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RENEWABLE ENERGY SOLUTIONS FOR THE MEDITERRANEAN

Ministero degli Affari Esteri e della Cooperazione Internazionale

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RENEWABLE ENERGY SOLUTIONS FOR AFRICA

Renewable Energies as never seen before

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RENEWABLE ENERGY SOLUTIONS FOR AFRICA

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Il ruolo delle energie rinnovabili: opportunità di crescita globale ed investimenti nelle economie emergenti

Ministero degli Affari Esteri e della Cooperazione Internazionale
Roma, 11 maggio 2018

Indice

- ***Renewable Energy Technologies***
- ***Why choose renewable energies?***
- ***Utility-scale Renwable Energy Soruces***
- ***Hybrid micro-grids for rural electrification***

Q&A

Energy and Power

Energy

Is the capacity to do a work

Has different forms: kinetic, potential, thermal, electromagnetic, sound, light

Energy can be converted from one form to another

Energy can be stored

M.U. : Joule (J), Calorie (cal), Watt-hour (Wh)

Power

Is the rate of producing or consuming energy

Has different forms: electric power, human power, and optical power

Power can't be converted or transformed

Power can't be stored

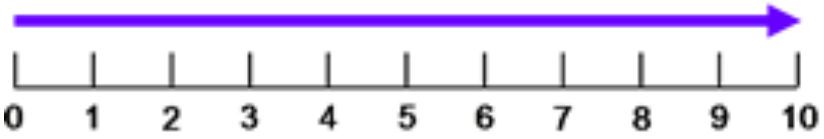
M.U. : Watt (W)

Energy is the total amount of work done/to do and Power is how fast you can do it.

Energy and Power

Example: Lighting with 100 Watt Light Bulbs

You need 100 watts of power



1 bulb x 100 Watts x 10 hours =

1000 Watt-hours = **1 kilowatt-hour (kWh)**

You need 1,000 watts of power

Time (hours)

10 bulbs x 100 Watts x 1 hour =

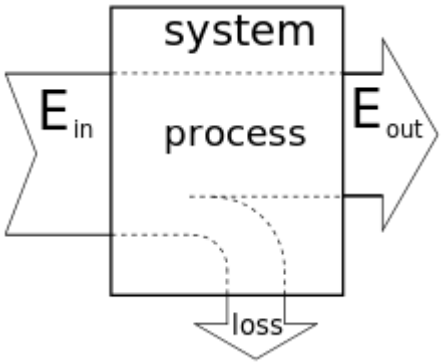
1000 Watt-hours = **1 kilowatt-hour (kWh)**

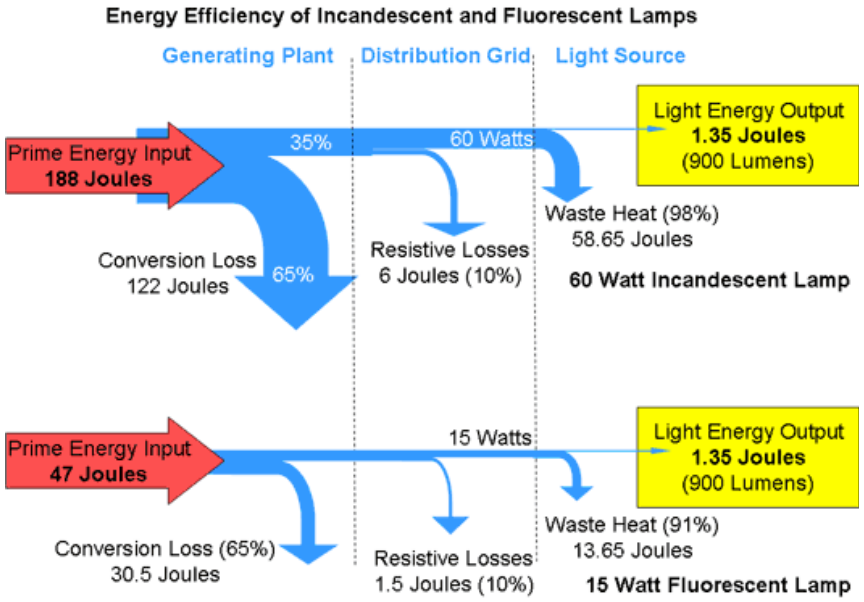
You used the same amount of Energy and you paid the same amount

Energy Conversion System Efficiency

A energy conversion system transform energy from forms provided by nature to forms that can be used by humans.

Energy conversion efficiency (η) is the ratio between the useful output of an energy conversion machine and the input, in energy terms. The input, as well as the useful output may be electric power, mechanical work, light (radiation), or heat.





Solar Energy

Solar Energy is the use of light and heat from the Sun to generate power.

There are several technologies that have been developed allowing solar energy to be used in different forms.

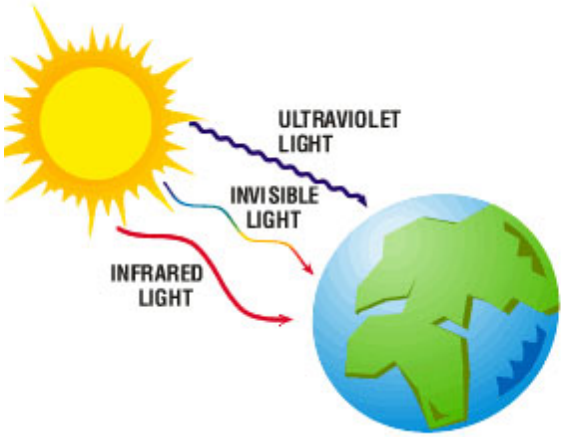
Since large amount of solar energy are available this makes solar a very appealing source of energy.

Over time, people developed devices (technologies) to collect solar energy for heat and to convert it into electricity

Solar Water Heaters

Photovoltaic Panels

Concentrated Solar Panels

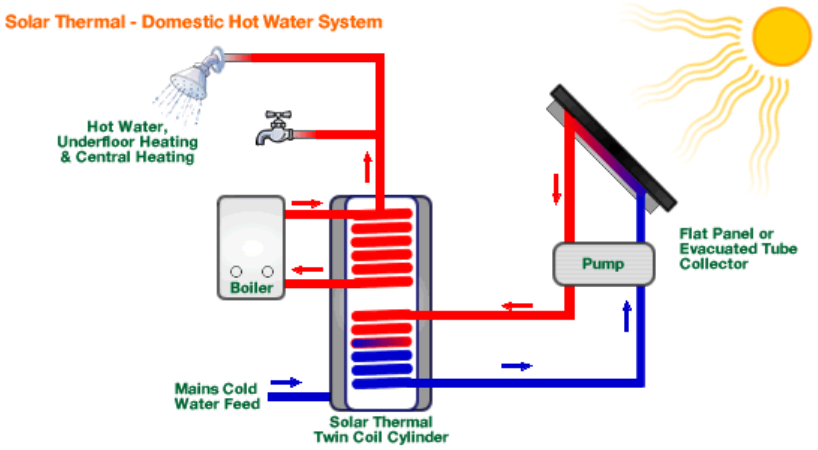


Solar Water Heaters

Solar Water Heaters capture the heat and the radiation from the sun to heat water and store it in a tank

This reduces the dependence on LPG in households and hence, reduces monthly expenses

Today solar water heaters are very efficient devices that can capture energy for two or three days even though it's cloudy

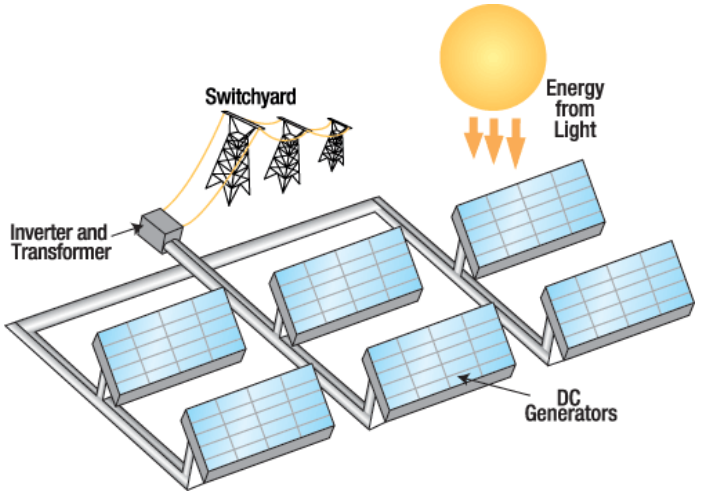


Photovoltaic

Photovoltaic is a process of converting solar energy into direct current electricity by photoelectric effect

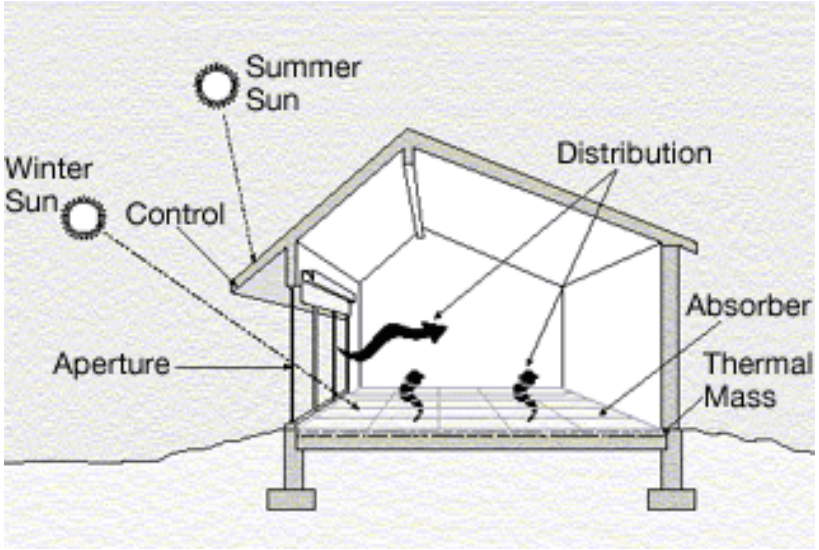
It uses solar panels which is composed of solar cells to generate the electricity

Photovoltaic enables electricity to be generated on a large scale to supply to the grid and on a small scale to supply a house or building.



Passive Solar Building Design

Passive solar building design employs architectural design that allows solar energy to be collected and distributed efficiently in winter and reject unusable solar heat in summer. The design makes best use of local climate conditions to create comfortable and ecological houses



Wind Energy

Wind energy is the energy derived by the kinetic energy of the wind.

A wind turbine is used to harness the energy in the wind and produce electricity.

The environmental problems caused by wind energy technologies are less than the problems that are caused by the use of fossil fuels.

Scientists and engineers have efficiently designed wind turbines which consists of blades, gearbox and other control system that allow maximum energy from the wind be captured

Types of Wind Turbines

There are two types of wind turbines that were developed to harness wind energy.

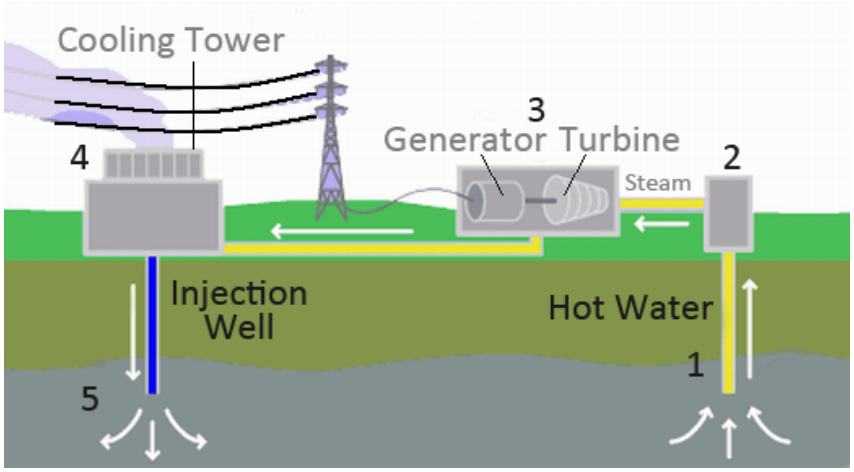
These two configurations are given below:

Horizontal Axis Wind Turbines (HAWTs)
- Higher efficiency
- Bigger challenge in installation

Vertical Axis Wind Turbines (VAWTs)
- Lower efficiency
- easier to install

Geothermal Energy

Geothermal energy is a renewable energy system that uses the thermal heat energy at the Earth's crust to generate high pressure steam that is in turn used to activate a turbine and generator to produce electricity

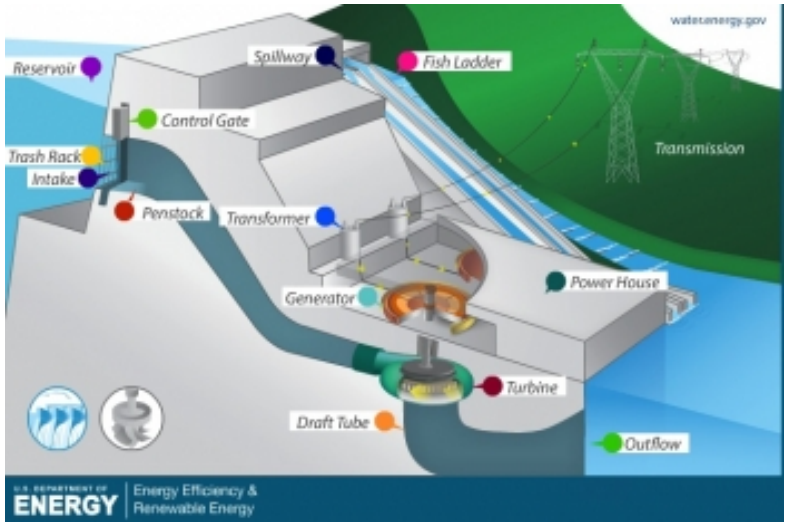


Hydropower

Hydraulic power is the use of water from dams and reservoirs to generate electricity.

Through a dam the water will be stored as potential energy on a high level above the turbine. Opening the dam will release water downhill through a penstock.

The potential energy is converted into kinetic energy in the speed of the falling water. This water drives a turbine at the end of the penstock.



Biomass

Biomass energy, or "bioenergy" is energy derived from living or recently-living organism

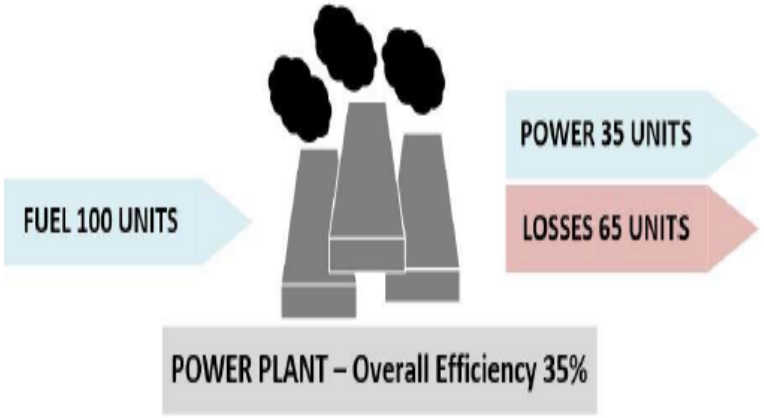
They include plant materials such as:

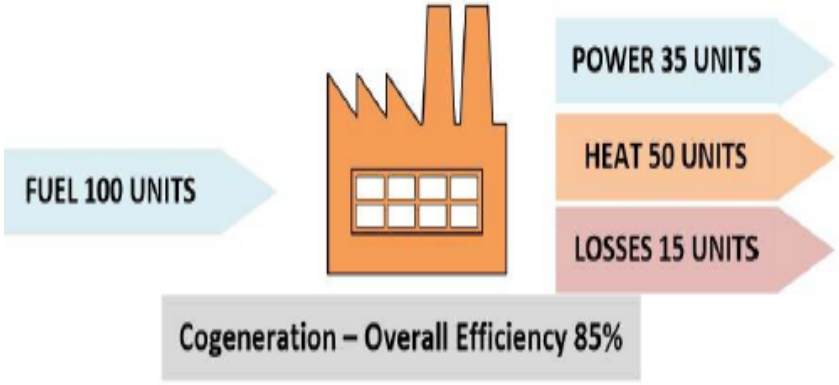
- Wood
- Agricultural and forest residues
- Municipal and industrial solid wastes
- Algae

Bioenergy can be converted to liquid or gaseous fuels or used directly as a solid fuel

Biomass Energy for Cogeneration

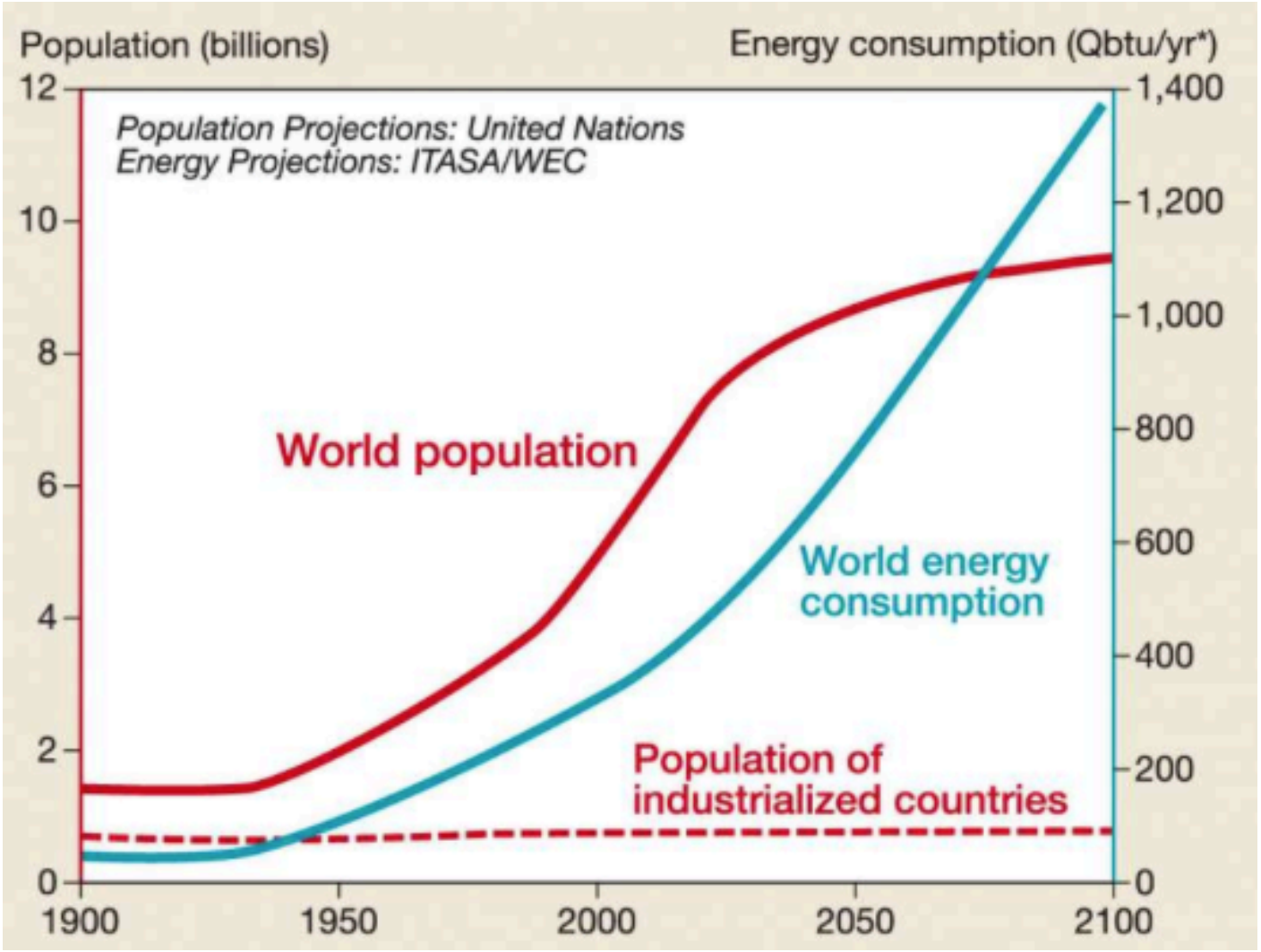
Cogeneration (or combined heat and power production) is the simultaneous production of heat and power from a single fuel source (biomass, natural gas, municipal solid waste, etc.)
The electricity is fed to the grid and the heat (in the form of steam) is used for industrial applications or district heating in some countries.
Through the cogeneration technology, the overall efficiency of a system can be increase.





Why choose renewable energies?

World energy consumption projections



World energy consumption projections

Demand growth is expected to be exponential in the first 5-10 years and to stabilise thereafter

Technology cost is predicated to come down fast in the next years making the capacity addition cheaper

Future capacity additions are expected to be cheaper and not to need any further economic support from Governments

Opportunity cost of renewable energy

Opportunity cost is the ***cost*** incurred by not enjoying the ***benefit*** that would be had by taking the second best choice available

Opportunity cost of not having access to modern electricity:

electricity opens up opportunities for education, entrepreneurship, food and healthcare that can lead to tremendous improvements in standard of living

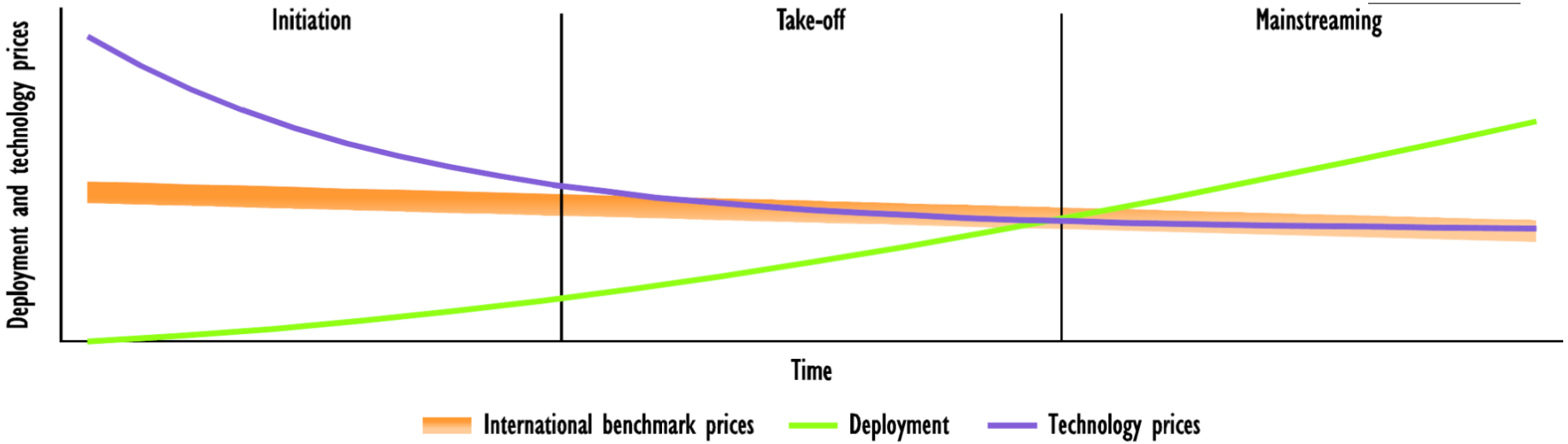
(Source: World Finance)

2,778 billion in 2013:

the Cost Of Not Having a Renewable Energy Infrastructure

(Source: Solavis, The Global Cost of the Fossil Energy System Vs. The Renewable Energy Infrastructure, 2014)

The renewable policy journey

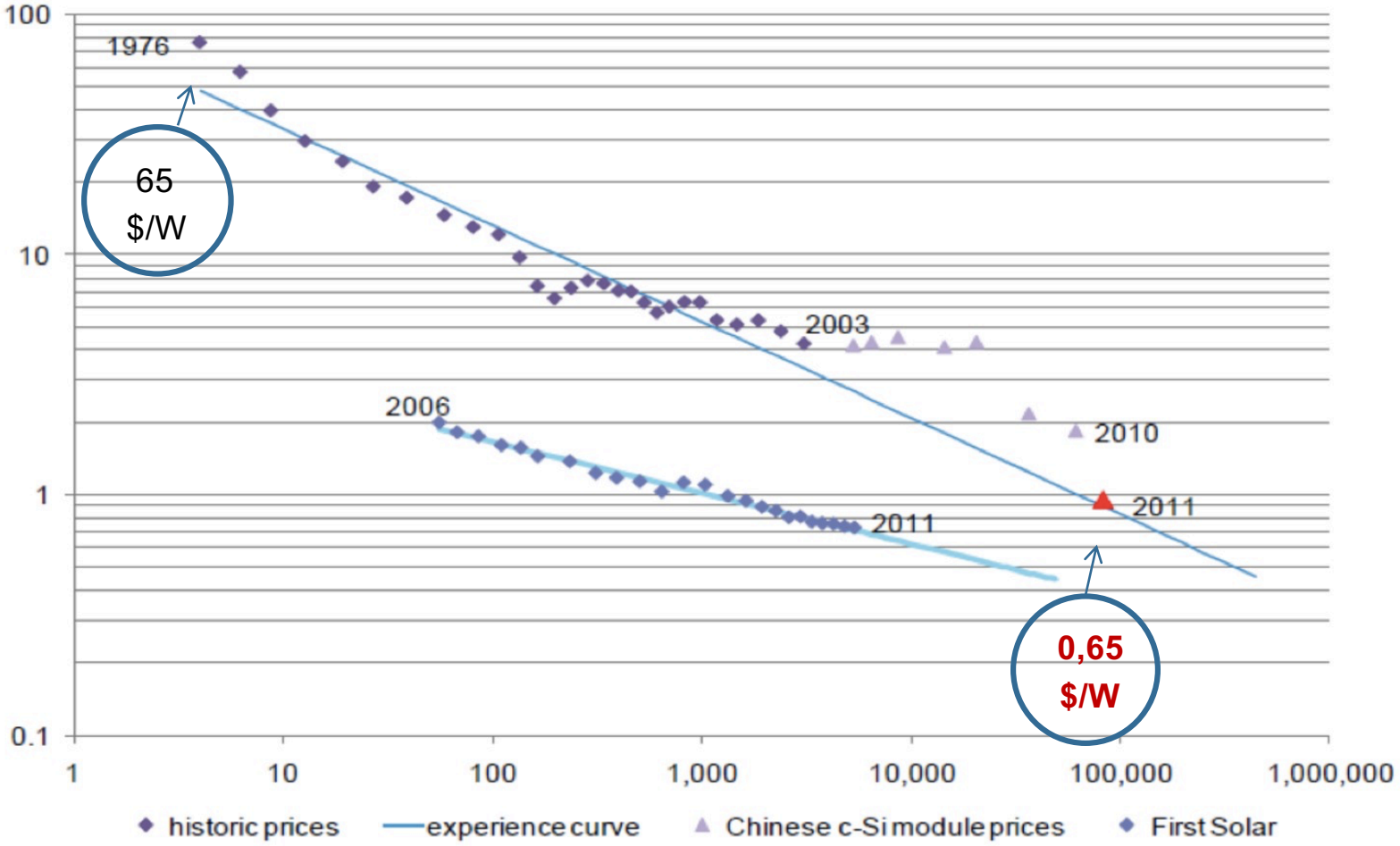


Initiation phase	Take-off phase	Mainstreaming phase
• The first examples of the technology deployment under commercial terms • **Secure support needed to encourage early investors.** • Local supply chain absent. • Define regulatory framework e.g. permitting procedures may be unclear or lengthy.	• The market starts to grow rapidly. • **Policy priority is to encourage costs to converge with international benchmarks.** • Manage total support costs remain within the expected envelope. • Refine regulatory procedures.	• The annual market has reached a significant scale. • The supply chain is well established. • Generation prices are consistent with international norms and approach fossil-based alternatives. • **Technical and market integration becomes key issues.**

Source: IEA (2015), *Enabling Renewable Energy and Energy Efficiency Technologies: Opportunities in Eastern Europe, Caucasus, Central Asia, Southern and Eastern Mediterranean*,
www.iea.org/publications/insights/insightpublications/EnablingRenewableEnergyandEnergyEfficiencyTechnologies.pdf.

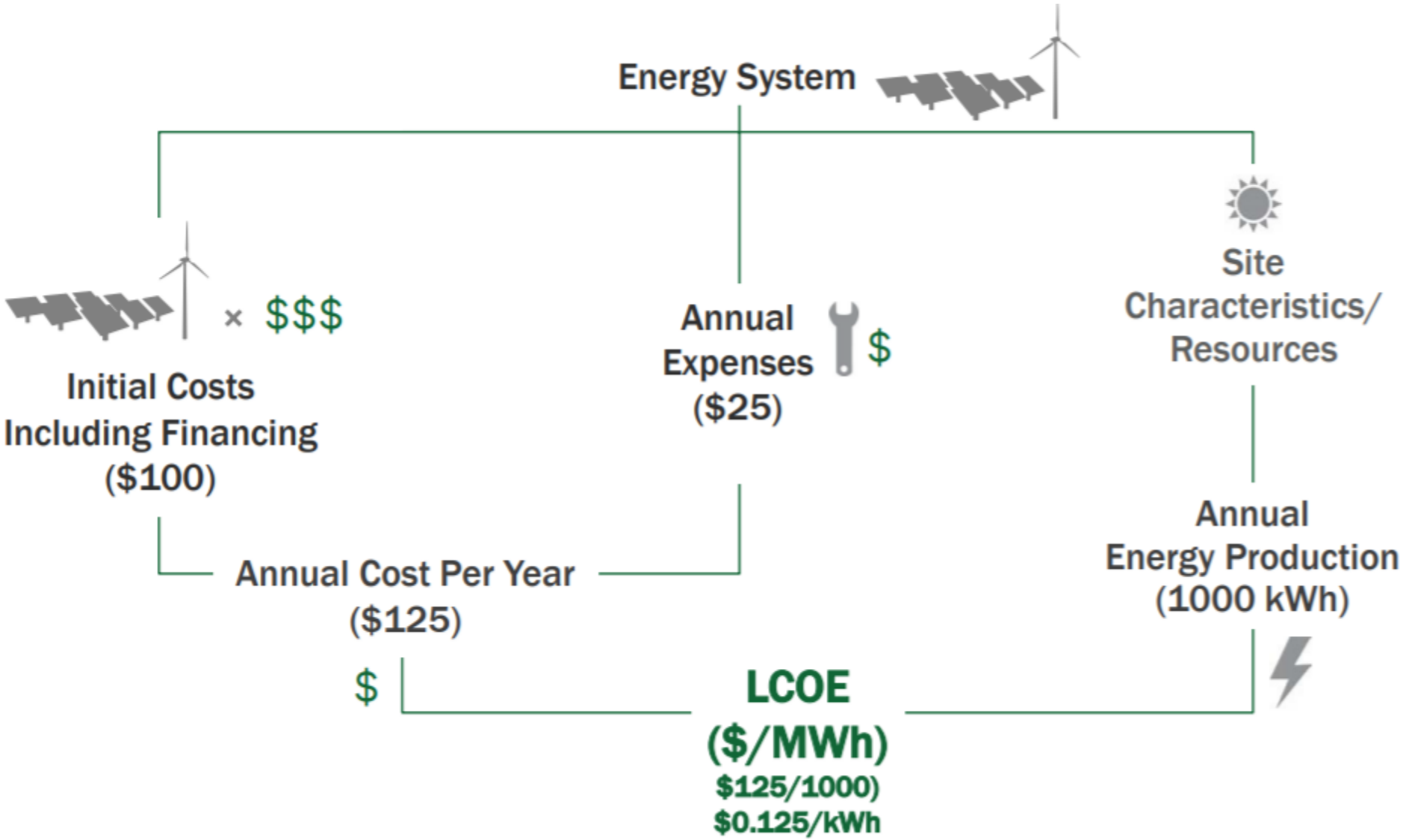
Evolution of the renewable energy cost: the case of solar PV

Solar PV cost **Down** 100-fold

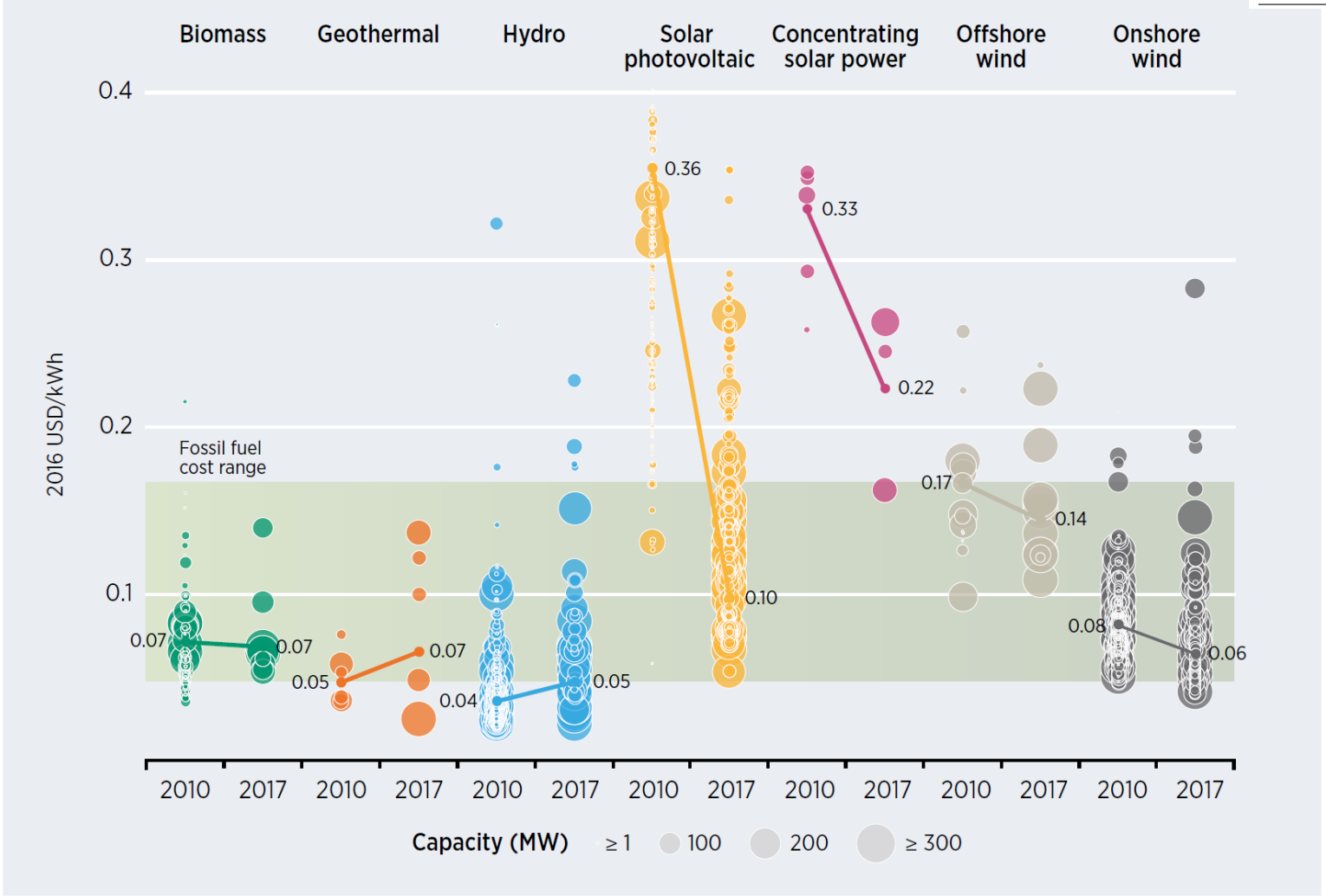


Source: BNEF

Levelized Cost of Electricity



Global LCOE from utility-scale RES generation technologies



Source: IRENA Renewable Cost Database.

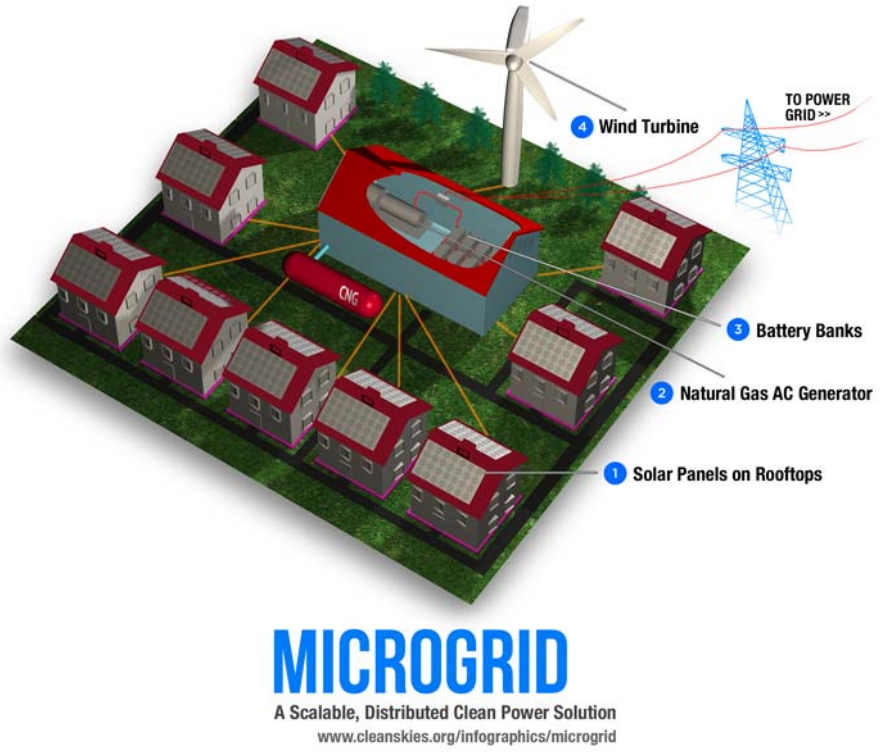
Note: The diameter of the circle represents the size of the project, with its centre the value for the cost of each project on the Y axis. The thick lines are the global weighted average LCOE value for plants commissioned in each year. Real weighted average cost of capital is 7.5% for OECD countries and China and 10% for the rest of the world. The band represents the fossil fuel-fired power generation cost range.

Micro-grid definition

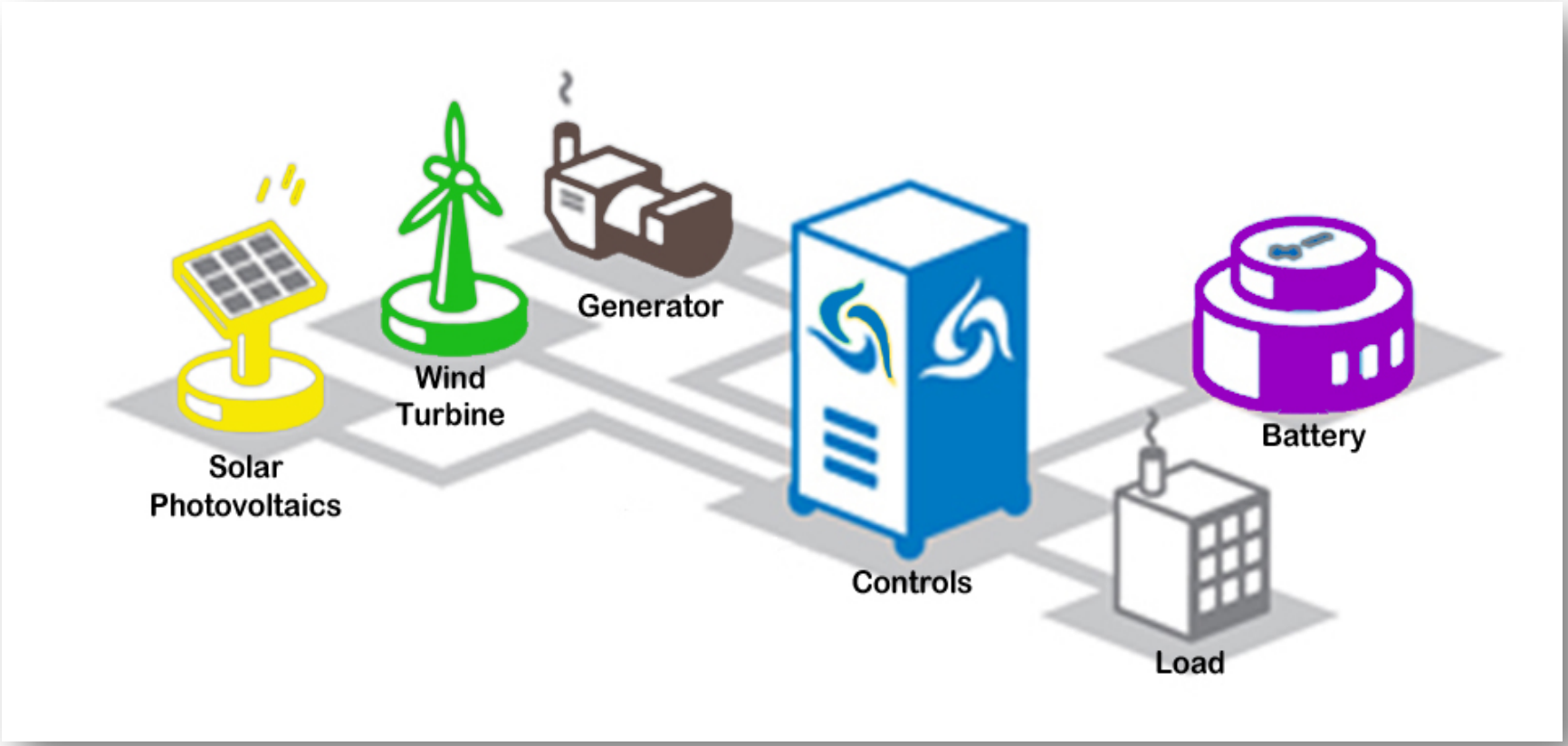
It is involving a ***small-scale electricity generation*** (from 10kW to 10MW).

The distribution of electricity to a limited number of customers via a distribution grid that can operate in isolation from national electricity transmission networks and supply relatively concentrated settlements.

"Micro-grids" are similar to mini-grids but operate at a smaller size and generation capacity (1-10 kW).



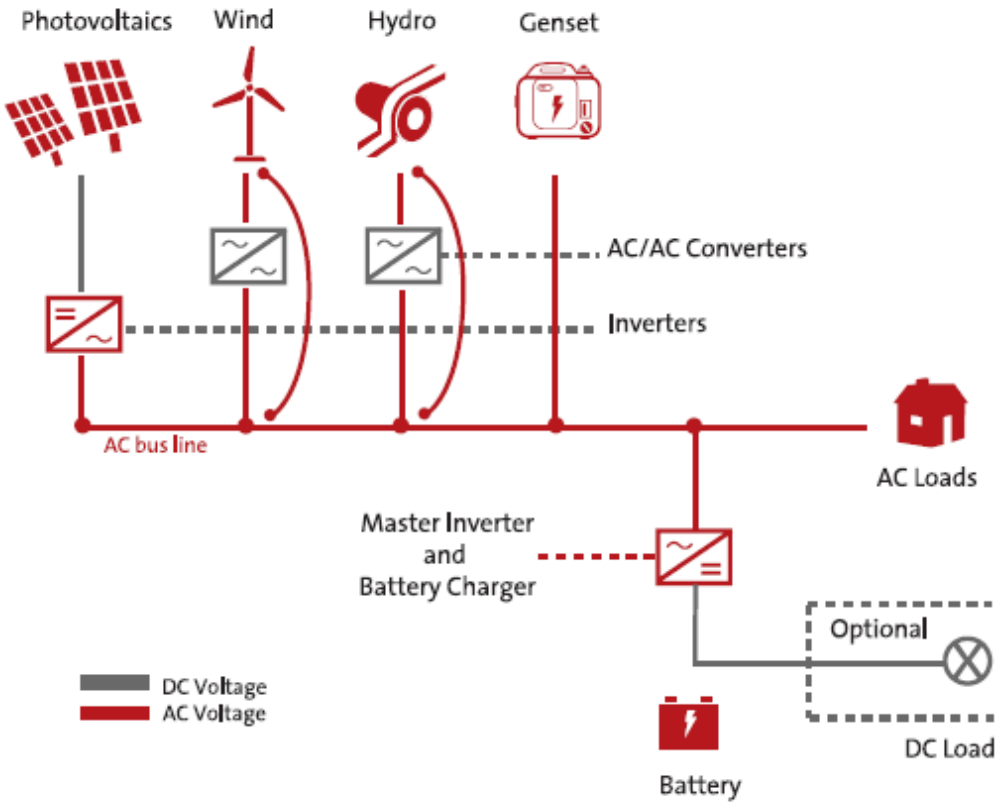
Micro-grid:
a replicable model for rural development



Micro-Grid Basic Features

A mini-grid has **five basic features**:

1. Power Generation System
2. Storage System
3. Distribution Network
4. User or application subsystem
5. Smart Management System

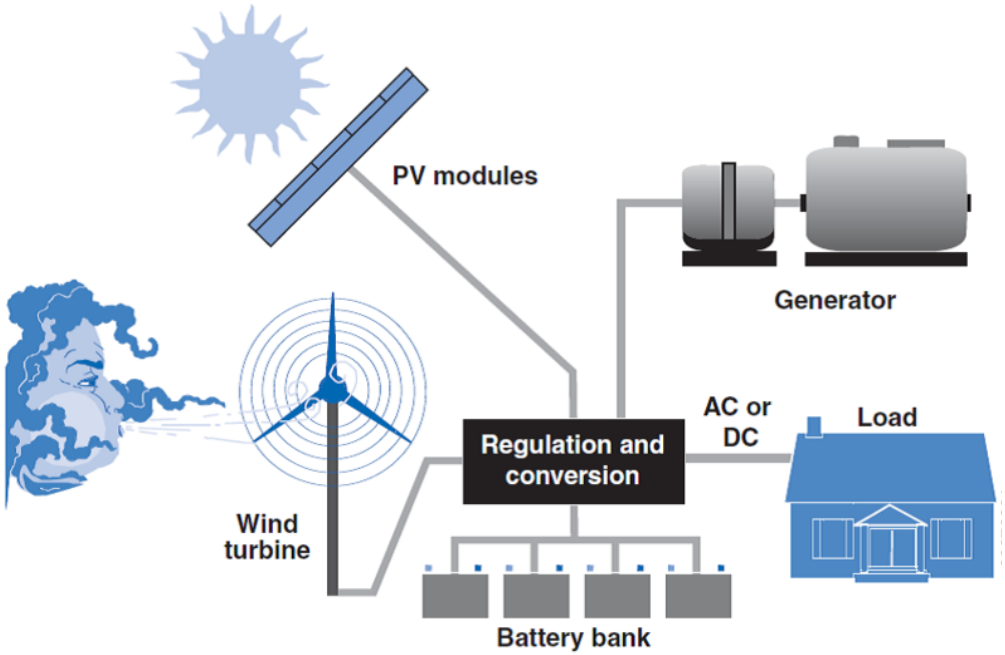


Diesel Generators

- High Fuel costs
- Maintenance intensive
- Pollution damages the environment and causes health problems
- Noise

A diesel generator in the region of Iriona, Hondruas

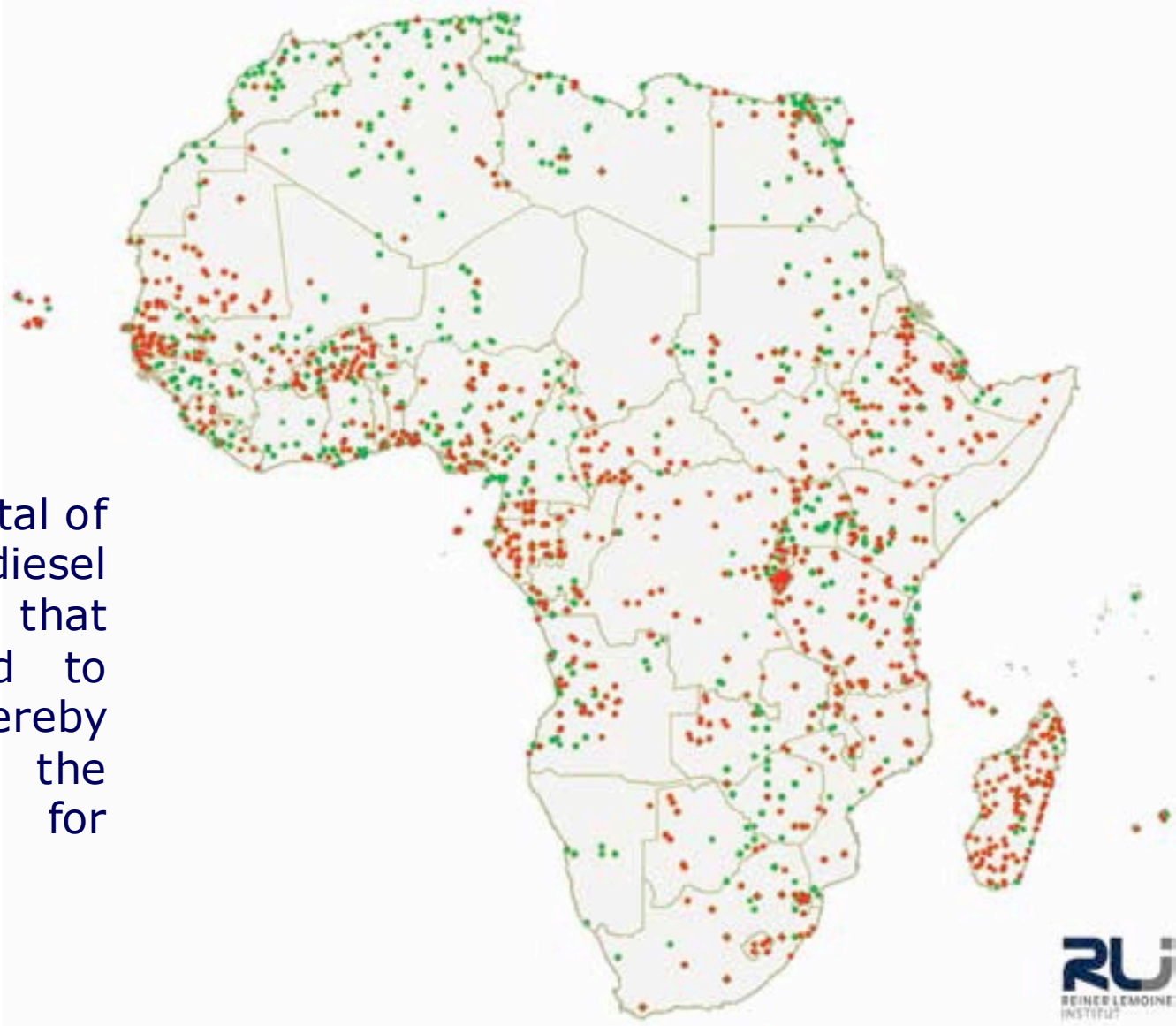
The relevance of hybrid systems



- Hybrid systems are more reliable and less costly
- Fuel procurement is often difficult in rural areas
- Cost reduction and performance improvement can help in providing **productive uses** for energy
- The optimization of the management of the intermittent renewable sources, the diesel generator and the energy storage is challenging but crucial

Micro-grids hybridization opportunities

The map shows a total of 1,101 known diesel generators in Africa that are not connected to national grids, thereby illustrating the opportunities for hybridisation.



The Micro Grid Academy Experience

HOME / STORIE / KENYA: LE DONNE AFRICANE A SCUOLA DI MICRO-GRID

Kenya: Le donne africane a scuola di micro-grid

Pubblicato venerdì, 4 maggio 2018

Main Sources

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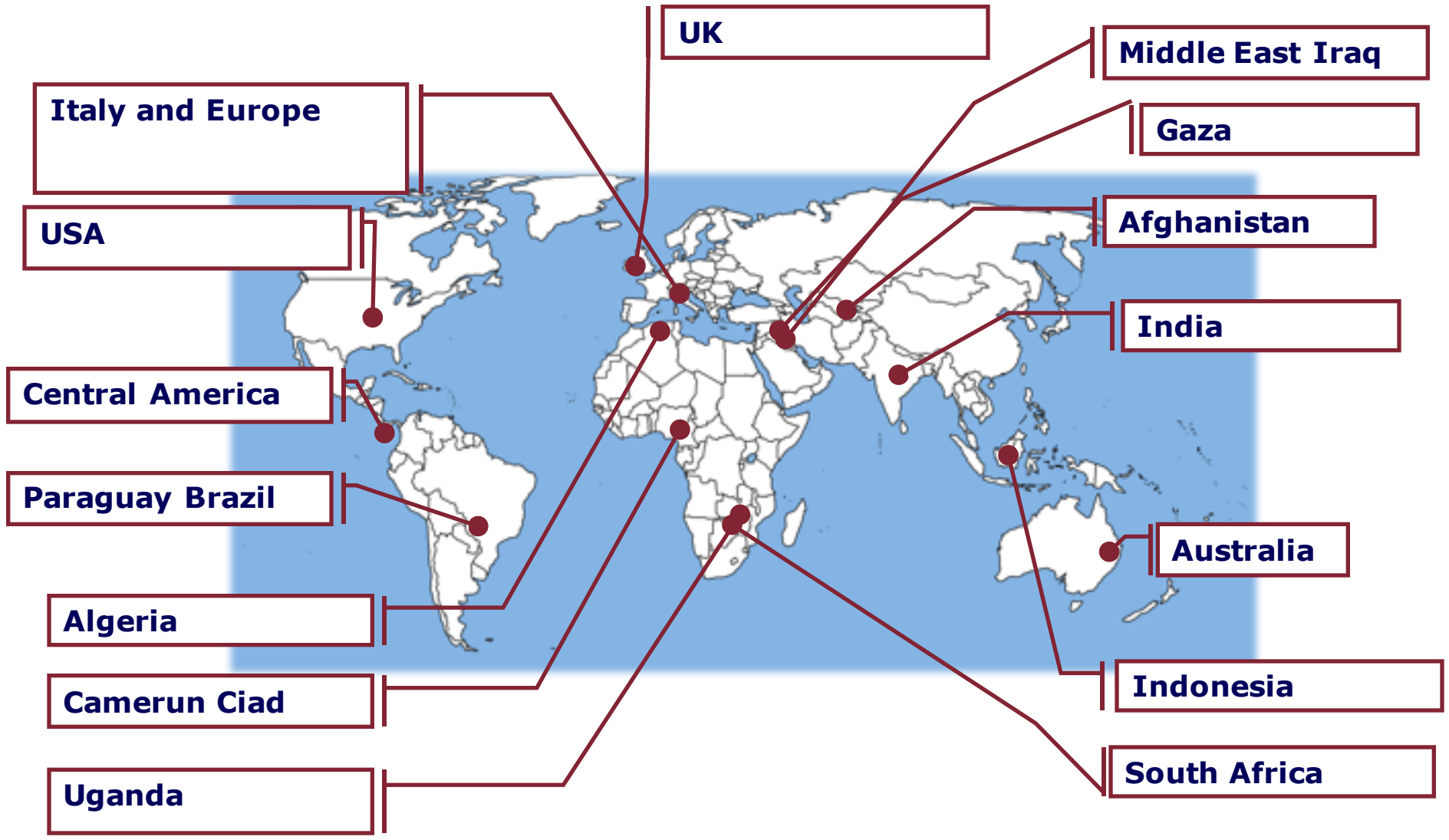
About me - International experience



International experience

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Grazie per l'attenzione

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