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Practical approach in deploying sustainable hybrid renewable energy systems in small isolated islands

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Hybrid RE Systems Deployment in Small Islands of Maldives and Sri Lanka

- Regional TA 7485: pilot hybrid systems (wind and/or solar and efficient diesel generation coupled with lithium-ion batteries) commissioned in Maldives (Rakeedhoo and Dhidhoo islands) and Sri Lanka (Elevaithivu Island)
- Replication in three islands in the Jaffna area of the Northern Province (Nainathivu, Analaitivu and Delft) of Sri Lanka

Major Stages and Challenges in Deploying Sustainable Hybrid RE Systems

- Required data collection and analysis
- Selection of a suitable business model
- Optimal design, technical architecture and configuration
- Addressing capacity building
- Operation, maintenance and monitoring

Required Data Collection and Analysis

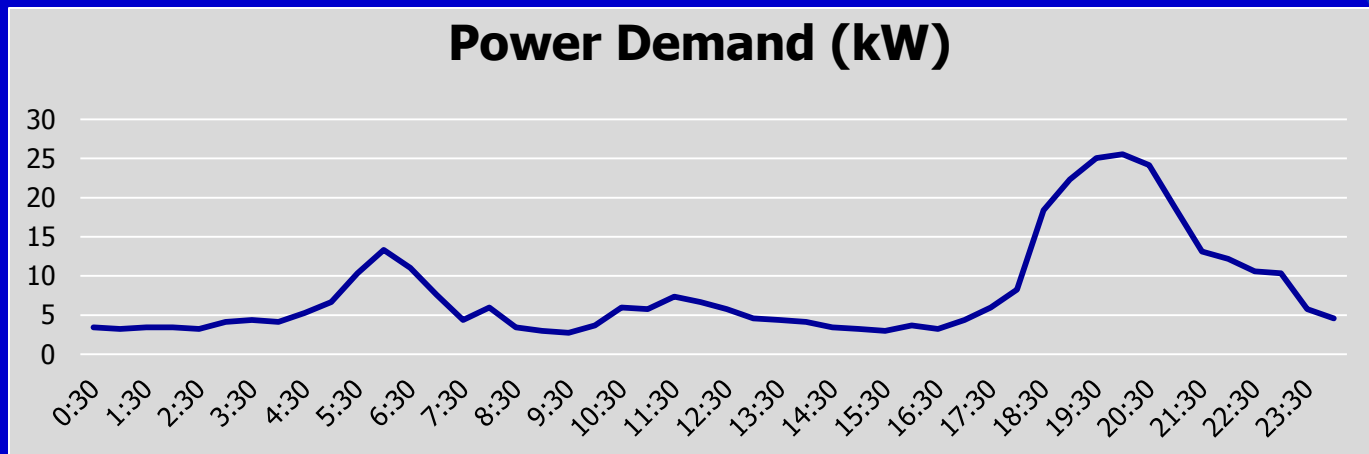
- Electric demand assessment (average daily energy demand, annual peak power, daily load profile and seasonal variations)
- Solar resource evaluation
- Wind resource evaluation
- Existing infrastructure, land/space, logistics, etc.

Elevaithivu Island

Initial Status

Installed generation old 100kW and 25 kW diesel gensets.

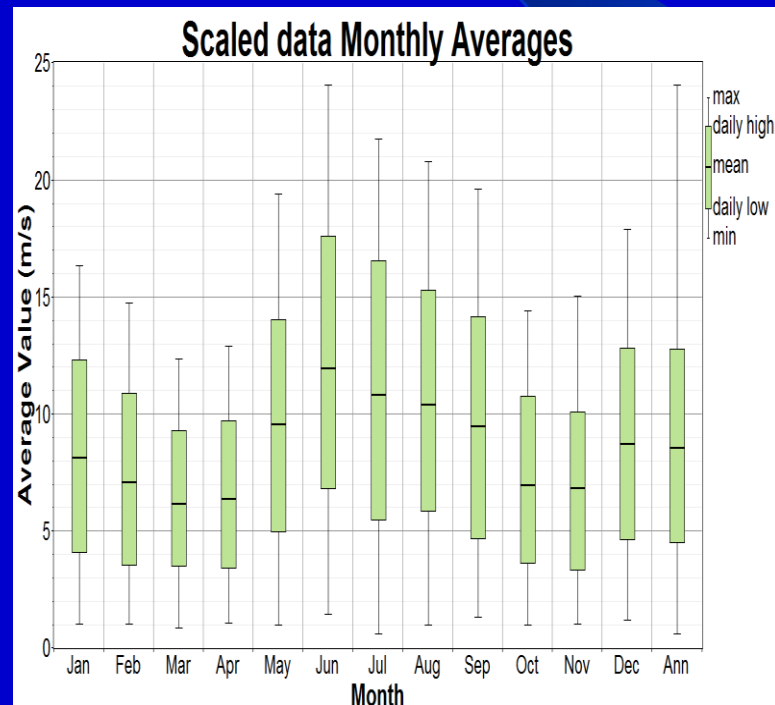
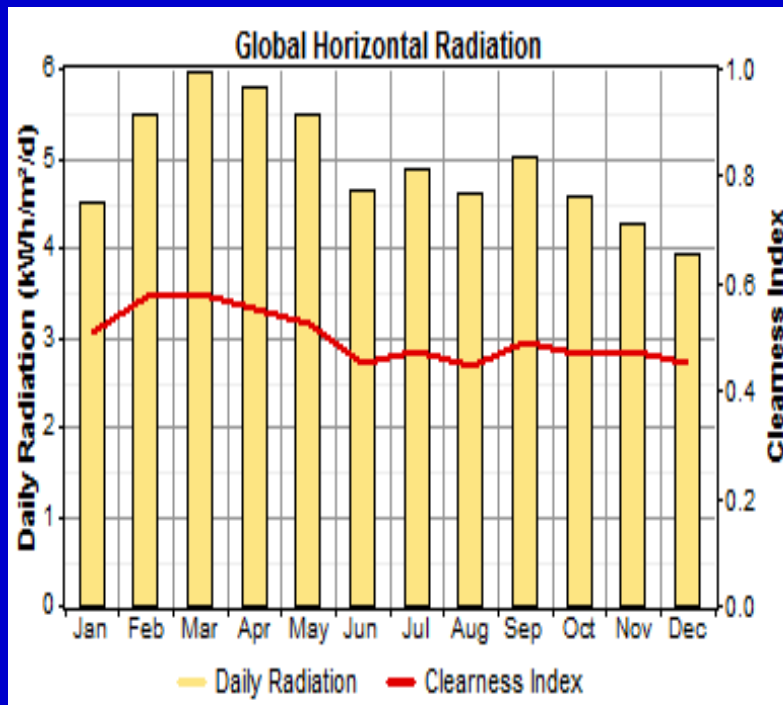
Population	800
Measured peak (kW)	26
Energy consumption (kWh/day)	180
Specific fuel consumption (L/kWh)	0.58
Estimated CO ₂ emissions including for demand growth (kg/year)	101,563



Wind and Solar Resources in Elevaithivu Island

Solar: Annual average 4.93 kWh/m²/day

Wind: Annual average 6.5 m/s at 12 m height



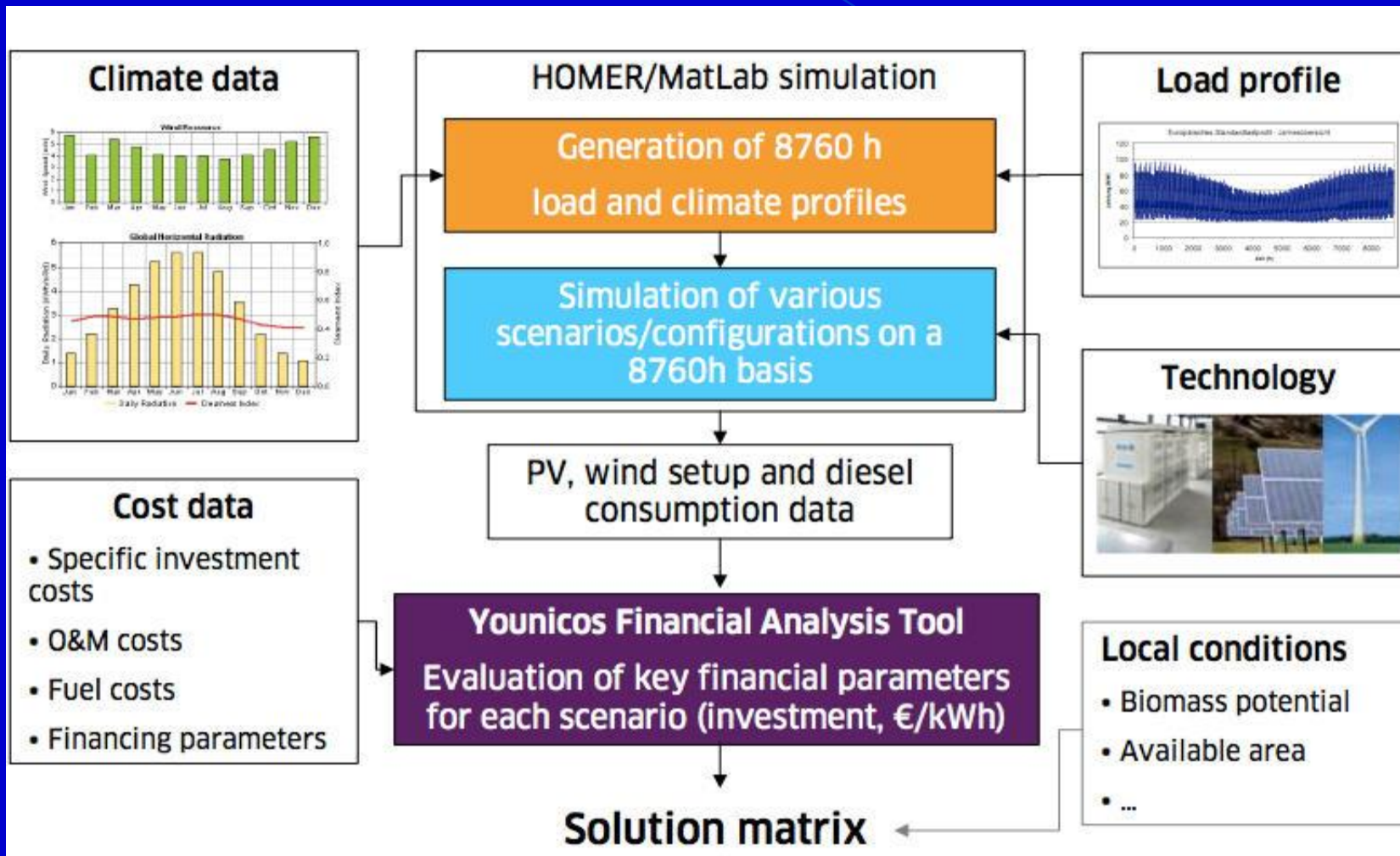
Selection of Suitable Business Model

- Utility based
- Private sector operator based
- Community based
- Hybrid (possible combination of other models)

Optimal Design, Technical Architecture and Configuration

- Establishing optimum generation mix
- Defining appropriate technical architecture (voltage, bus line arrangements, etc.)
- Centralized or decentralized architecture
- Optimal configuration

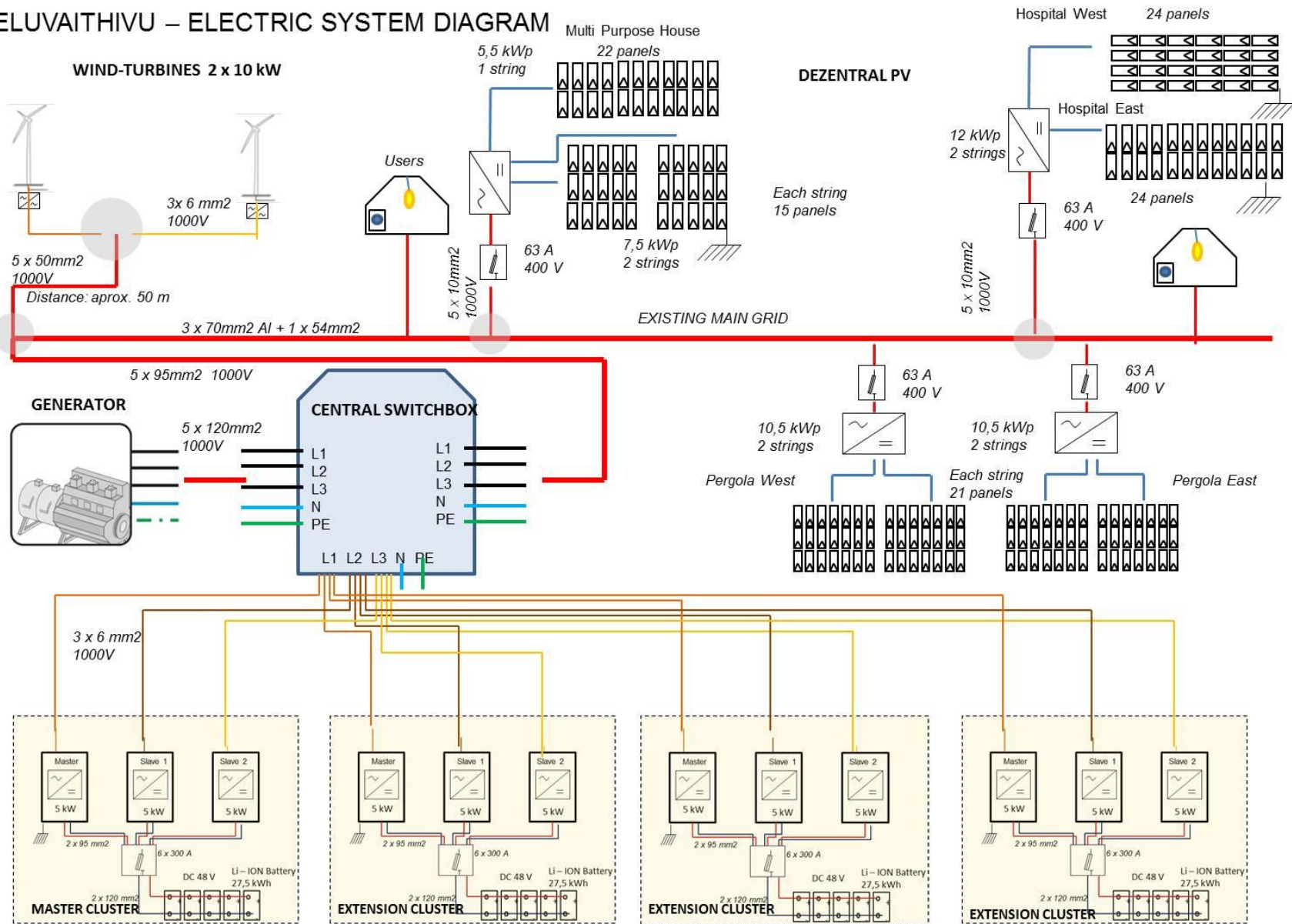
Design Approach



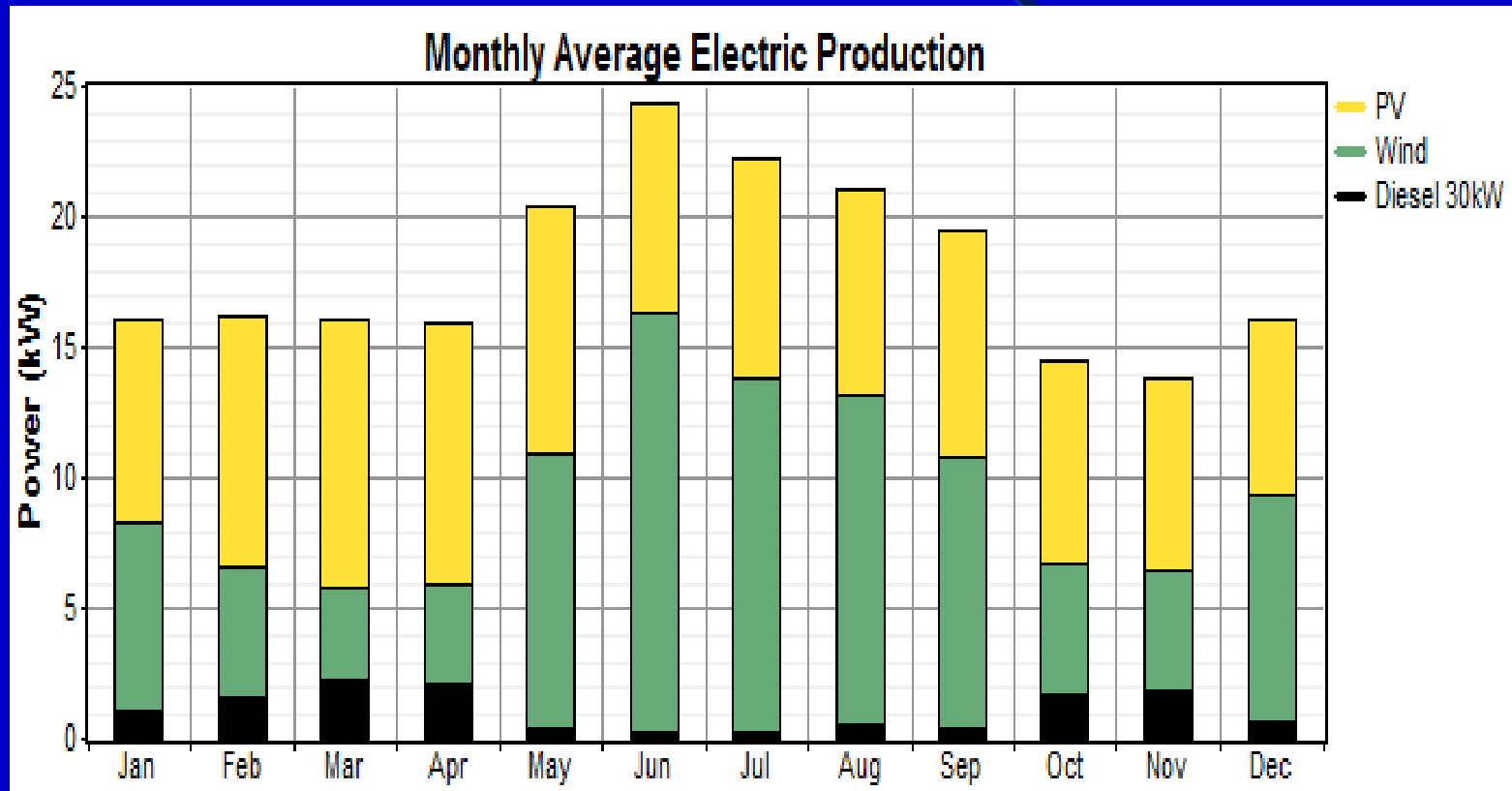
Configuration in Elevaithivu Island

Component	Data
Electricity Demand	73 MWh/yr
Solar Power	43.5 kWp
Wind Power	18 kW
Storage Capacity	126 kWh
Diesel Power (New)	30 kW
Diesel Power (Existing old – for back up)	125 kW
Reduction in Levelized Cost (\$/kWh)	From 1 to 0.37

ELUVAITHIVU – ELECTRIC SYSTEM DIAGRAM



Elivaithuvu Island



Capacity Building, Operation and Maintenance

- Personnel training
- Community awareness
- Manuals/Operation and maintenance documentation
- Periodic maintenance/Maintenance plan and schedule
- Monitoring

Planned Replication in Other Small Islands in Sri Lanka (2016-2018)

Component	Analaitivu Island	Delft Island	Nainativu Island
Solar PV	200 kWp	400 kWp	250 kWp
Wind	60 kW	160 kW	-
Battery Storage	200 kWh	400kWh	300 kWh
Inverter	200 kW	400 kW	250 kW
Diesel Genset 1	100 kW	200 kW	150 kW
Diesel Genset 2	100 kW	350 kW	300 kW

Thank You

ADB