Smartening the Renewable Energy Supply on Islands – addressing technical, economic and systemic challenges:

Experiences from German bilateral cooperation

German Side Event

German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

Federal Ministry for Economic Cooperation and Development (BMZ)

6 September 2012

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German Federal Ministry for Economic Cooperation and Development (BMZ)

- The German government supports the development and implementation of energy supply systems based on renewable energies on islands and isolated mini-grids on the mainland
- In 2011, more than **1.8 billion USD** were spent **on energy related projects,** making energy the largest sector within BMZ
- BMZ is currently supporting bilateral energy projects in over **60 partner countries**
- BMZ supports various energy initiatives and partnerships – e.g. Energizing Development, Africa-EU Energy Partnership, the Renewable Energy Policy Network for the 21st Century (REN21) and IRENA
- Close **collaboration with the private sector** (promoting entrepreneurial activity and thinking; working to improve conditions for private sector engagement; helping to create vibrant, attractive and fair economic areas)
- Strong supporter of SE4All – seeking to provide an additional 100 million people with access to sustainable energy by 2030.

Corporate Purpose

GIZ's corporate purpose is to provide international cooperation services and engage in capacity development work for the sake of promoting sustainable development

GIZ worldwide

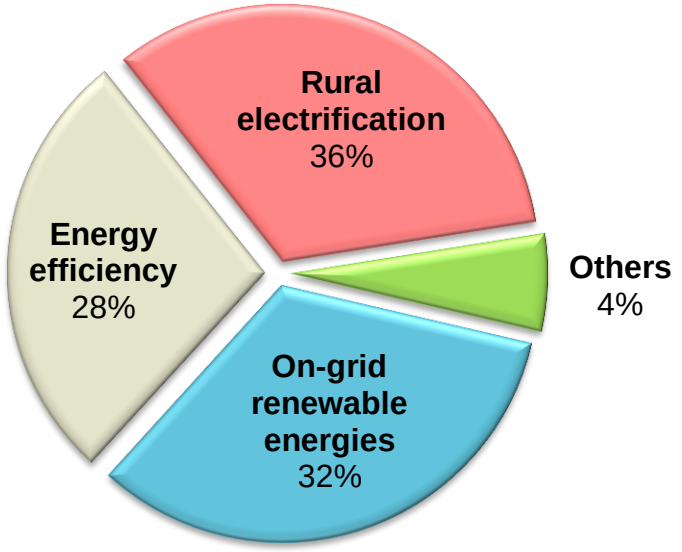
- GIZ operates in more than 130 countries worldwide
- GIZ has over 17,000 staff members across the globe – some 70% of whom are employed locally outside of Germany as national personnel
- In 2011, GIZ had a total business volume of EUR 2 billion
- The services delivered by the GIZ draw on a wealth of regional and technical expertise

GIZ Energy Project Portfolio: Figures (2012)

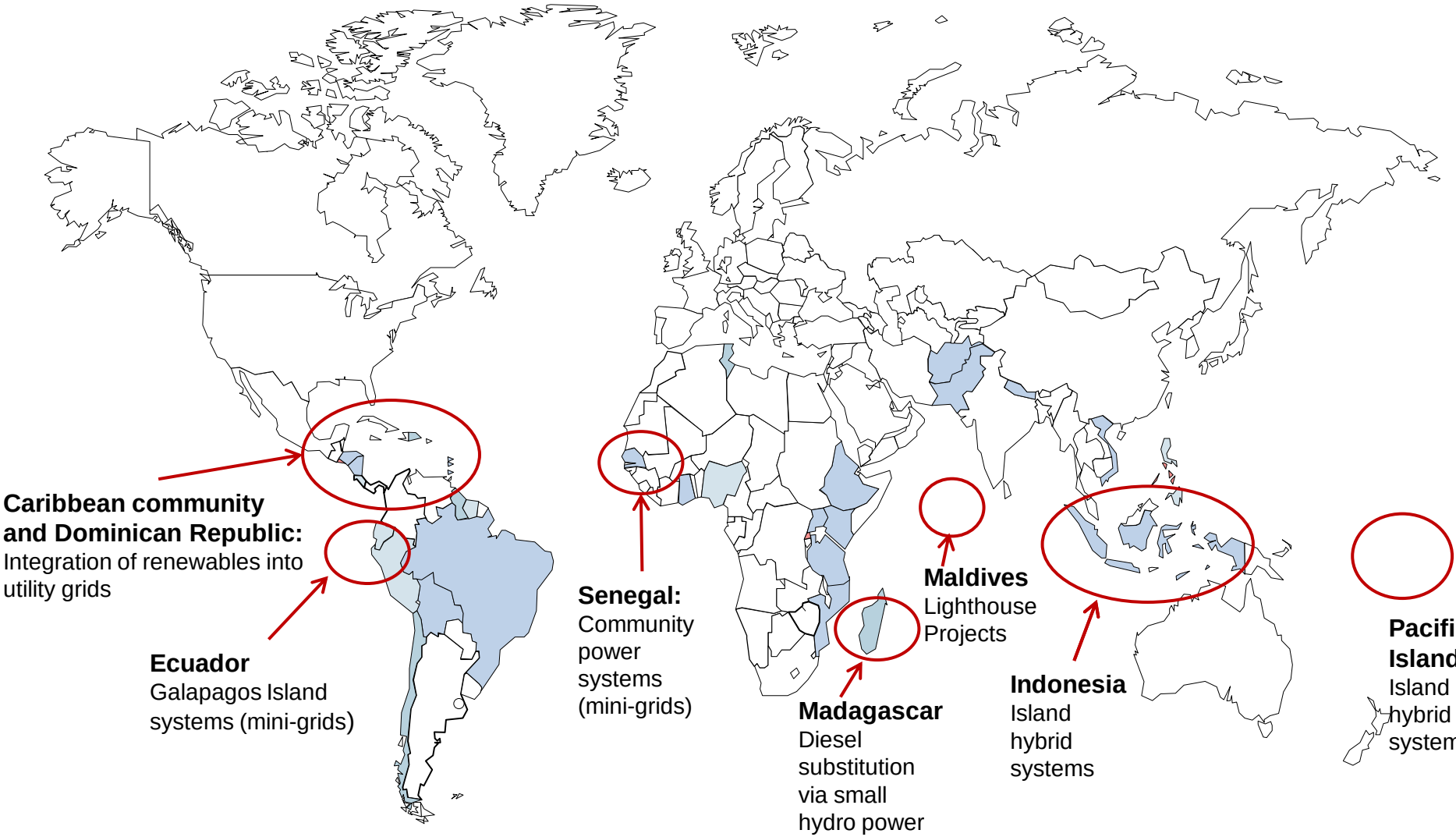
- More than **100 energy projects**

- **Financial project volume (total):** € 442 million (**annual turnover**: ~ € 110 million p.a.), of which:
  - BMZ-funded: € 229 million
  - BMU-funded: € 67 million
  - Energising Development: € 130 million
  - Others: € 16 million

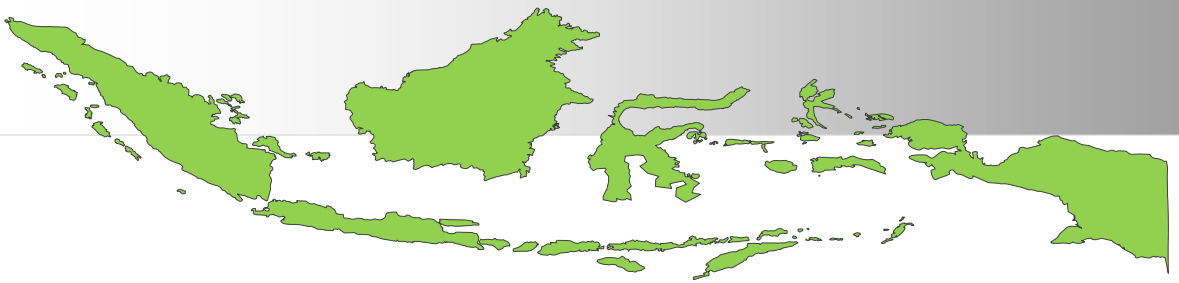
- **Financial project volume by energy topics:**
  - Rural electrification 36 %
  - On-grid renewable energies 32 %
  - Energy efficiency 28 %
  - Others 4 %



A sample of relevant ongoing GIZ energy projects



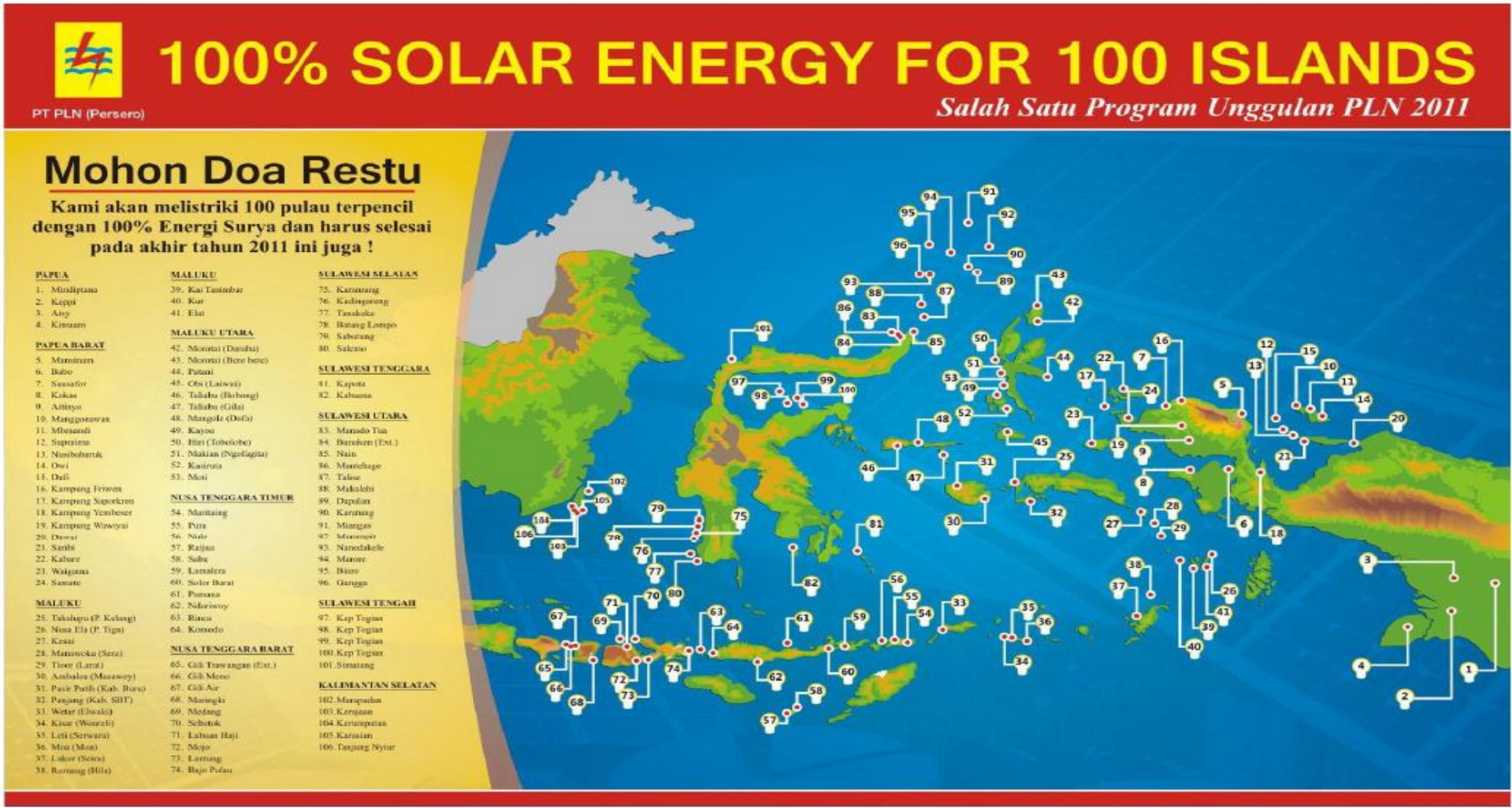
Indonesia



- Indonesia: 17,000 islands, population of 240 million
- Yearly growth: Economic – 6%; Power consumption – 9 %
- Electrification – 66%, 80 million people without electricity
- PLN (state utility company) > 5,000 power plants
- Average generation costs PLN: 1,200 IDR (€ 0.10/kWh)
- In remote areas: 3,000 – 9,000 IDR/kWh (diesel) **(€ 0.25 – 1.0/kWh)**
- Solar irradiation: 4.1 - 5.5 kWh/m^2/d (about 50% > than Germany)
- Total PV potential compared to Germany: 10x
- Installed PV Capacity: 15 MW

Regional Focus: Islands in Eastern Indonesia

- Strong solar irradiation, dry climate
- Little potential for hydropower/biomass
- PV as best renewable solution



GIZ roles in project development

Project stage	Activities/possibilities for GIZ involvement	
Identification & Selection	❖ field surveys ❖ preliminary studies ❖ screening processes	❖ program socialization ❖ matchmaking ❖ commercial scenario development
Pre-Construction	❖ bankable FS ❖ permit securitisation ❖ PPA process/final	❖ training & study tours ❖ financial scheme accomplishment ❖ selecting tech. providers & contractors
Investment Decision & Construction	❖ site selection ❖ investment decisions ❖ financial disbursements	❖ civil construction ❖ grid connection studies ❖ operation training
Commissi-oning	❖ commissioning ❖ operating manual/guideline preparation ❖ monitoring & evaluation	
Operation	❖ operation ❖ monitoring & evaluation ❖ dissemination & replication design	

Conclusions: Paving the way towards higher renewables penetration on islands

- Renewables on islands are already economically viable and broad deployment is possible
- Technical solutions are available for integrating intermittent renewable energy sources into isolated systems
- Innovative systemic solutions (e.g. grid integration of larger amounts of RE) are necessary for self-sufficient supply
- Lessons learnt from mini-grid experiences and approaches on the mainland can easily be transferred to island solutions
- Sustainable business models (i.e. project development, financing) and viable operation/maintenance concepts are key factors for investments and broad-scale dissemination
- A quick win can be achieved through hybrid systems - as fuel and cost savers - and should be strongly supported by the international donors/ organizations

What should the next steps be?

- Experiences made with renewable energy projects and investments should be analyzed in detail and shared among respective countries
- Information about feasible projects and standardized hardware solutions should be provided to local authorities, investors, project developers and technology companies
- Further development of technological innovations with significant scale-up potential (in close cooperation with the private sector) should be supported
- Business models and incubation processes should be furthered in order to accelerate the successful establishment of local renewable energy companies
- Innovative financing mechanisms and commercial scaling-up should be advanced (e.g. attracting private equity financing, providing ‘first loss’ capital, early stage project financing, etc.)
- A global program that provides technical assistance (especially capacity building) should be set up within the project development process

Thank you for your attention!

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Case study 1: Galápagos Islands

- Contracting authority: BMU
- Background
  - Two islands with populations of 2,200 on Isabela and 200 on Floreana
  - Energy supply before: 100% via old diesel fuelled generators
  - Ecuadorian government targets 100% renewable energy by 2020
  - Jatropha: already in wide-spread use as natural live-fences in the mainland coastal province of Manabí, Ecuador
- Overall Goal
  - Establishing a hybrid energy system comprising PV and Jatropha oil-fuelled generators
  - Developing the hybrid system into a smart grid, automatically coordinating energy production on the islands

Case study 1: Galápagos Islands

- GIZ support
  1. Implementing a hybrid energy system and transforming it into a smart grid
     - Floreana: Reactivate PV plant and integrate it into a hybrid system with two already existing Jatropha oil-fuelled generators
     - Isabela: Financial assistance to convert generators to be Jatropha oil-fuelled
     - Workshops, seminars and expert advice to support smart grid development
  2. Sustainable production of Jatropha oil on mainland Ecuador
     - Develop business plan for growing and processing Jatropha, enabling local smallholders (especially women) to earn an additional income
     - Central pressing installation and targeted agricultural advice
  3. Knowledge management
     - Knowledge transferable to projects on other islands
     - Knowledge sharing with expert community

Case study 1: Galápagos Islands

- State of Implementation
  - Inauguration of two new generators (69 kW each) on Floreana
  - Increase of Jatropha harvest from 30.5t in 2009 to 155.7t in 2011
    - Additional income to 800 families of 50 USD per family in 2011
    - Harvest in 2012 will not only cover required supply of oil for Floreana but also contribute to start-up process of new generators on Isabela
  - Since 2009, InWent (now part of GIZ) has been implementing a Human Capacity Development-Programme together with MEER, concerning RE on the Galapagos Islands. In 2010, InWent organized seminars on mobility, wind energy and PV on the Galapagos Islands as well as on mainland Ecuador.

Case study 2: Fernando de Noronha

- Contracting authority: BMZ
- Background
  - Population of 3,000 people
  - 100% diesel-fuelled power generation by Tubarão Thermoelectric Plant
    - High electricity generation costs of 950 BRL/MWh (379.24 EUR/MWh)
    - Diesel-fuelled generation is highly subsidized
  - Comparatively high average solar radiation per day: 5.54 kWh/m²
- Overall Goal
  - Integration of a 400 kWp PV power plant into the island system and substituting parts of the current diesel consumption for electricity generated by PV/ diesel hybrid system

Case study 2: Fernando de Noronha

- Objectives
  - Assessment of a general energy concept, professional support and transfer of know-how
  - Decentralized energy production to contribute to higher energy efficiency of the country's electricity net
  - Show opportunities for decentralized use of RE in isolated areas
- Services provided by GIZ
  - Study on the integration of the 400 kWp solar plant into the local grid and general energy concept based on a solar/diesel hybrid system
  - Support during the tender process on technical issues
  - Supporting local partners from planning to operation
  - Support in choosing the project site
  - Documentation and training

Case Study 3: Outcome and Benefits

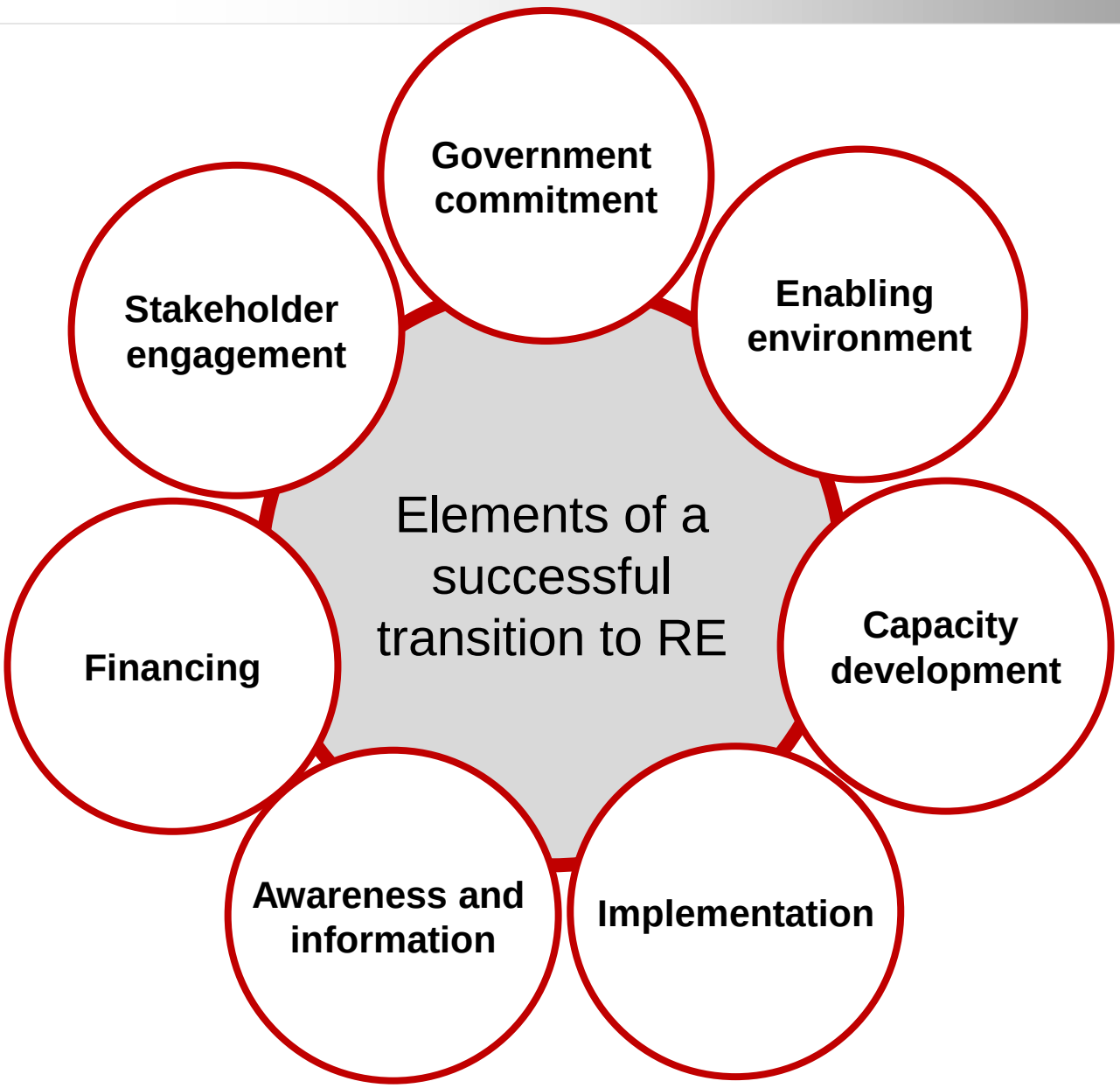
Indonesia: Investment in a 100 kW Solarplant (results of a feasibility study)

- Proposed FIT is set lower as actual generation cost (2500 IDR/kWh < 2800 IDR/kWh);
- Avoiding up to 840,000 liters of diesel fuel;
  - (140,000 kWh/Year * 0.3 Liter/kWh * 20 Years)
  - *[Assumed Diesel Price in NTT: 8000 IDR/Liter ~ 580,000 EUR over 20 years]*
- Avoiding up to 300,000 EUR of costs over 20 years of operation;
- Proves financial viability of solar investments in Indonesia
  - ➔ multiplier effects and economies of scale are expected;

Pacific islands

- Many (remote) islands generate electricity based on diesel oil transported by ships
- Fuel switch (introduction of hybrid systems) is already economically competitive

- Reao, French Polynesia:
  Fuel costs of 1,000 EUR/day (250l of diesel per day at 4 EUR/l) for 100% fuelled power generation have been reduced by 80% through switch to PV/diesel hybrid system. Investment of 2m EUR recouped after 6-7 years


Government commitment
Enabling environment
Capacity development
Implementation
Awareness and information
Financing
Stakeholder engagement
Elements of a successful transition to RE