REPIC PLATFORM

Les énergies renouvelables dans les pays en développement – quelles réponses à quels besoins

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IEA PVPS Photovoltaic Power Systems Programme - Operating Agent Deployment of PV Services for regional development (Task 9)

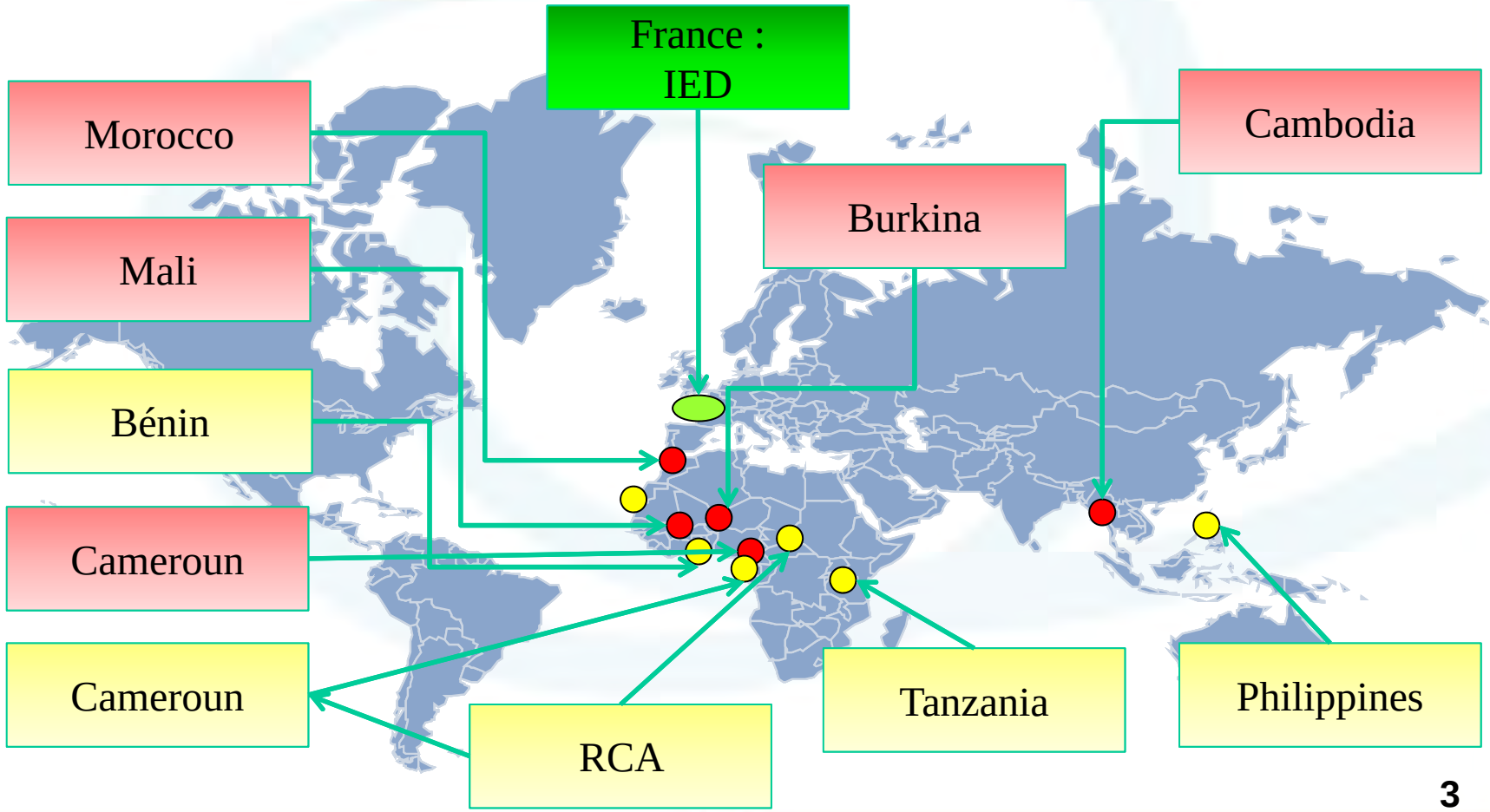
1. Introduction to IED and IEA PVPS T9

2. What are the needs that renewables can respond to?

3. Example of a biomass gasifier mini grid

An International Engineering and consultancy firm

- 70 experts, 15 nationalities
- 60% located outside France
- Offices in different countries



Engaged in sustainable energy development since 1988

1 – Infrastructure and Engineering:

- Access to energy services. Technical and social social engineering, pricing aspects, service quality and technology management.

2 – Renewable Energy Development:

- Photovoltaics, Hydroelectricity, Biomasse, Energy Efficiency

3 – Project Financing:

- Fesability Studies, financial engineering, support to the financial sector, …

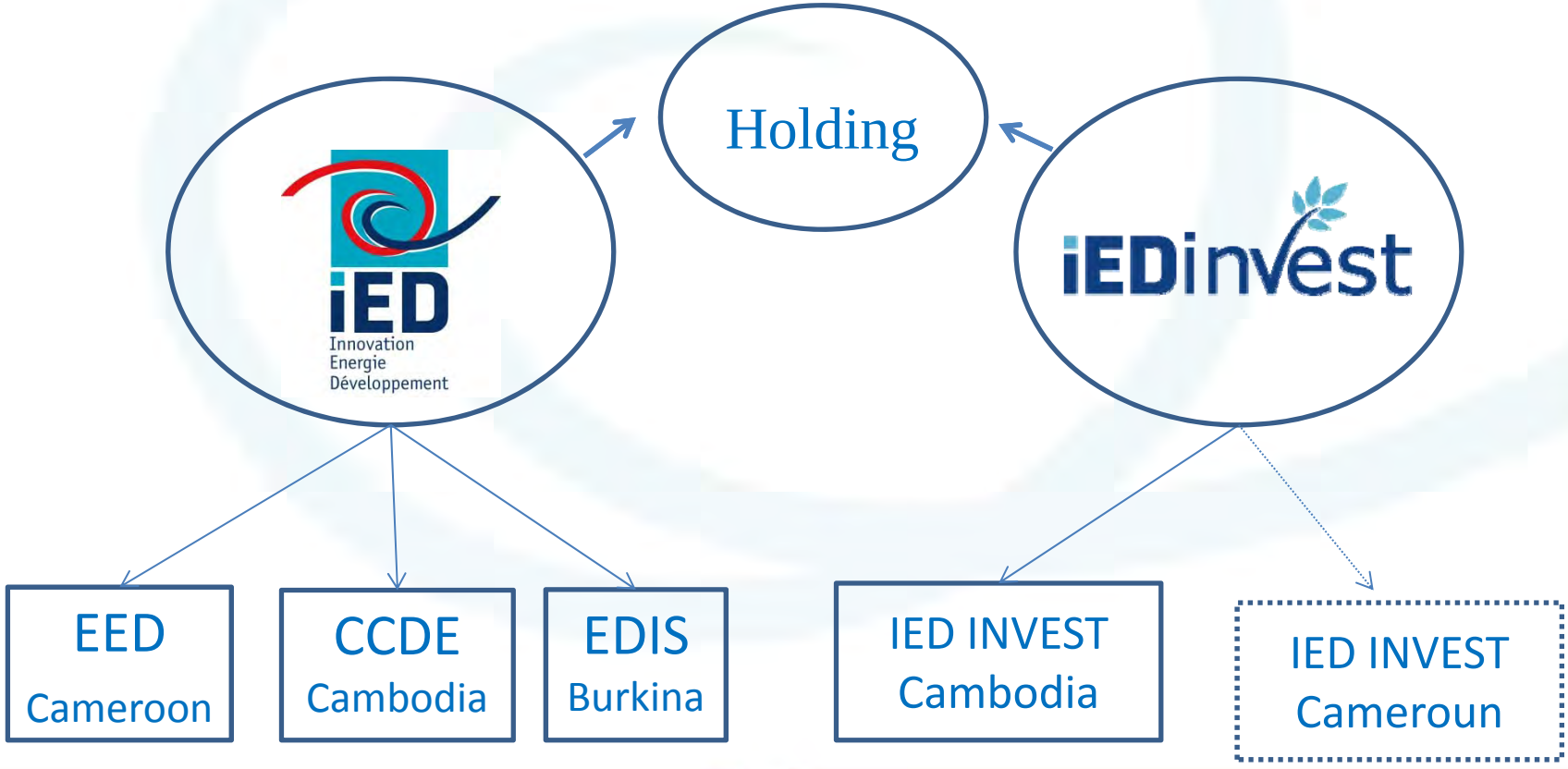
4 – Support to development strategies:

- Planning, capacity building.

Activities and Structure

Engineering and Consultancy Firm:

- 50% Turnover in studies;
- 50% in project in project implementation



Workplan of IEA PVPS T9 till july 2014

Millenium Development Goals related *(including business models)*

1 - PV for Drinking Water pumping (completed, publication, SWI)

2 - PV and Health, community services (en cours, All)

3 - Pico PV Services (completed, publicatino, N,SWI, FR)

Integration of PV in energy systems *(including business models)*

4 – PV and hybrid mini grids for rural loads – status (completed, publication, FR, N)

Modelling for Rural loads (T11) (ongoing, FR, N)

5- PV in medium scale fast growing urban cities (ongoing, FR, DK, J)

6 - Deployment and outreach in Asia

- Asian Development Bank (8 events, completed)
- ASEAN Center for Energy (3 events, ongoing)

7 – Deployment and outreach in Africa

- Club ER (4 events, ongoing)
- IRENA, AfDB (ongoing)

PVPS

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2005 – 2030 : Renewable Energy Growth (IEA)

- 2005 : 13,2% renewables
- 2030 : 13,8% renewables
  - Traditional biomass +16%
  - Hydro power +33%
  - Other renewables +225%

❑ Capacity additions:

- DCs + 484 M toe
- Industrialised countries + 364 M toe
- Transition economies + 27 M toe

❑ Developing country motivations:

- Environmental concerns of secondary importance
- To reduction of fossil fuel dependance (India, Thailand, Tunisia)
- With grid expansion, access to all offers opportunities for local renewable energy sources

Three Market segments for renewables in Developing Countries

Grid connected renewables: reduced fossil fuel dependancy

- No need for storage
- Too many points of fluctuating production can cause problems
- Today wind and hydro and cogen (biomass) are competitive
- Requires reliable LT FiT

For loads of 50kW to 1MW: mini grids competitive with diesel costs

- Key issue is how demand is matched and cost of storage
- Hybrid solutions offer continuity of service

PV SHS or pico hydro for individual localised loads

Renewable energy is cost competitive under certain conditions

Filière	Invest. € /kW	Cost ct€ / kWh		Nb hours functioning per yer
Photovoltaïcs (real installed conditions)				1000 – 1200
- Grid connected	3000 - 7000	20 - 40		
- Isolated : hybrids	7000 – 12 000	35 - 100		
Wind (large)				
- land	1000	4 - 8		2000 - 2500
- Off shore	1200 - 1500	4 - 8		2500 - 3000
Hydro electricity				
- Large	1400 - 2000	2 - 8		3000 - 8000
- Small <10MW	900 - 4000	1 – 9,5		3000 - 8000
Bio electricity	2000 - 3900	10-40		8000
Coal	900 - 1400	4,2 – 5,6		8000
Fuel / diesel	400 - 1500	25 - 100		indifférent

Need political commitment and strategic planning to obtain scale: Example of Cambodia

Develop a clear vision of time frames, financial and technical resources required

- Vision and Objectives:
  - Why electrify?
    - Is the objective Social – eg to reach all ? -
    - Is it Economic – eg irrigation for food self sufficiency (India)?
  - What targets ? Are the resource available to reach them?
  - *Is there the political will* to prioritise scarce resources for RE?
- Strategic Planning:
  - Decide on priority areas, and cost the investments
  - In order to engage in a credible dialogue for fund mobilisaiton
- Reality check and Roadmap:
  - Can the required financing be mobilised?
  - Do appropriate policies, structures and frameworks exist?

Costs and prices of electricity (2011)

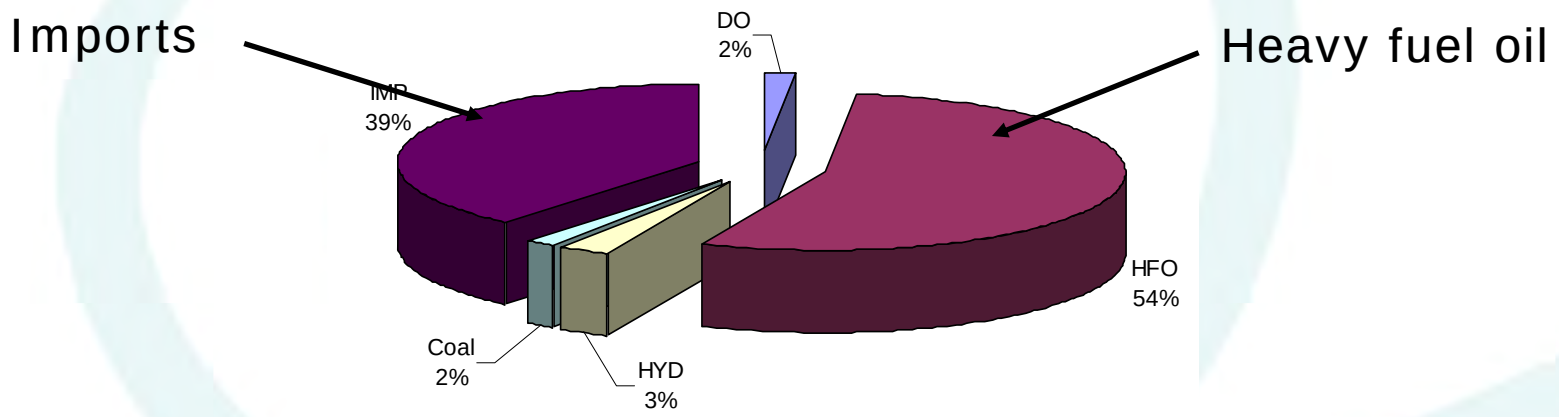
- Costs on the EDC network
  - Generation cost: $0.11 per kWh,
    - average of fossil generation ($0.15) and
    - imports ($0.08-0.09)
  - Generation cost + high voltage transmission: ~$0.13 / kWh

- Electricity tariffs
  - $0.18 per kWh in Phnom Penh (EDC)
  - $0.25 to $0.40 in towns and urban areas connecting to the grid
  - **$0.50** to **$1** per kWh in rural areas with diesel generators
  - Up to **$4** per kWh for users of car batteries

- **Average** capacity to pay: 6$/month/ HH

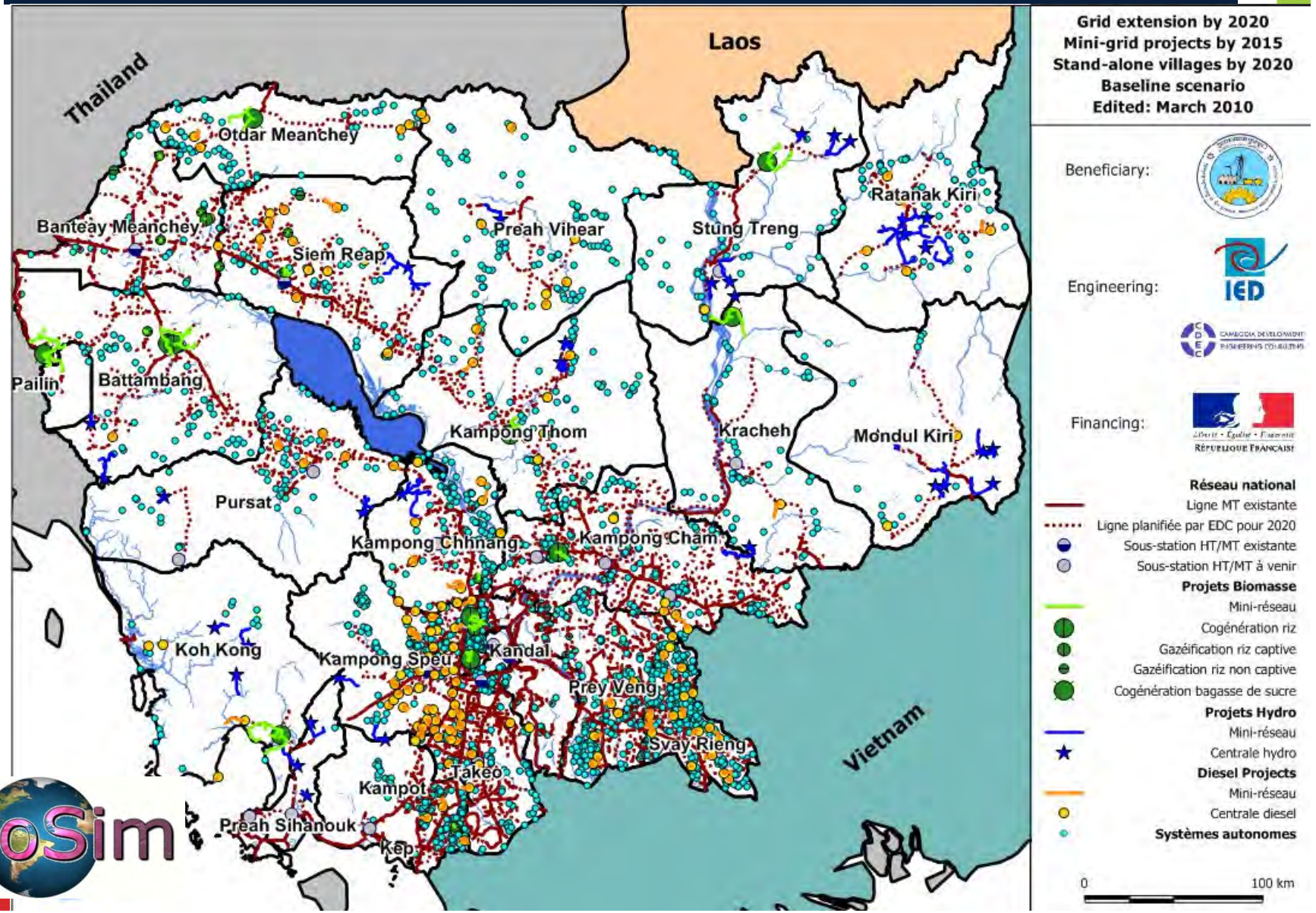
Status of power sector (2010)

- 400 MW installed capacity, fossil fuel dependant
- Non interconnected provincial networks, border connections, several hundred independent REEs



- Changing situation :
  - 900 MW hydro power planned (2011-2015)
  - Interconnections
  - Large scale grid connected renewables are welcome under 10c/kWh

Baseline scenario results – summary map for 2020



Baseline scenario results – financing requirements

- Between 2010 and 2015: Total of **> 400 M$** worth of investments have to be executed, in order to meet the RGC targets
  - 140 M$ for MV (essentially for EDC)
  - 180 M$ for distribution (how will the private REES – micro utilities mobilise this?).

    A financing mechanism to support REE borrowings would be essential
    70 M$ for mini grids.

    Financing mechanism? Rules for Integration with the grid?
  - 20 M$ for stand alone (essentially PV) Need a 50% buy down given capacity to pay and cost of collections and maintenance

- Whole period until 2030
  - **> 1 BI$** have to be mobilised to reach the target of 100% village coverage, including 95% from the grid – for Cambodia with a total population of ~12M

ECOWAS Renewable energy policy adopted by Ministers in 2012

- Policy prepared with the support of the EUEI-PDF was adopted in 2012. Targets have been established for three market segments:
- Increase grid-based supply of renewable energies with new capacity of 7.6 GW by 2030, with a penetration ratio of 31% in the electricity mix;
- Create 156,000 Renewable Energy powered mini-grids of less than 100 kW by year 2030, covering the needs of 103 million inhabitants of the ECOWAS region living in small villages (< 2000 inhabitants) that will remain far away from the main grid;
- Distribute 4.7 million stand-alone renewable energy systems to cover the residual demand coming from the isolated population, enabling the universal access by 2030.
- Reaching these objectives would require an **investment of 20.6 billion euro in Renewable Energy technology**. If Transmission and Distribution costs are taken into account, the total amount might be twice as high. Currently, ECREEE is working on setting up a framework for the development of National Renewable Energy Action Plans (NREAPs) for ECOWAS member states.

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Biomass gasifiers mini grids for Rural Electrification: the concept

- Current situation
  - Existing gasification units installed at rice mills : over 100 operating in Cambodia
  - Only 30% of the husk produced is used
  - Neighbouring REE provides power to rural dwellers with very expensive gensets.
  - Power on EDC network: marginal cost expensive at the far end of the grid
- Solution
  - Use the additional husk with the existing gasifier at times when not needed for the rice mill (e.g. in the evening) in order to provide power to the village.

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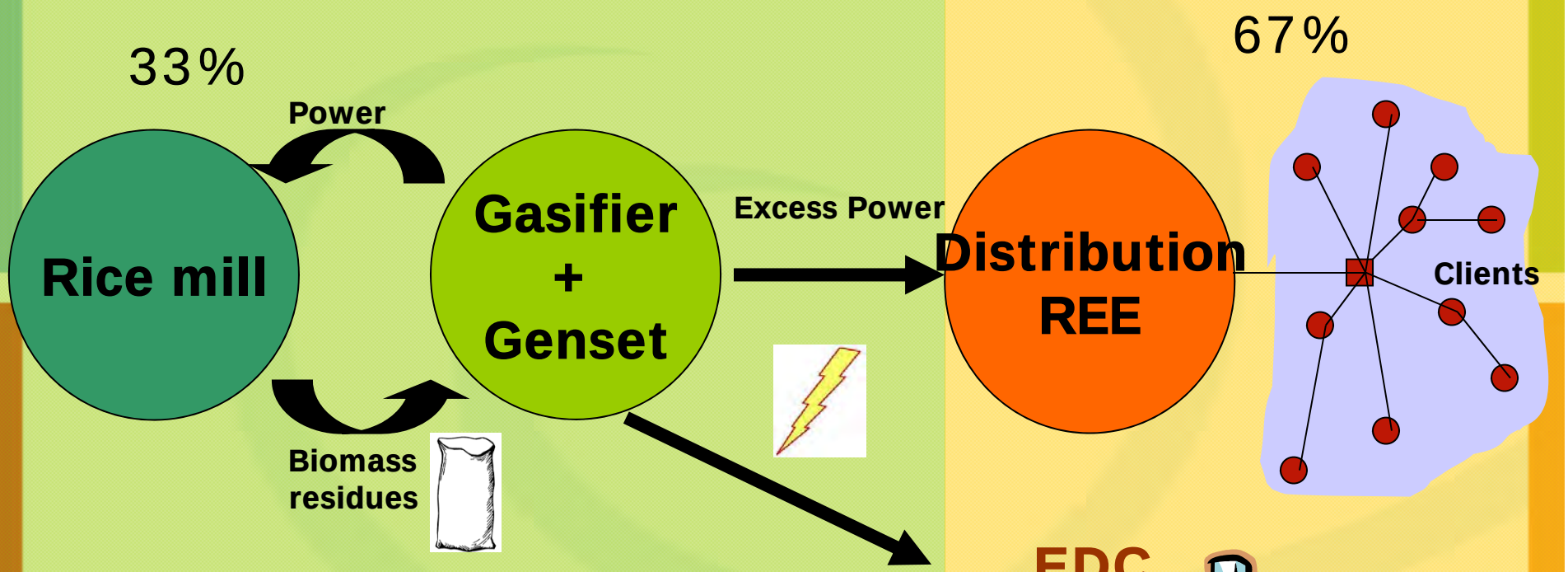
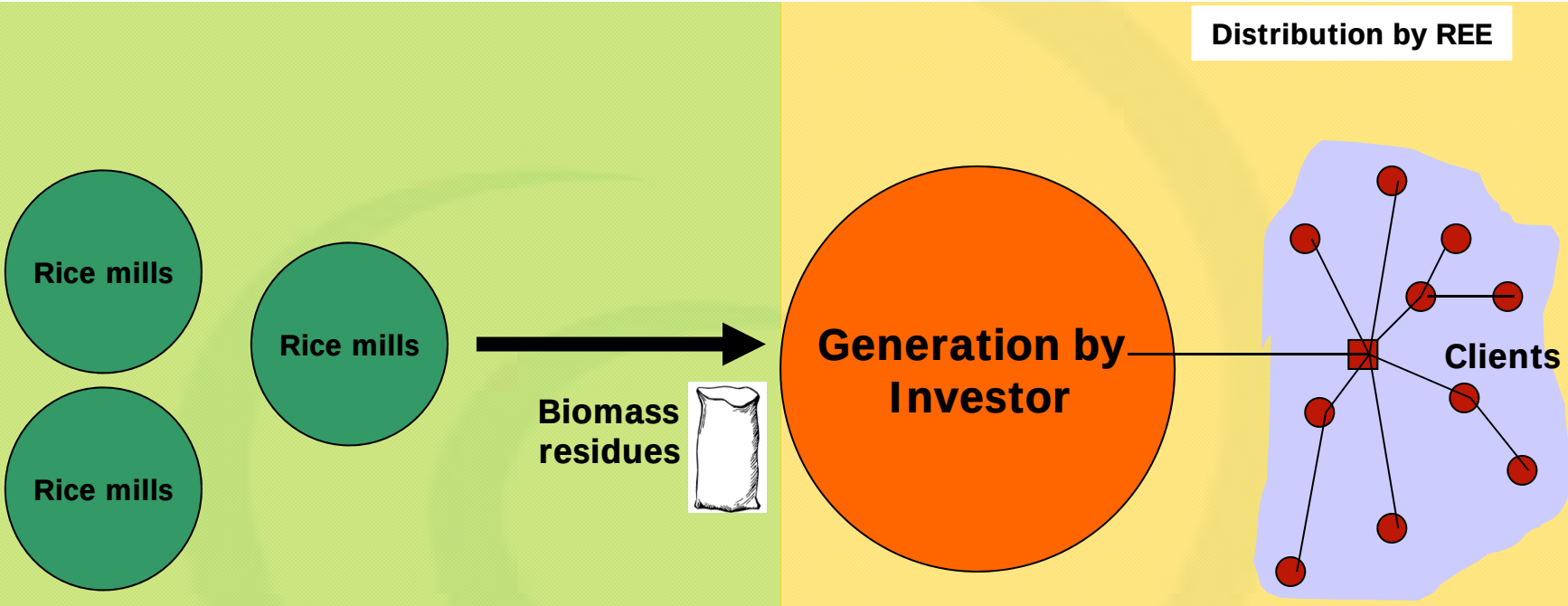
Gasifier business model concept 1



- The Miller is unwilling to diversify in the Rural Electrification business
- EDC Feed in Tariff (standardised) is not available yet

Gasifier business model concept 2



OBJECTIVE:

- In locations away from the grid where baseline for a few years is diesel
- Achieve costs under diesel costs with commercial financing
- Work out the financing conditions required to achieve acceptable returns for the investor and fair tariff for end user: between EDC (1300R) and diesel tariffs (up to 4000 R)

Biomass Gasification:
Char Chuck Project, Siem Riep

- Baseline situtation
  - 400 HH connected, old genset and network, intermittent power
  - More than 75c/kWh tariff
- Solution:
  - Gasifier of 200 kWgas – ultra clean, 24 hours
  - 70kW 100% gas engine
  - 150kW dual fuel engine (30% fuel)
  - Loss reduction in network (LV MV line)
  - Estimated total investment cost: 350 k$

- Project partners: PPP
  - **IED-INVEST** – private investor
  - CCDE Operator
  - UNIDO and REEEP / OFID co financiers
  - TOTAL provides high quality fuel
  - REE is the off taker
  - MIME and EAC provide the framework

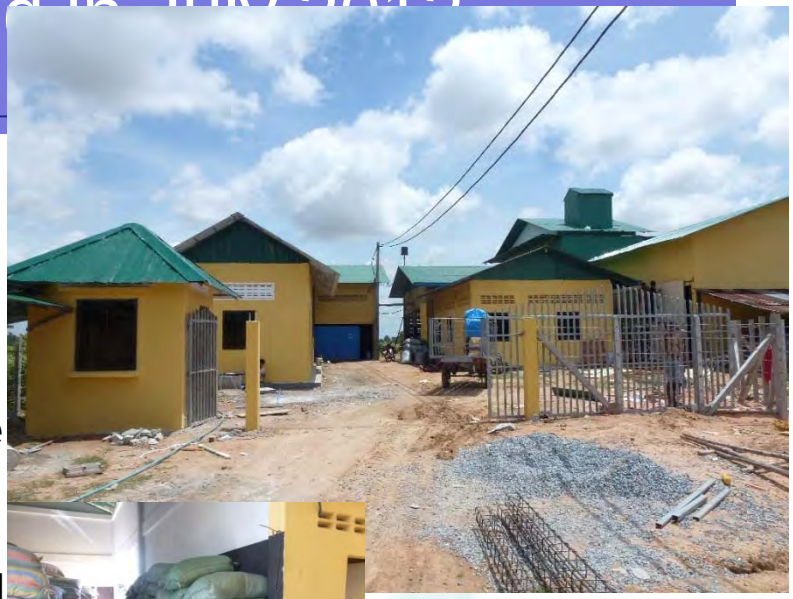
System commissioned in July 2012

Targets

- Bring down production tariff by 50%
- Provide quality 24 h supply and connect anchor loads
- Operate the gasifier in “ultra clean mode”
- Bring down tariffs to enable HH to consume more than the current 10kWh/month
- Expand to neighbouring household and villages
- Till February 2013, close to 1000 customers, load increase by 40%

Issues

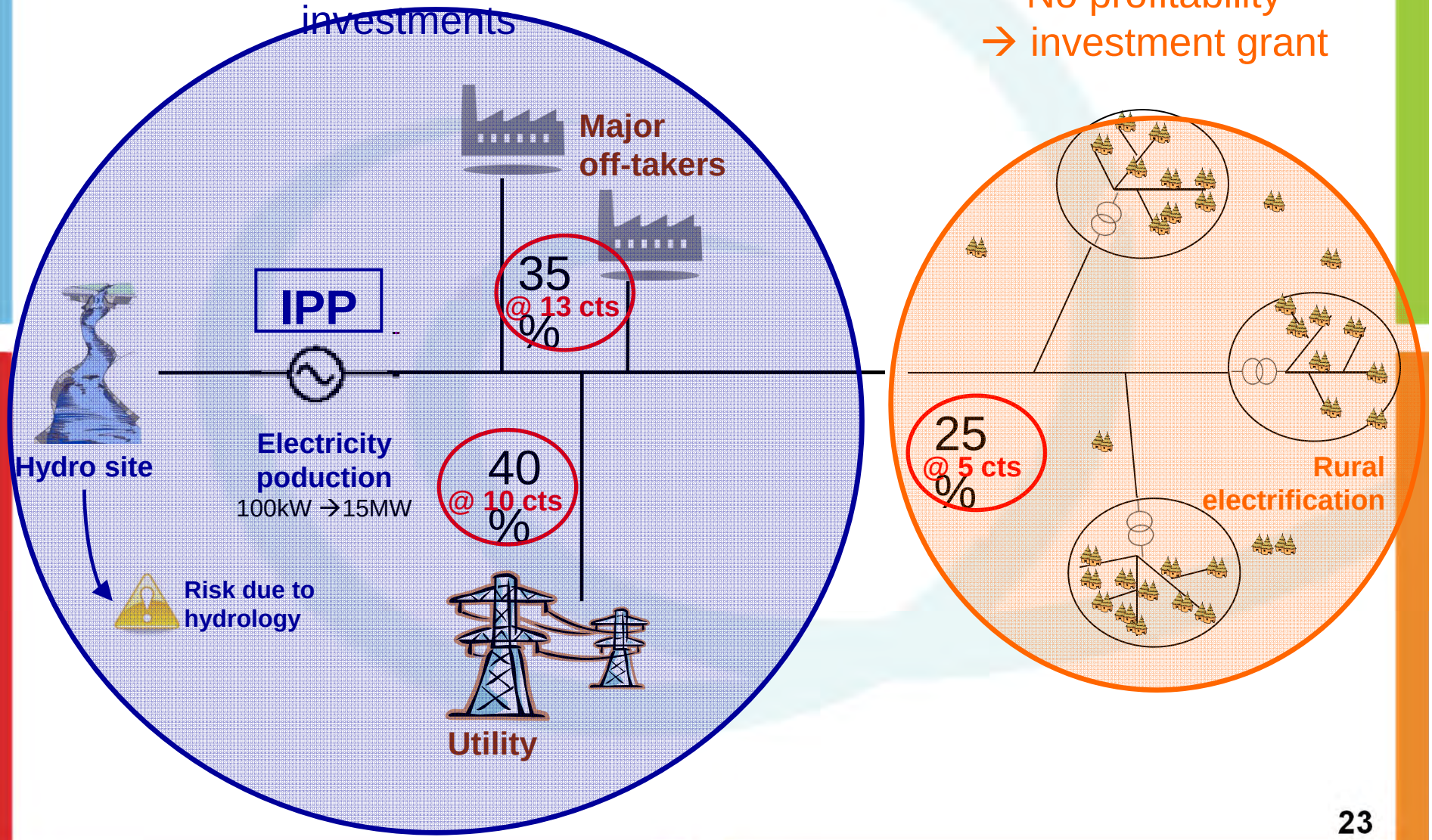
- Training staff for 24 hour supply: 4 teams
- Meeting high load variations
- Spare parts and Chemicals for treating waste water availability
- Maintenance of the system for 24 hour service: proper management of down time, having a back up supply
- Success with gas engine
- But high maintenance costs, needs a “programme”
- >*<u>political pressure to come under 20c/kWH</u>*



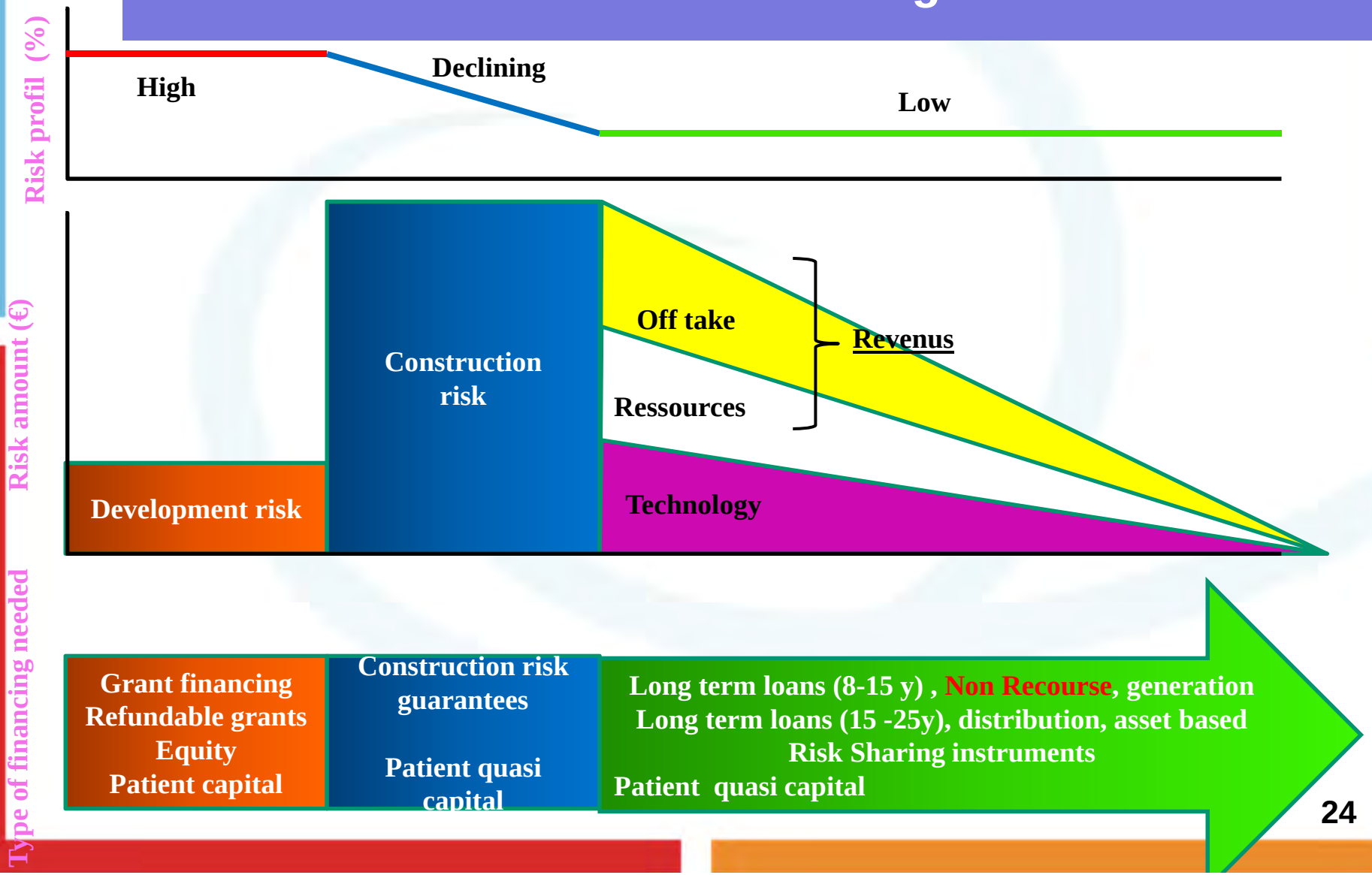
Economically viable
→ Credit line, concessional to match the profile of hydro investments

Mini grids: complex business models

No profitability
→ investment grant



Finding Credit worthy investors, technically credible And financial institutions with an appetite: **the real challenge**



THANK YOU FOR YOUR ATTENTION

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