# *Retrofitting Diesels in International Settings*

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# *Retrofitting options*

Five types of retrofitting options are seen as most likely:

- **Type A:** Adjust diesel size or install a second diesel engine.
- **Type B:** Add automatic controls to an existing diesel plant.
- **Type C:** Install batteries and a power converter to cover low load periods.
- **Type D:** Install renewables to reduce diesel operation.
- **Type E:** Installation of an advance hybrid power system that will result in shutdown of all diesels.

Retrofit options depend primarily on resource, load size and the load profile

Simulation models greatly assist in the design process

# *Technical issues*

- Resource assessment / Data collection
  - Always a problem
- System Questions
  - stability, voltage, frequency and power system failures
  - Defining requirements of voltage and frequency
  - UPS systems for critical loads
  - Penetration of wind turbine
  - Control system complexity
  - Different methods of system stability control (passive, active)
  - Availability of thermal or controllable loads

# *Technical issues II*

- Continued system support
  - Number of systems to allow support infrastructure
  - Hybrid systems are power systems, they need technical support like any power plant
  - Tariff to allow system sustainability
- Energy efficiency implementations / re-wire
  - Electrical efficiency not critical in many diesel plants & so systems do not have them
  - The cost to produce an addition kWh of energy while the diesel is operating is minimal (Avoided cost of diesel) but with power from renewables/battery it is expansive
  - Installation of energy efficient devices is critical to system cost

# *Social issues*

- Level of service
  - What is currently provided
  - What is mandated or wanted
  - Willingness to pay for increased level of service
- Final decision
  - Usually based on economics and policy considerations (environmental and comfort level secondary)
  - Color of money issues
- Tariff structure to insure operation & control growth
- Training of utility personnel

# *Steps in Retrofitting*

- Resource assessment (Macro/micro)
- Initial social impact assessment: LoS, willingness to pay
- Load measurement: Current, new and large loads
- Options analysis / feasibility study
- Go/no-go decision
- Gathering system information
- Detailed system design
- Specifications of social issues: Tariffs, O&M
- Final decision/project funding
- System installation/commissioning/DAS
- Continued O&M, oversight and expansion

# *Tres Lagos, Argentina*

Existing all diesel power system in remote community.

**Community load: 200 inhabitance with 80 power connections**

- Hourly average load was 37 kW (17 to 67kW range)
- 200 kWh/user/moth
- Potential thermal loads
- Lots of room for efficiency measures

**Wind Data:** Collected at the site for about 9 months - Long term data from other area towns

**The Tres Lagos diesel plant:** 3 diesels w/ local distribution

- Two 80 kW units
- One 100 kW unit

**Fuel price:** $0.37/liter