for energy in the area.
2. Where there is population density, larger businesses can become anchor consumers of electricity and provide employment all year round, driving local economic growth. They can also be co-investors in the electricity plant.
3. Microfinance institutions and potentially NGOs to promote rural enterprise development in communities and support village leaders with technical knowledge & training, loan processes and community fund management, etc. They can also provide seed capital or loans for the electricity plant to investors and to entrepreneurs.

Rural Enterprise Development

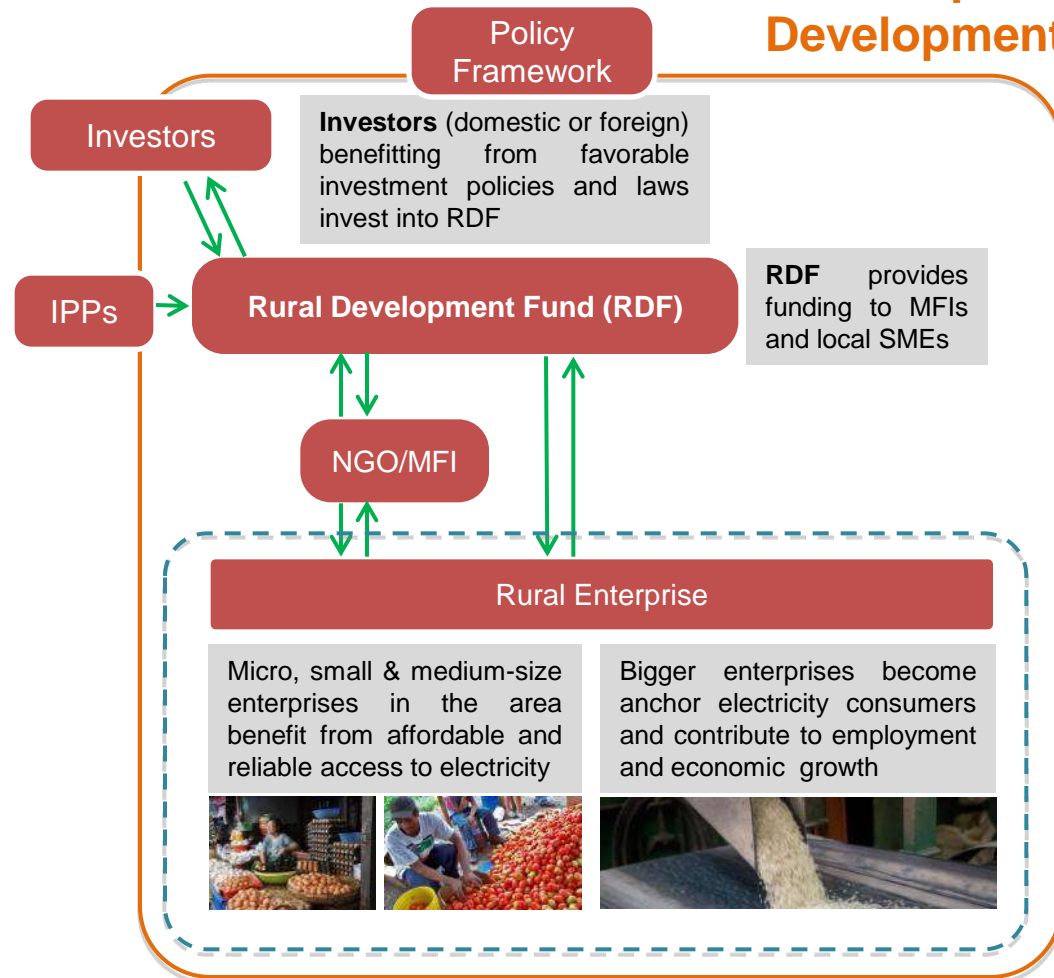


Rural enterprise development framework (2/2)



4. A **Rural Development Fund** set-up as an impact investment fund to support SMEs with a socio-economic mandate.
5. Funds can also be channeled via NGOs and/or microfinance institutions (MFIs) with wider networks and operations in rural areas.
6. The fund would be capitalised by local and regional institutions such as the Lao PDR Agricultural Promotion Bank, ADB, and others, and topped up by IPPs enjoying preferential FiT.
7. Rural businesses to leverage fund for business expansion and growth, i.e. upgrading technology & machinery, hiring additional staff, sales & marketing, etc.

Rural Enterprise Development



Application in Lao PDR: The government's enterprise development vision for rural development through 2020



- Community ownership and community-based institutions
- Organisation of farmer groups for financing, collective leasing, etc.
- Training in agricultural techniques



- Diversification of farming activities
- Increase quality and value of agri output



- Strengthen manufacturing industries in rural areas
- Promote and scale-up agricultural industries

Rural enterprise development strategy aligned with government's goals



Rural enterprise development can positively impact agriculture in Lao PDR

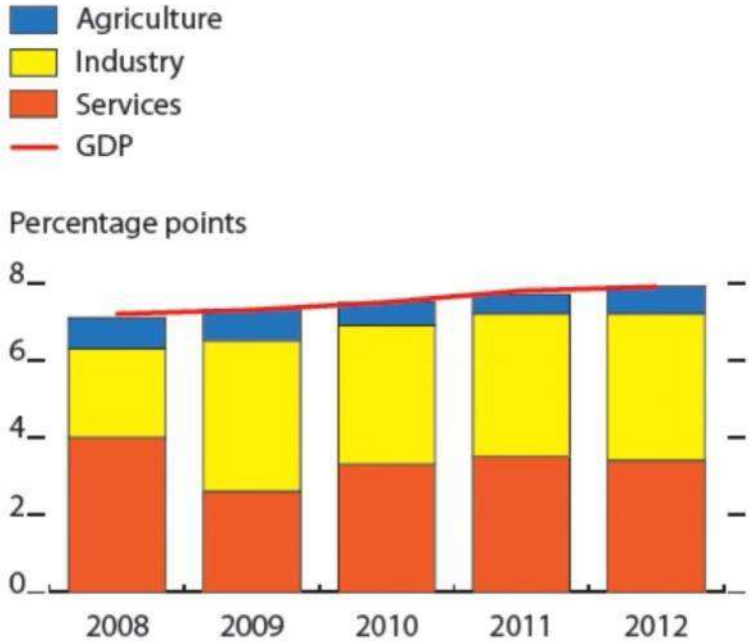
- Agriculture accounts for 27% of GDP and employs 75% of the population (World Bank, 2014)
- Main crops: Rice (~80% of cultivated land), coffee (highest contributor to agricultural exports at US\$60 million in 2012), maize, rubber and livestock.

Challenges:

- Limited mechanisation due to low purchasing power of smallholder farmers who lack access to credit.
- Inadequate supply chain infrastructure affects quality.
- Most smallholders reliant on rainfall and thus limited to one harvest per year.

Opportunities:

- Mechanisation throughout the value chain, especially for crop management cycle.
- Drying and storage facilities along the value chain, particularly rice, to improve product quality.
- Irrigation to increase no. of harvests and improve yields.



Sources: Lao Statistics Bureau; Asian Development Outlook database.

Agriculture vital to Lao PDR's rural economy but the sector needs support such as investment in electricity and infrastructure

The rice value chain in particular would benefit from access to the Rural Development Fund



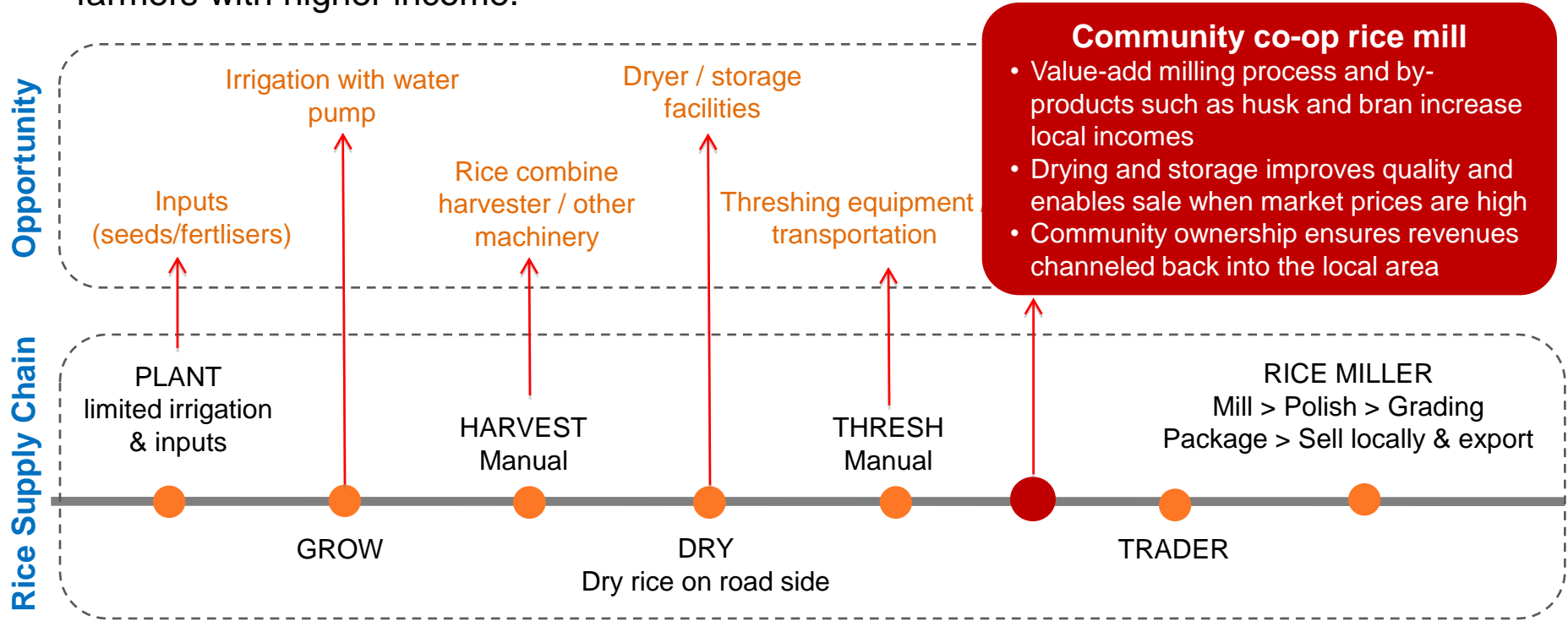
- Rice self-sufficiency attained at national level, but differences persist among provinces.
- Exportable surplus expected to reach 0.45-0.5 million tons by 2015 (from current 0.3 million).
- Increased rice production does not translate into increased income for farming households as prices of paddy are suppressed at the farm gate and farmers lose out to middlemen/traders.
- Post-production of rice, especially rice milling, is underdeveloped and inefficient: difficulty for local rice millers to compete with regional and international markets. Industry requires significant investment into modern mills and polishing factories.
- Rice post-production can be improved by strengthening drying and storage facilities and services at local/community level. By drying and storing paddy when prices are low, farmers can command a higher selling price at the farm gate when production levels are lower.
- See *Business plan for [ProspeRice - Strengthening the rice value chain in Cambodia](#)*





Strengthening the rice value chain

- A consolidated and inclusive rice value chain from production to post-production of paddy can improve yields and output quality, improve food security and support smallholder farmers with higher income.

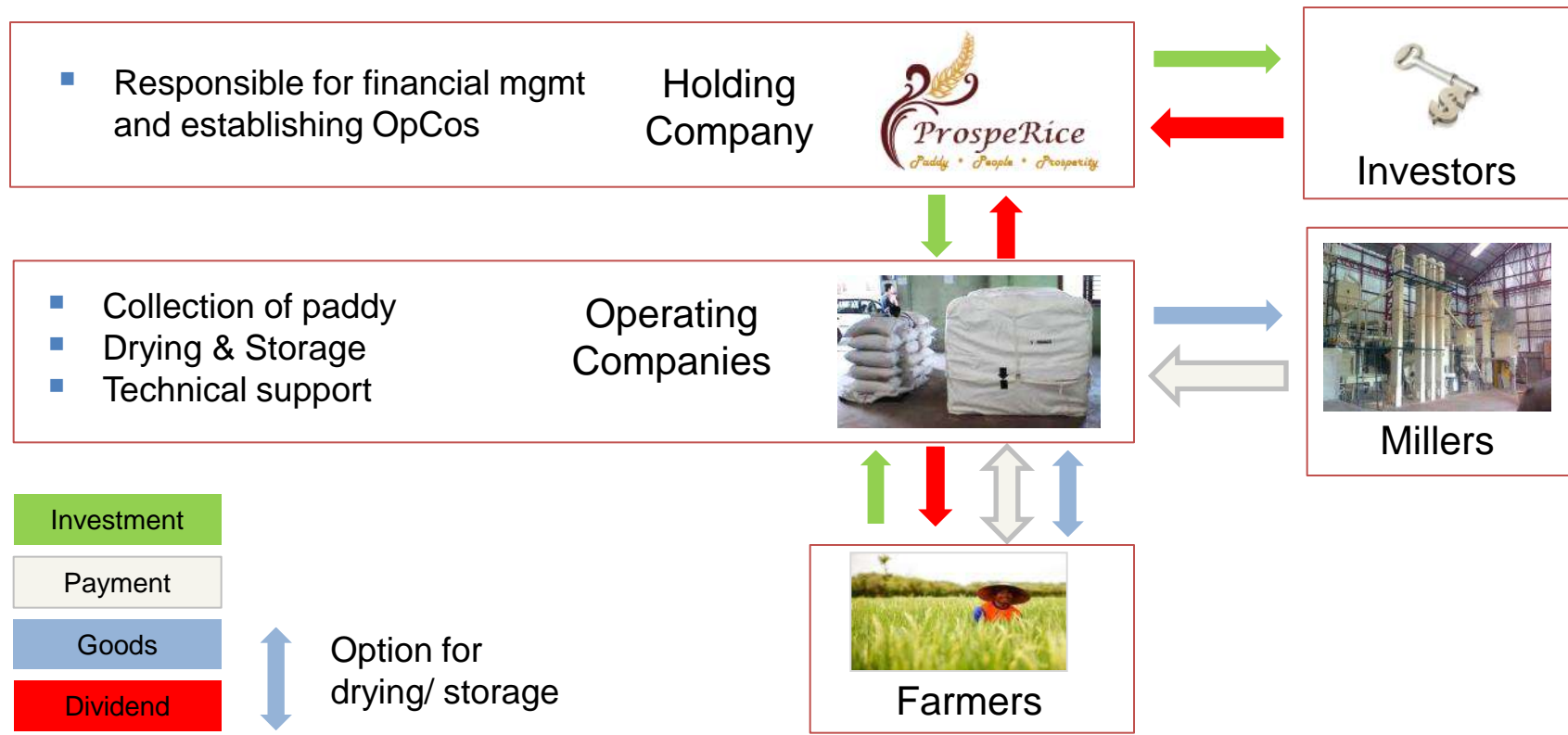


Note: For export, quality rice varieties such as Jasmine should be considered to compete with neighbouring countries (Thailand and Vietnam). Small-scale dryers and storage for dry commodities are available and can contribute to increased income for smallholder farmers.

Potential commercial opportunities through access to energy and funding

Example of a financially viable social business for the rice value chain: ProspeRice, Cambodia

A business model centered around technically sound and appropriate drying and storage solutions to improve rice quality, provide millers with steady supply of paddy throughout the year and offer smallholder farmers a better price for their output.



Business model empowers farmers by realigning the market landscape

Small hydropower utilities can also provide irrigation for a range of agricultural activity such as rice and coffee



- In paddy producing areas, the provision of irrigation systems all year round increase cropping cycles, rice yields and contribute to higher incomes for smallholder farmers.
- For hydro plants with a dam and water catchment area, the retained water resources can be utilised for irrigation to nearby fields and communities so that other potential crops (cash and otherwise) can be grown and processed.
- This further highlights the importance and possibilities of linking rural electrification with enterprise development in the area.

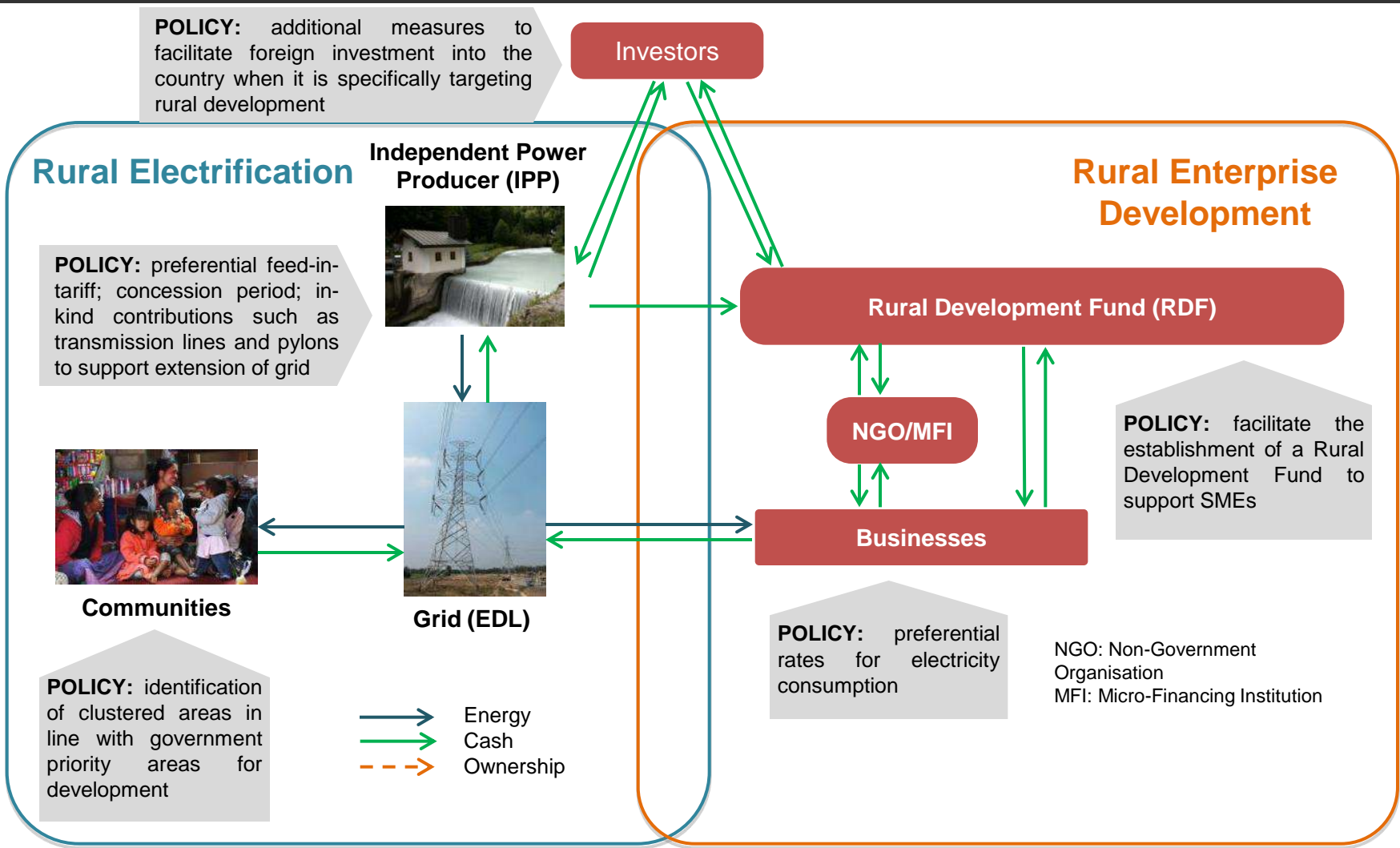


Policy recommendations



- The government of Lao PDR has developed a number of policies and decrees in recent years to support infrastructure development, rural electrification, agriculture and investment.
- However implementation of these policies is still a work in progress. More cooperation across various ministries are needed and the monitoring of policy implementation needs to be systematised to support the government's targets for socio-economic development.
- Additional policies to support rural enterprise development and rural electrification include:
 - Preferential tariffs and concession periods for IPPs using renewable energy and offering communities ownership in exchange for labour and stewardship of the environment;
 - Laws to facilitate the establishment of a rural development fund to support SMEs, MFIs and NGOs in Lao PDR with funding and management services;
 - A concerted effort to identify and define sizeable “Special Rural Economic Zones” for the effective bidding of energy packages and contracts by IPPs and exclusive rights to service to these areas with small scale utilities.

Proposed policy framework



Existing policies: Highlights (1/2)



Law on Electricity (2011)

- Encourages electrification for rural development and creates long-term opportunities for investors.
- Includes strategies for development of rural electrification network and methodologies for pricing of electricity, concession terms (art.33), investment on rural electricity development (art.44) and a Fund for Rural Electricity Development (art.46).



Renewable Energy Strategy (2011)

- Targets to increase share of renewable energy in total energy consumption to 30% by 2025.



National Socio-Economic Development Plan (2011-2016)

- NSEDP identifies energy sector as strategic development sector to achieve objective of rapid economic growth and poverty eradication.

Existing policies are in place but more efforts needed to create synergies across ministries and monitor policy implementation

Existing policies: Highlights (2/2)



Law on Investment Promotion (2009) – applicable to investors based in different promoted sectors and promoted zones.

- Tax holidays offered up to 10 years
- Exemption from export duty on export products
- Exemption from land lease or concession fee up to 15 years
- Exemption from import duties and taxes on raw materials and capital equipment using for production
- Additional tax holidays available upon negotiation for large concession projects
- All investments in renewable energy projects in Lao PDR (grid-connected or isolated systems) are entitled to investment incentives (import duty free) under the Investment Promotion Law

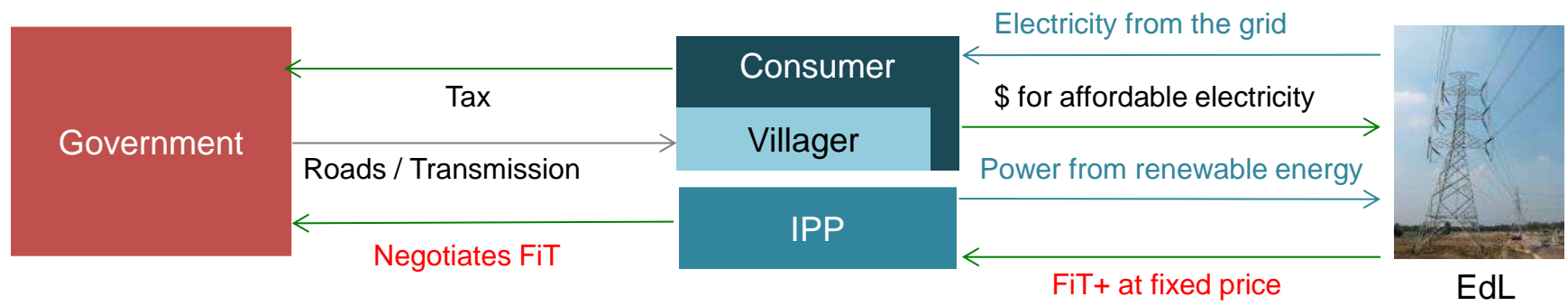
Agriculture Law

- International Agricultural Cooperation (art.7) to spur modernisation of the sector.
- Highlights priority on capital and promotion fund; mechanisation; training; storage and processing; pricing and protection of farmer benefits (art.49).



Proposed policies: Premium Feed-in-Tariff (FiT+)

- Small-scale IPPs in rural areas to benefit from **premium Feed-in-Tariff (FiT+)** as long term price guarantee on condition that:
 - Use of renewable energy sources in area where there is currently no/unreliable electricity;
 - Contributes a small portion of the FiT+ to Rural Development Fund to support enterprise development;
 - Utility built to government specifications and IPP potentially funds or co-funds up front costs of grid extension and connection (FiT+ ensures this investment will be recouped);
 - Community owns up to 10% of the IPP.
- To raise funds for FiT+ and grid extension to connect rural IPPs the government can consider the following options:
 - Levying a small charge per kWh of electricity produced by large-scale foreign IPPs to subsidise 90% of the FiT+ and a nominal increase in national tariff rates to cover the remaining 10%.
 - Deploying the rural electrification fund amassed by MEM through sale of world-bank-funded solar home systems.
 - Seeking soft loans from institutions such as ADB for which there is already a precedent.



Small-scale rural IPPs must meet strict criteria to be eligible for FiT+

Proposed policies: “Special Rural Economic Zones”



- Promotion of geographical clusters, “**special rural economic zones**” where concentrations of enterprises can be developed which are closely connected, along a value chain or as a network settling around an important buyer or industrial company.
- Clusters can be bid out to IPPs who gain exclusive rights to service the area.
- Key to attract investment into rural locations where electrification and rural enterprise development are needed.
- This requires a shift away from small-scale and sparsely located pilot projects towards larger projects in sizeable and investable areas.
- Benefits can also be offered to enterprises investing in the area such as tax incentives and subsidised electricity.
- In some cases and where appropriate government policies should also incentivise very remote small villages to be clustered together if they wish to be on the national grid and enjoy the benefits associated with being located in one of the special rural economic zones.



Special Rural Economic Zones is a shift away from focus on urban development at the expense of rural economies

Proposed policies: Incentives for investments in rural electrification and enterprise development



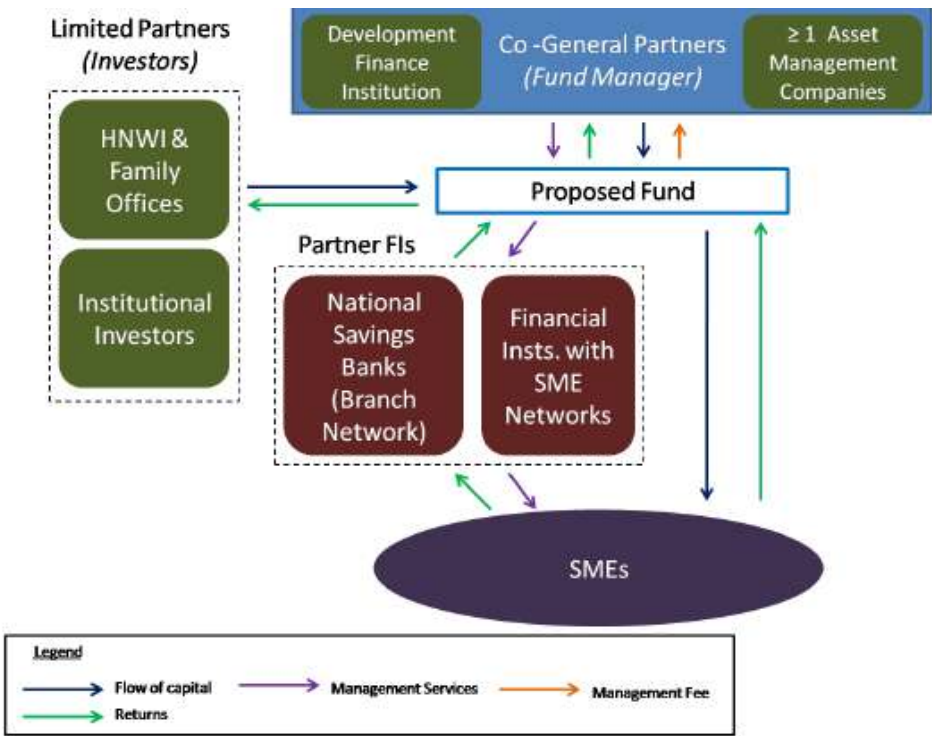
- Small-scale IPPs in rural areas can also benefit from additional **incentives** such as:
 - Extended tax holidays (i.e. from income and import tax) providing aforementioned criteria are met - terms to be negotiated based on location, power capacity and technology used;
 - In-kind contributions from national government and local authorities, such as the provision of hardware like concrete pylons and transmission lines to ensure utilities are built to a specification that can be connected to the grid;
- Investors or SMEs willing to invest in rural enterprises in carefully identified Special Rural Economic zones alongside IPPs should also be offered preferential treatment such as similar tax holidays and potentially discounted electricity prices.
- The government may also provide support to develop these Special Rural Economic Zones in the way of infrastructure and services, much in the same way it already does for urban-based industrial parks.

Government policy mechanisms to attract sustainable private sector involvement rather than development aid



Proposed policies: Rural Development Fund

- Support the establishment of a **Rural Development Fund (RDF)** to be deployed in partnership with the Central Bank which supports local SMEs. IPPs to contribute a portion of the FiT+ to the Fund. Government could consider extending this requirement to foreign IPPs and build into contract negotiations before large-scale projects begin.



- The Fund is a multinational impact investment fund targeting SMEs operating in key development sectors throughout Asia.
- Key sectors include: food (safety & security), water & sanitation, low-cost housing, meeting basic needs, public health and education.
- Run in partnership with national savings banks, microfinance institutions, and credit unions as well as Development Finance Institutions such as ADB and IFC for capitalisation.

Source: GIFT Concept Paper: Pan-Asian Impact Investment Fund

Fund based in Asia designed to support Asian SMEs with a social mandate



Investment and Implementation



- This section presents a financial model to substantiate the commercial viability of a small-scale rural power utility in Lao PDR.
- The model is built around a proposed 60Kw solar/hydro hybrid system and it assumes that policy recommendations, especially those regarding the premium Feed-in-Tariff (FiT+), are adopted by the government.
- The utility is developed in an area with sufficient population density (300 households) and where there is currently no grid connection or unreliable and unstable grid connection.
- As previously mentioned, the FiT+ could be funded by a combination of a nominal increase in national tariff and a small levy on large scale foreign IPPs.
- Based on Cap-Ex of US\$230,000, after 10% of the utility's income has been distributed to the community in line with their equity stake, and a contribution of US\$0.02/KWh has been made to the Rural Development Fund the base case IRR is 11% with a payback period of 8-9 years.
- The recommended FiT, which is high in comparison to the current FiT rates, has been recommended to attract private sector investors into rural areas. Alternative funding mechanisms and approaches can be considered to lower the FiT, which is not fixed for the financial model to be feasible.



Investment needs to electrify 300 households

Solar System	
Size (kW)	20
Annual generation	~22MWh
Capital investment	US\$70,000
Feed-in Tariff (20 years)	US\$0.60/kWh (escalating)
NPV10	~US\$25,000
IRR	13%
Payback Period	~6 years

Hydro System	
Size (kW)	40
Annual generation	~230MWh
Capital investment	US\$100,000
Feed-in Tariff (30 years)	US\$0.12/kWh (escalating)
NPV10	~US\$150,000
IRR	20%
Payback Period	5-6 years

Total System	
Household wiring (300 households)	US\$60,000
Annual contribution to Regional Development Fund	US\$0.02/kWh (escalating)
Total NPV10	~US\$80,000
IRR	11%
Payback Period	8-9 years

Total capital investment of US\$230,000

A 60kW hybrid energy model provides a 11% return on investment



Electrification model assumptions and sensitivities

Assumption	Worst Case	Base Case	Best Case
Solar			
Solar PV capital cost (US\$/kWh)	4,500	3,500	2,500
Size of Solar Facility	20KW	20KW	20KW
Solar Feed-in Tariff (US\$/kWh (escalating))	0.60	0.60	0.60
Hydro			
Micro Hydro capital cost (US\$/kWh)	4,500	2,500	1,500
Size of Hydro Facility	40KW	40KW	40KW
Hydro Feed-in Tariff (US\$/kWh (escalating))	0.12	0.12	0.12
Escalation rate	4.5%	4.5%	4.5%
WACC	8.5%	8.5%	8.5%
General			
Contribution to Development Fund (US\$/kWh (escalating))	0.02	0.02	0.02
Wiring for houses (US\$/household)	200	200	200
Summary			
NPV (US\$)	16,485	106,485	166,485
IRR	9%	13%	17%

Cost estimates derived from Engineers Without Borders report , *Limits of grid extension in the Lao PDR:A financial perspective*



Investment needs to electrify 5% of the population

- The total generation capacity of the proposed hybrid model is ~250MWh p.a. (~20MWh from solar + ~230MWh from hydro).
- Scaling up this model to electrify ~5% of the population of Lao PDR (~340,000 people) would require an additional ~ 181GWh p.a., so around 725 times the proposed model of ~250MWh p.a.
- The electrification of 5% of the population using a hybrid model for IPPs in rural areas translates into a total investment opportunity of ~US\$ 160 million.

Population	
Lao PDR population	6.8 million
85% electrified	5.8 million
10% planned to be electrified	0.7 million
Remaining 5% in rural areas	0.34 million

Source: CIA Factbook for Lao PDR, 2014

Electricity needs	
Annual consumption in Lao PDR	3,075 GWh
Consumption per electrified capita	532 KWh
Assume 10% consumes the same	372 GWh
Assume 5% consumes the same	181 GWh

Source: Electricite du Laos and IPPs, 2012

The target market for this model

Scaling the model to electrify 5% of the population translates to a total investment opportunity of US\$160 million

Options to fund a fixed Feed-in Tariff (FiT)



Option 1: Nominal increase in national electricity tariffs could fund the costs of the Feed-in Tariff for small scale energy systems

- Option commonly used in countries with a comprehensive FIT policy.
- Tariff paid by every customer across the national grid increased slightly to cover the cost of the preferential FIT for small scale generation in rural areas.
- Estimated increase of US\$0.01/kWh to the national tariff would cover the costs to electrify 5% of the population.

Option 2: Charge a small concession to major energy export developers

- Lao PDR continues to attract a number of foreign companies interested in the country's power sector. Consider levying a small charge per kWh of electricity generated from new large-scale developments destined for export to neighbouring countries.
- A small charge for large-scale power projects can translate into considerable gains to cover higher subsidies for small-scale generation in rural areas, as well as additional incentives and costs such as transmission and distribution to extend the national grid to rural areas.

Option 2 shifts part of rural electrification costs to foreign IPPs and reallocates part of the country's revenues from hydropower to local communities



Case Study: Luang Prabang Province



- This section uses Luang Prabang province in Northern Lao PDR to illustrate the potential for investors to invest in a region's electricity infrastructure to support projected GDP growth based on some of the policy recommendations suggested in the previous section.
- A key consideration is that the investment opportunity, given these are rural areas, needs to be sizeable enough and attractive to investors who are most likely to be small to medium size players. Some of these local investors are already operating in this sector in Lao PDR and can be key players provided incentives and policies are aligned.
- It utilises the correlation between energy usage and GDP which has been calculated using available data from 202 countries.
- Taking the model presented in the previous section as an indicator of the potential upside for small-scale rural IPPs there is a significant commercial opportunity for interested parties if suggested policies pertaining to preferential Feed-in Tariffs and concession period are adopted by national and local authorities.
- It is worth noting again here that the overall emphasis is that investment in electricity infrastructure in a certain area should not be in isolation and should go hand-in-hand with rural enterprise development plans.

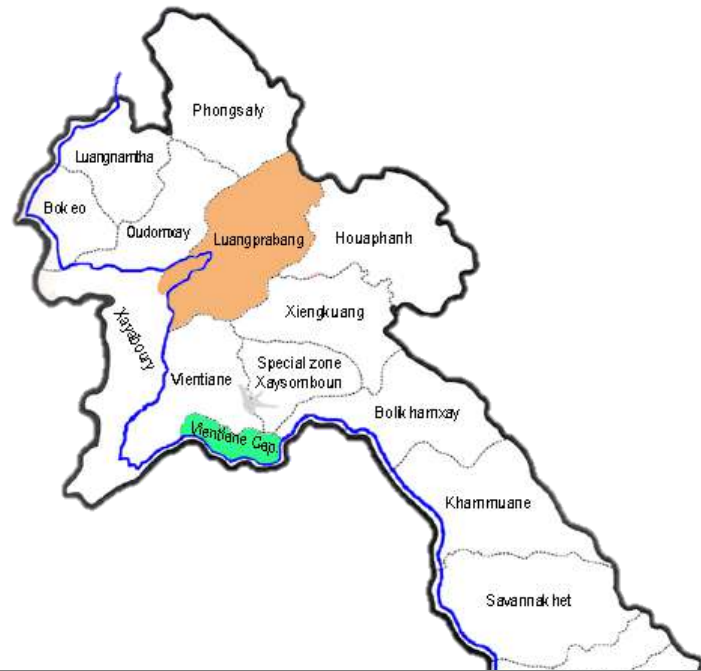


A case for Luang Prabang province: Overview

- Luang Prabang Province: 2nd largest province in northern Lao PDR and accounts for 7% of the total population.
- It represents many of the challenges that confront rural electrification in Lao PDR and in many ways those of other rural areas in poorer Asian countries.
- It is rich in resources and would help reinforce and even help validate the approach that places rural enterprise development plans in tandem with investment in electrification.
- Luang Prabang’s GDP per capita and GDP growth rates are indicative of Lao PDR as a whole.

	Lao PDR	Luang Prabang Province (2014)
Population	6,695,166	483,485
Land Area	230,800 km ²	16,875 km ²
GDP per capita (2013)	\$1,600	\$1,373
GDP Growth (2013)	8%	9%
GDP (2013)	\$11.1 B	\$664 M
Population below poverty line	22%	13%

Source: Provincial Planning and investment department



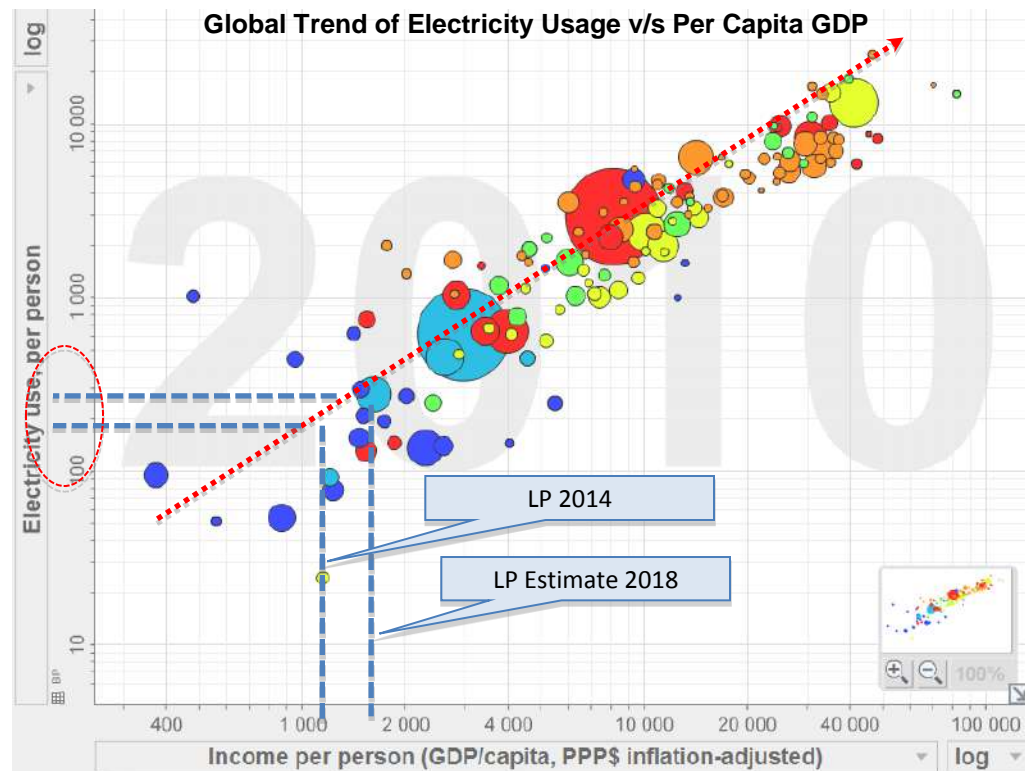
A sizeable and investable region with growth potential

Electricity requirements to drive growth in Luang Prabang province



- Globally it is well understood that within certain parameters there is generally a positive correlation between GDP/capita and electricity use, regardless of a country's level of development, population size or geography.
- Based on available data in the CIA world fact book for 202 countries, average GDP per Kilowatt-hour of electricity for all countries is US\$8.31.
- Based on the projected GDP growth and on this correlation (GDP/cap & electricity use), it is estimated that LPP will require an additional **32.9GWh** to meet its projected GDP/cap of US\$ 1,938 for 2018 based on continued annual growth of 9% p.a.

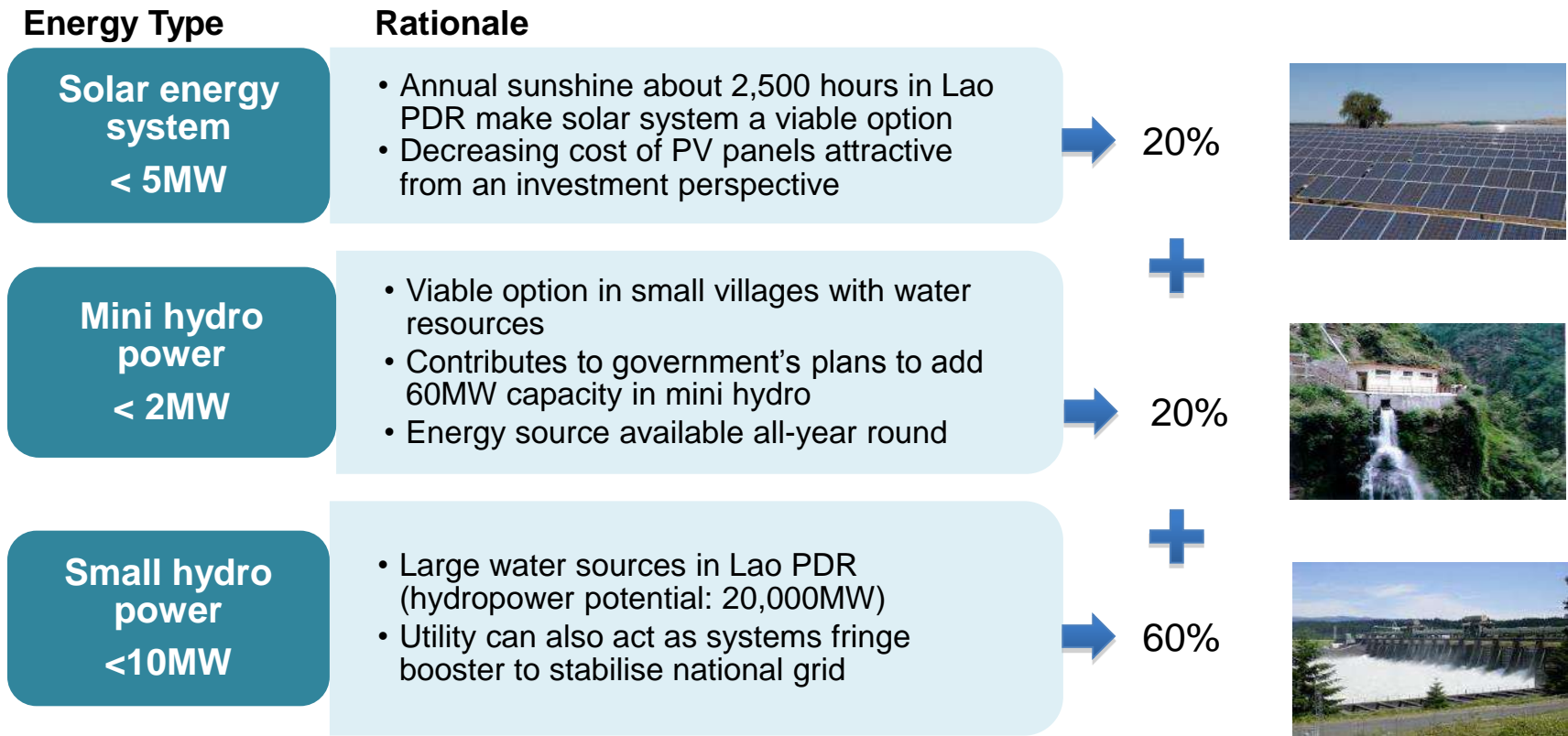
Luang Prabang Province	2014	2018 Est.
Per Capita GDP in US\$	1,373	1,938
Per Capita Electricity Usage in KWh (GDP/8.31)	165	233
Total Electricity Usage in GWh (per cap usage x total population)	79.7	112.6
Additional Capacity Required		
• GDP increase per capita : $1,938 - 1,373 = \text{US\$}565$		
• Avg GDP/KWh = US\$8.31		
• Electricity usage increase per capita $565/8.31=68\text{KWh}$		
• Usage increase for province $68 \times 483,485 = \mathbf{32.9GWh}$		



Suggested renewable energy options to fill the electricity gap in Luang Prabang province through 2018



- Recommended decentralised system using solar energy systems in addition to mini and small-scale hydro power systems



Different combinations possible between hydro and solar energy systems depending on terrain, energy needs and available natural resources



Investment requirements for capacity needed

- In order to produce an additional ~33GWh of electricity, a hybrid system with a combined capacity of 7 MW is recommended.
- Estimated investment required is **US\$23.8 million** (assumption based on average cost per MW of US\$ 3.4 million*).

Type of Power plant	Mix	Power Generation (GWh)	Capacity Installation (MW)	Investment Required (mIn US\$)
Solar power	20%	6.4	2.6	8.85
Mini-Hydro power	20%	6.4	1.1	3.75
Small Hydro power	60%	19.2	3.3	11.2
Total	100%	32	7	23.8

A US\$23.8 million investment in electricity infrastructure would help meet the GDP growth target for Luang Prabang in 2018

* Estimates derived from Engineers Without Borders report *Limits of grid extension in the Lao PDR: A financial perspective*



Conclusion

Conclusion



- Traditional development projects that focus on basic levels of rural electrification are usually small-scale and inefficient, making them unattractive to private sector investors, ineffective in creating the conditions for increased economic activity.
- A new conceptual framework that places the emphasis on rural enterprise development as the catalyst for rural electrification and associated investments links rural greater opportunities for governments, the private sector and local communities to be actively involved in stimulating economic development in rural areas.
- To support this framework, supportive policies are suggested, including preferential feed-in-tariffs (FiT+), and the establishment of a Rural Development Fund targeting SMEs should be enacted by the government to attract IPPs and private sector investment into rural areas.
- To ensure local communities are active stakeholders in rural electrification projects they should be granted ownership which encourages investors and IPPs to internalise the cost of ecosystem services and puts a value on the stewardship of these resources, particularly in the case of hydropower systems vis-à-vis forestry resources in the catchment area. The community may also contribute labour and construction materials, with a possibility for full ownership at the end of the concession period.
- In the case of Luang Prabang Province, an estimated investment in electricity infrastructure of US\$23.8 million is required to help meet the GDP growth target for the province in 2018.
- At national level, the framework offers investors the opportunity to invest US\$160 million into IPPs in rural areas to electrify 5% of the population, with a potential return on investment of ~11%, whilst supporting local businesses, enabling environmental protection and empowering local communities.

References



- UNDP (2014), [Universal access to modern energy for the poor](#)
- UNDP (2013), [About Lao PDR](#)
- World Bank (2014), [Lao PDR Economic Monitor January 2014: Managing Risks for Macroeconomic Stability](#)
- FAO (2008), [Rice Contract Farming in Lao PDR: Moving from Subsistence to Commercial Agriculture](#)
- OECD (2014), [Structural Policy Country Notes: Lao PDR](#)
- Ministry of Energy and Mines (2011), [Renewable Energy Development Strategy in Lao PDR](#)
- ESCAP (2014), [Enabling Environment and Technology Innovation Ecosystem for Affordable Sustainable Energy Options](#)
- World Bank (2012), [Poverty headcount ratio at national poverty lines \(% of population\)](#)
- MEM/DEPP (2010), Electricity Statistics Yearbook 2010
- Engineers Without Borders (2012), [Limits of grid extension in the Lao PDR: A financial perspective](#)
- IFC (2012), [From Gap to Opportunity](#)
- World Bank (2014), [Agriculture, value added \(% of GDP\)](#)
- GIFT (2014), Pan-Asian Impact Investment Fund

Contact information



If you are interested in the report, please contact:

The Global Institute For Tomorrow (GIFT)

- Helena Lim (Programme Manager) at hlim@global-inst.com

UNESCAP

- Deanna Morris (5P Project Manager) at morrisd@un.org

For more on the programme, visit us at www.global-inst.com

For more on the 5P initiative, please visit www.unescap.org/5P