



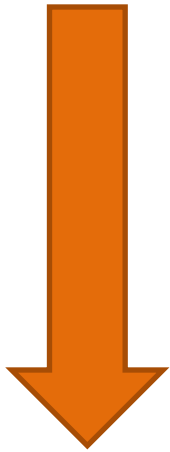
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Background

- Technical and Economic Assessment of Off-Grid, Mini-Grid and Grid Electrification Technologies (Dec. 2007)
- Study of Equipment Prices in the Power Sector (Dec. 2009)



- expand the list of generation technologies
- expand the list of T&D technologies
- take into account positive and negative externalities of power generations

Model for Electricity Technology Assessments (META)

The purpose of META

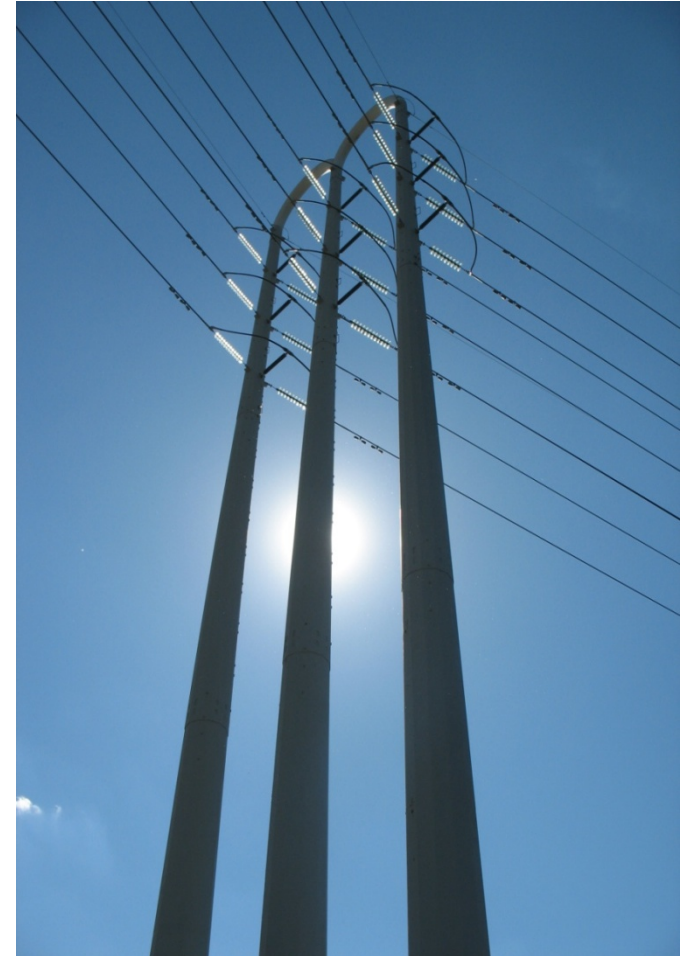
- The main purpose of META is to provide information and a tool that allows users to evaluate electricity options
- META provides
 - A guide to the technologies, as well as capital, fuel and operating costs for each technology
 - Generic estimates of the levelized cost per kWh of generating electricity and of electricity transmission and distribution
 - Screening curve showing levelized cost per kWh for a range of capacity factors from 10% to 90%.
 - Includes environmental externalities in the estimation of power generation costs

Typical Applications

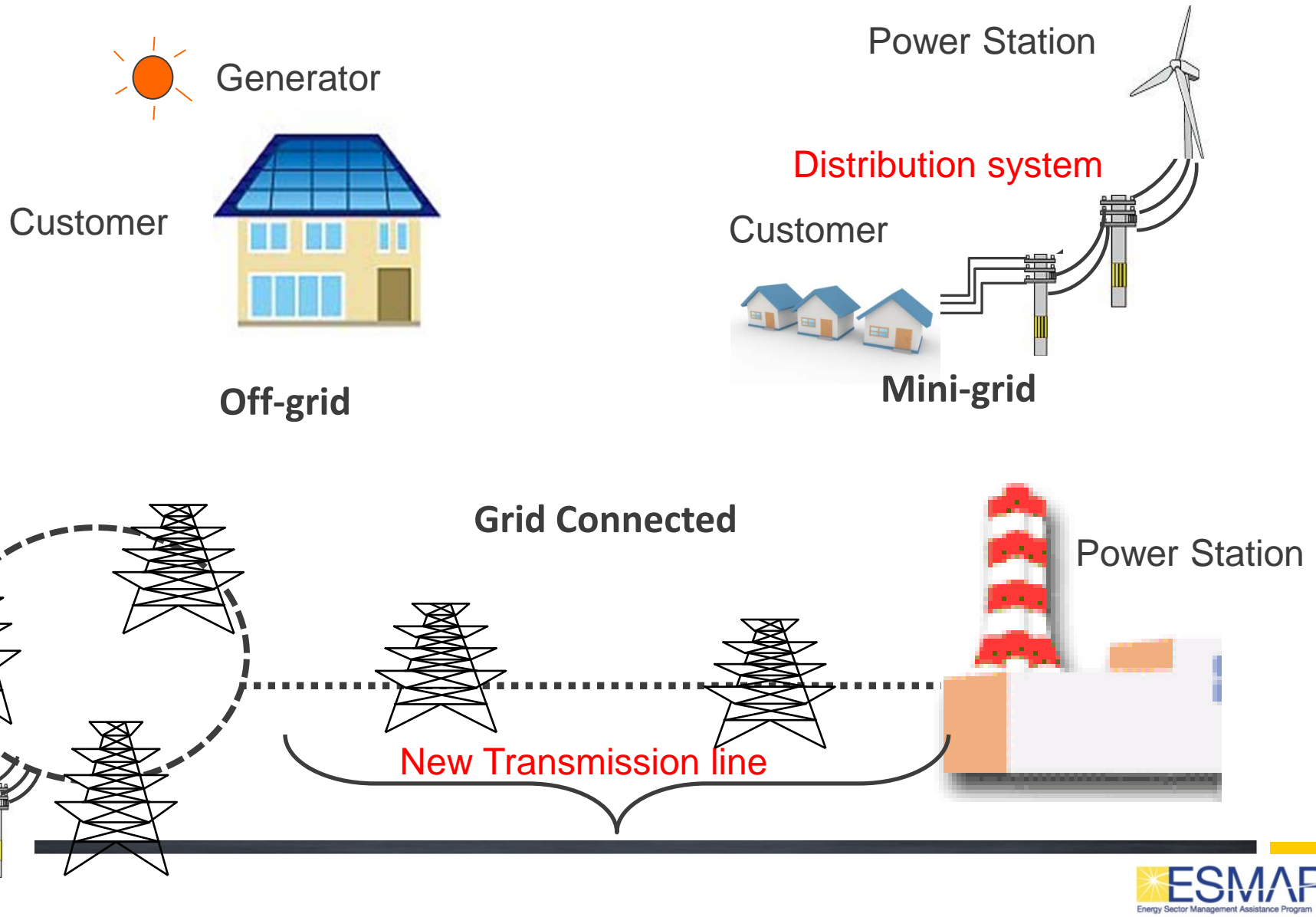
- Develop inputs to power system planning models
- Technology screening; narrow down list of options to be analyzed in more detail
- Assess the impact of key parameters on technology competitiveness (e.g., discount rate; fuel price; environmental externalities)

What is META?

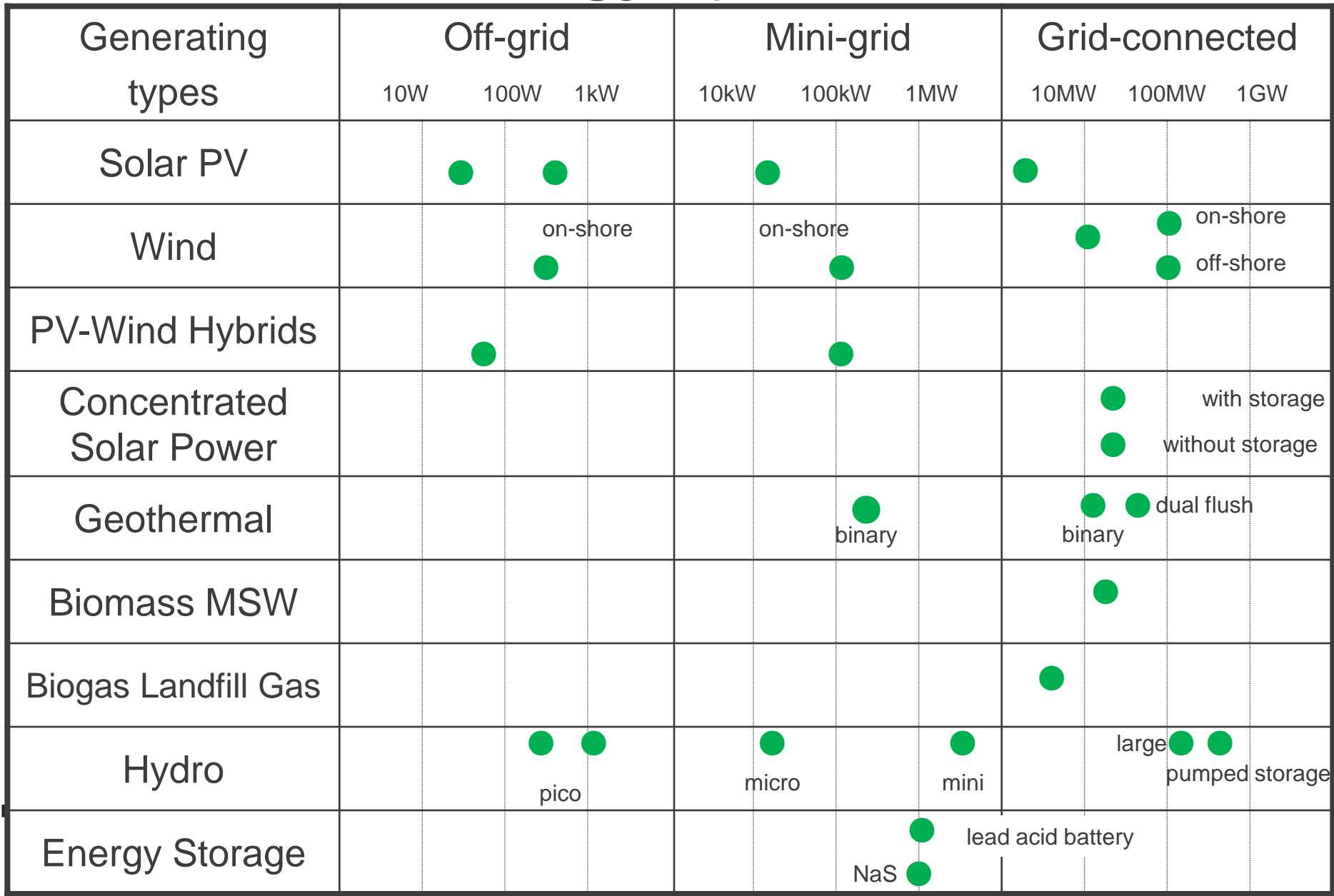
- Compares 54 electricity generation technologies
- Includes transmission, distribution and energy storage
- Includes environmental externalities
- Assesses levelized costs of electricity
- User-modifiable to suit local (site-specific) conditions
- United States, Romania and India as representative countries
- Has been customized for Haiti and Jamaica
- Work initiated to customize it for Morocco



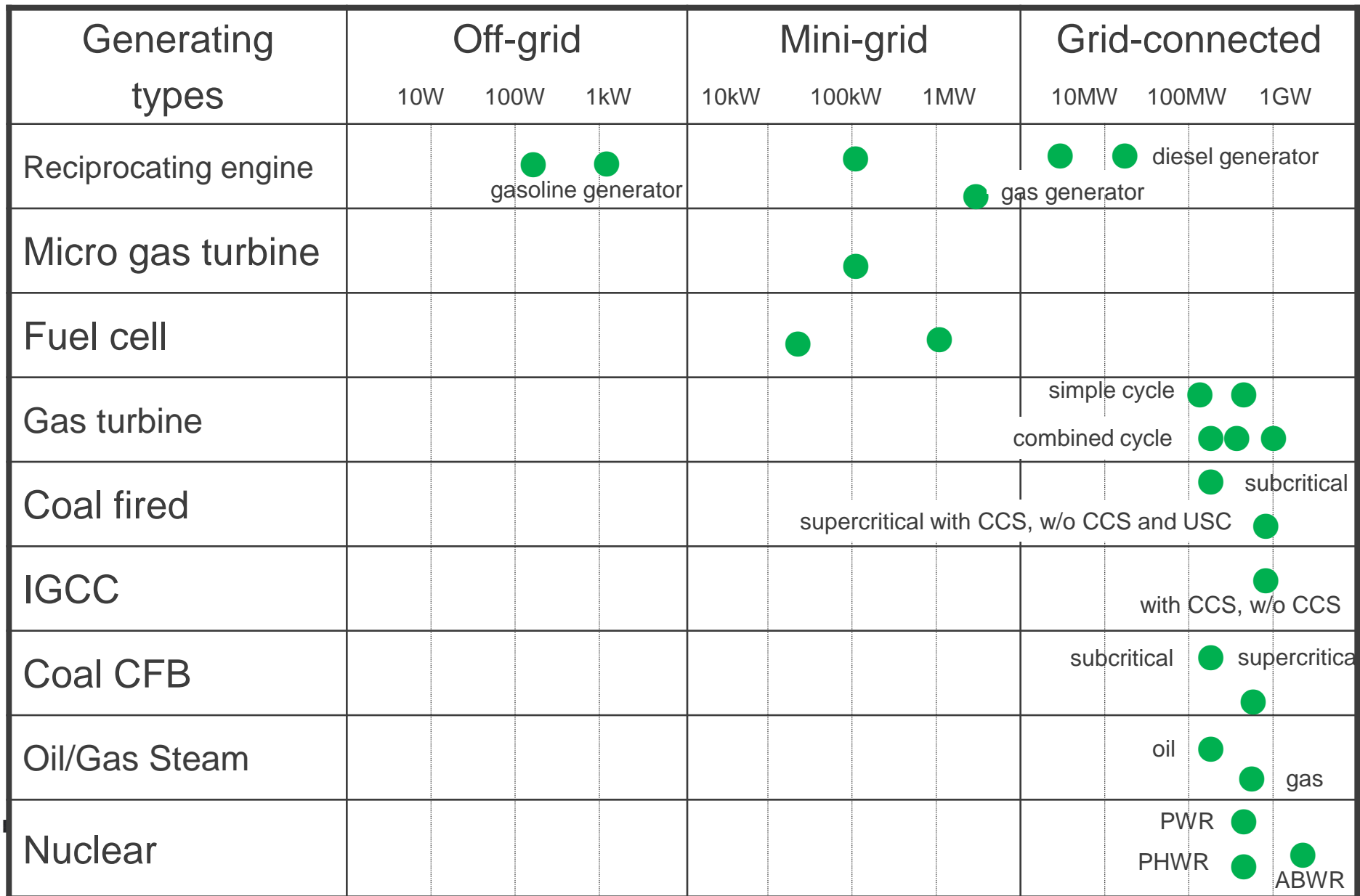
Grid and off-grid applications



Renewable Energy Generation Technology options



Thermal Power Generation and Nuclear Generation Technology Options



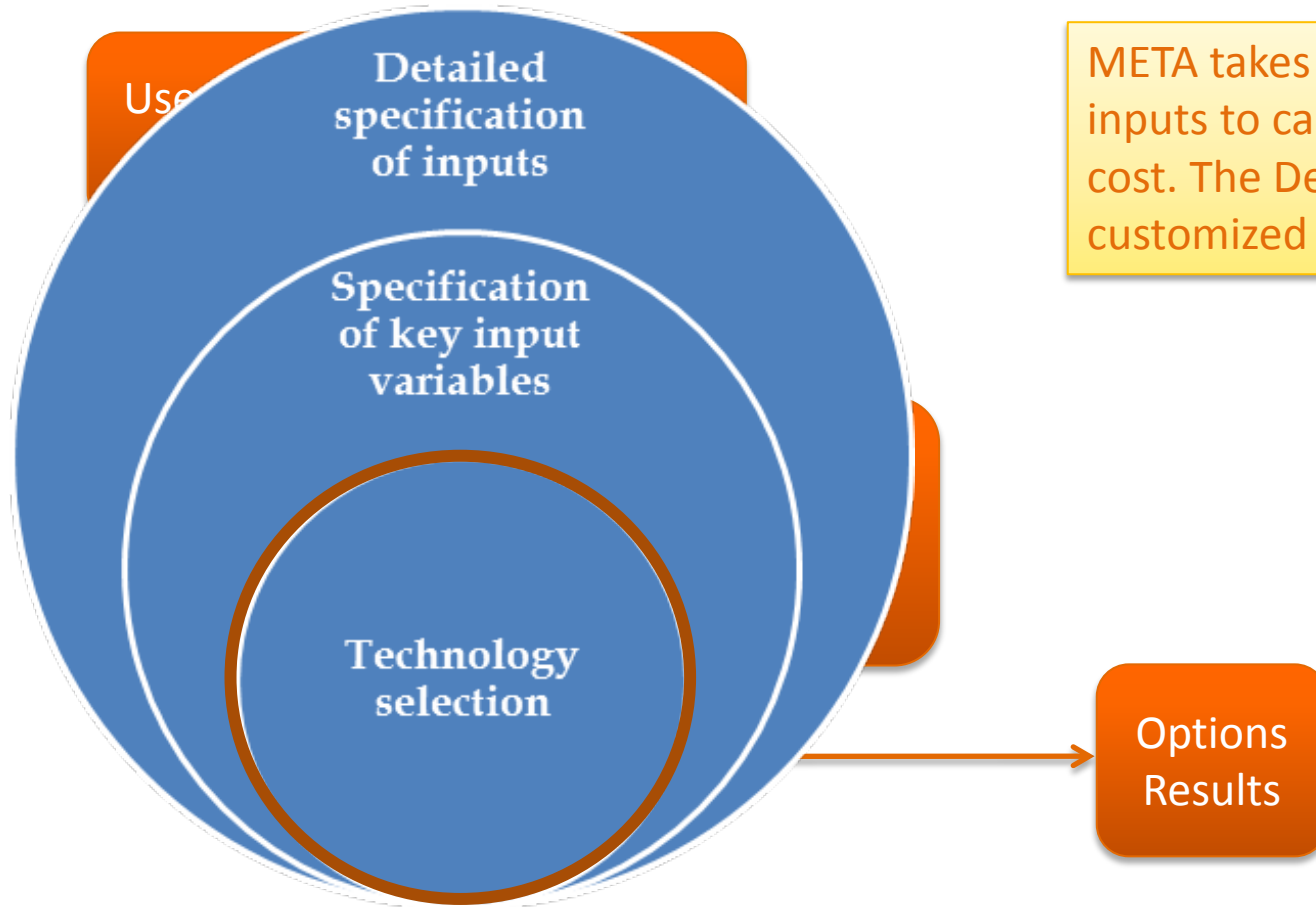
Power delivery technology options

- Transmission technologies include a range of transmission voltages and substation voltages.

Country	Transmission voltage		
	300 ~ 500kV	200kV ~	100kV ~
India	400kV	220kV	132kV
Romania	400kV	220kV	110kV
USA	345, 500kV	230kV	138kV

- Average distribution costs per kWh for each country are estimated.

META | How it works



META takes user input and default inputs to calculate delivered energy cost. The Default Inputs can be customized for a specific country

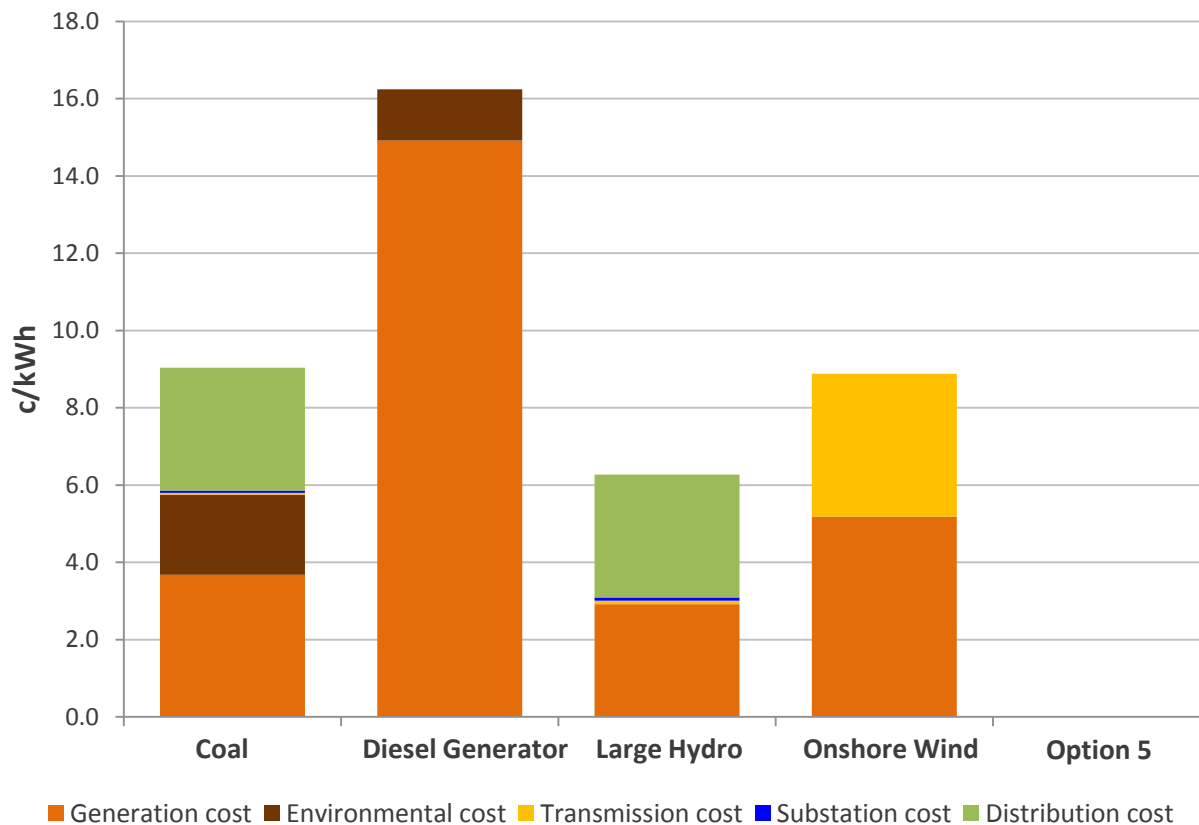
Different Levels of Use

Results | Delivered Energy Costs

META provides:

- Energy cost
- Transmission cost
- Substation cost
- Environment cost

Comparison of delivered energy costs

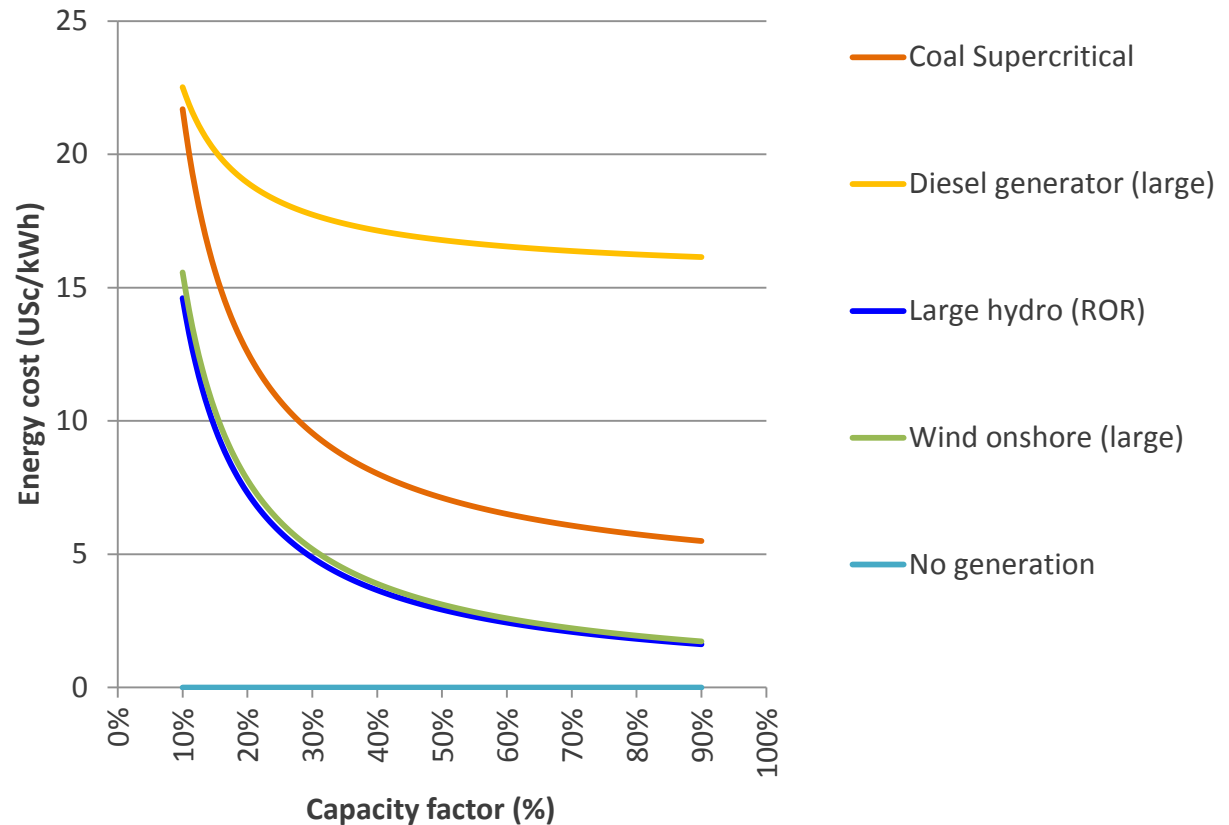


Assumed CO2 price = US\$23/tCO2e

Results | Screening Curves

Screening Curves allows the user to analyze the variation in cost as the capacity factor changes.

Screening curves for technology options



Customizing META

SPECIFICATION OF KEY INPUT VARIABLES

- Plant size and operating life
- Discount rate
- Opportunity cost of capital
- Seismic zone
- Capacity factor
- Plant Efficiency
- Auxiliary power consumption
- Fuel type, heating value and price
- Construction time
- Environmental technology installed
- The cost of environmental externalities
- Length and type of transmission line



Customizing META

DETAILED SPECIFICATION OF INPUTS

- Capital and O&M costs
- Commodity and labor prices
- Projected fuel prices
- T&D losses
- Interest during construction
- Emission factors
- “Learning curve”
(technology development over time)
- Transmission line impedance
- Transmission line load factor



Using META



TO GET MODEL or TRAINING | Contact:
Bipul Singh: bsingh2@worldbank.org

Tool and user guide can also be downloaded from www.esmap.org

FOR ADDITIONAL SUPPORT, CONTACT:
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