

# Status Report on the Peru Remote Area Power Systems Tests



- Status of RAPS Pilot Project in the Amazon Region
- *November 2002*

JERRY COLE  
International Lead Zinc  
Research Org., Inc. (ILZRO)



# Diesel Generators



While they have relatively low initial cost, diesel generators:

- Have high operating cost
  - **Expensive fuel**
  - **Frequent maintenance**
- Have noxious emissions

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Supported in Part by the US DOE ESS Program



# Benefits of RAPS



- 24 Hour Electricity
- Reduce Diesel Fuel Use
- Alleviate Poverty
- Improve Lifestyle
- Improve Environment

# Project History & Status

- ILZRO/SEIA/MEM MOU—July, 97
- Feasibility Study—January, 98
- Project Implementation Plan—June, 98
- Funds Assured-GEF&CFC—December, 00
- Implementation Begun—February 2001
- Commissioning planned by the end of 2002

# RAPS Summary

- Upgrade diesel only systems to hybrid RAPS system providing 24-hour electricity.
- Demonstrate in two villages in Amazon region.
- Pilot systems for Indiana (600 kWh/day) and Padre Cocha (300 kWh/day)
- Modular system design (150 kWh/day modules)
- Replication phase – ~150 villages in Loreto alone
- Cost~\$2.7million

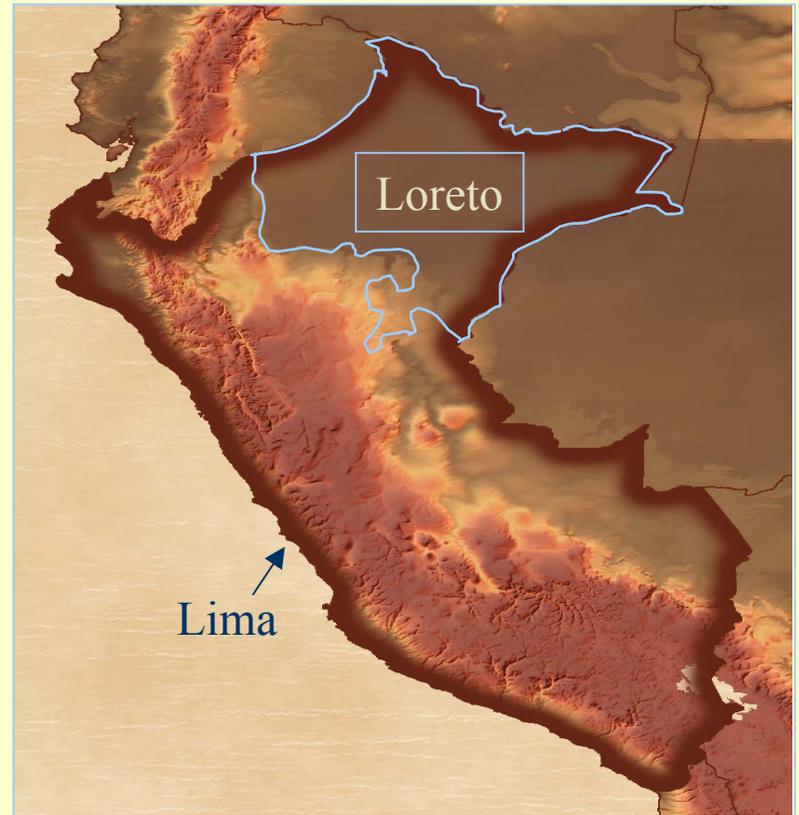
# Loreto - Peru

## Peru

- 70,000 Remote Communities

## Loreto

- 3,000 Remote Communities
- ~150 Communities with Small Diesel Gensets





# Indiana

- **500 Households**
- **Est. 600 kWh/day**
- **Existing 200 kW generator runs 4-5 hrs/day**



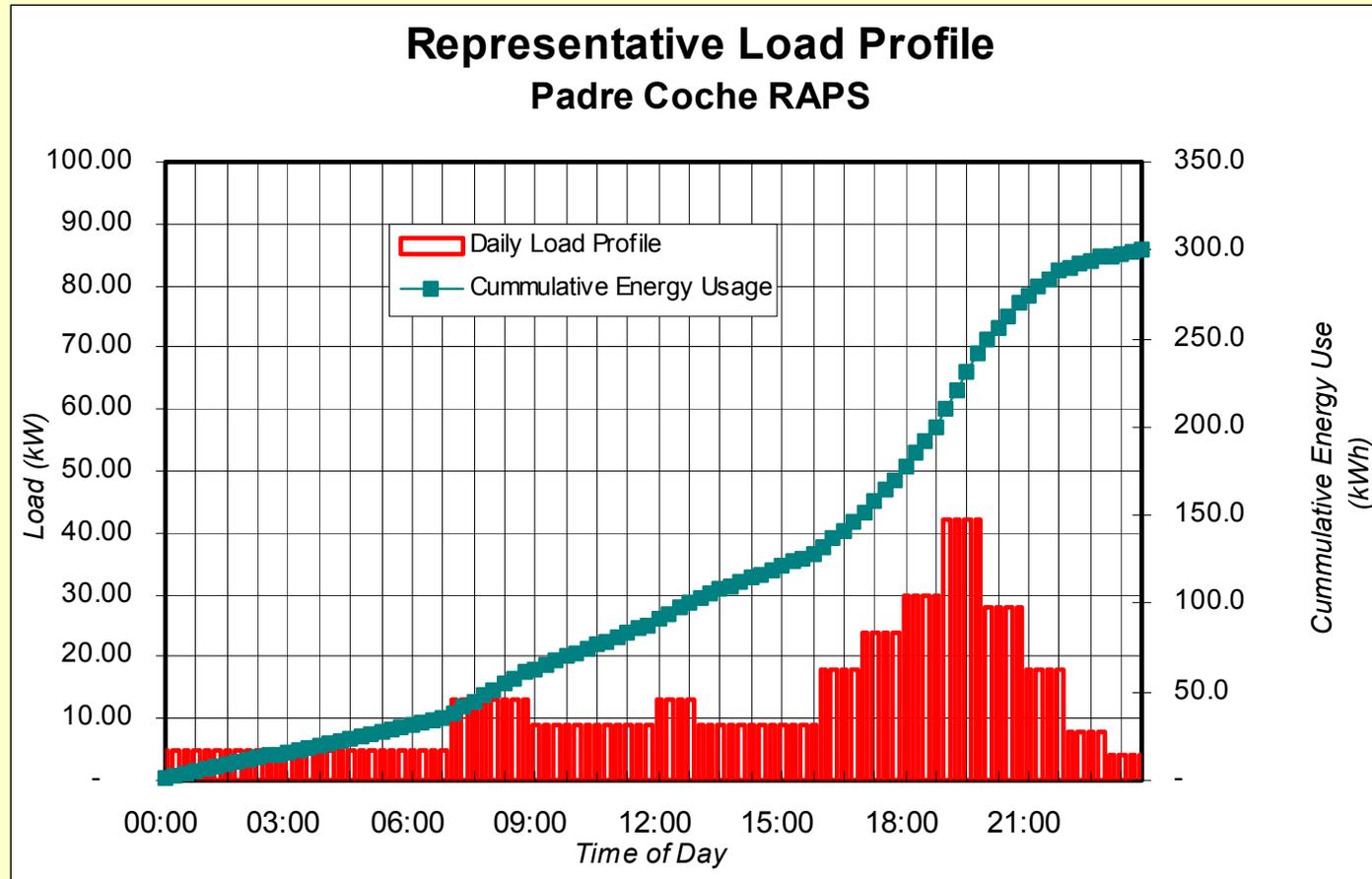
# Padre Cocha



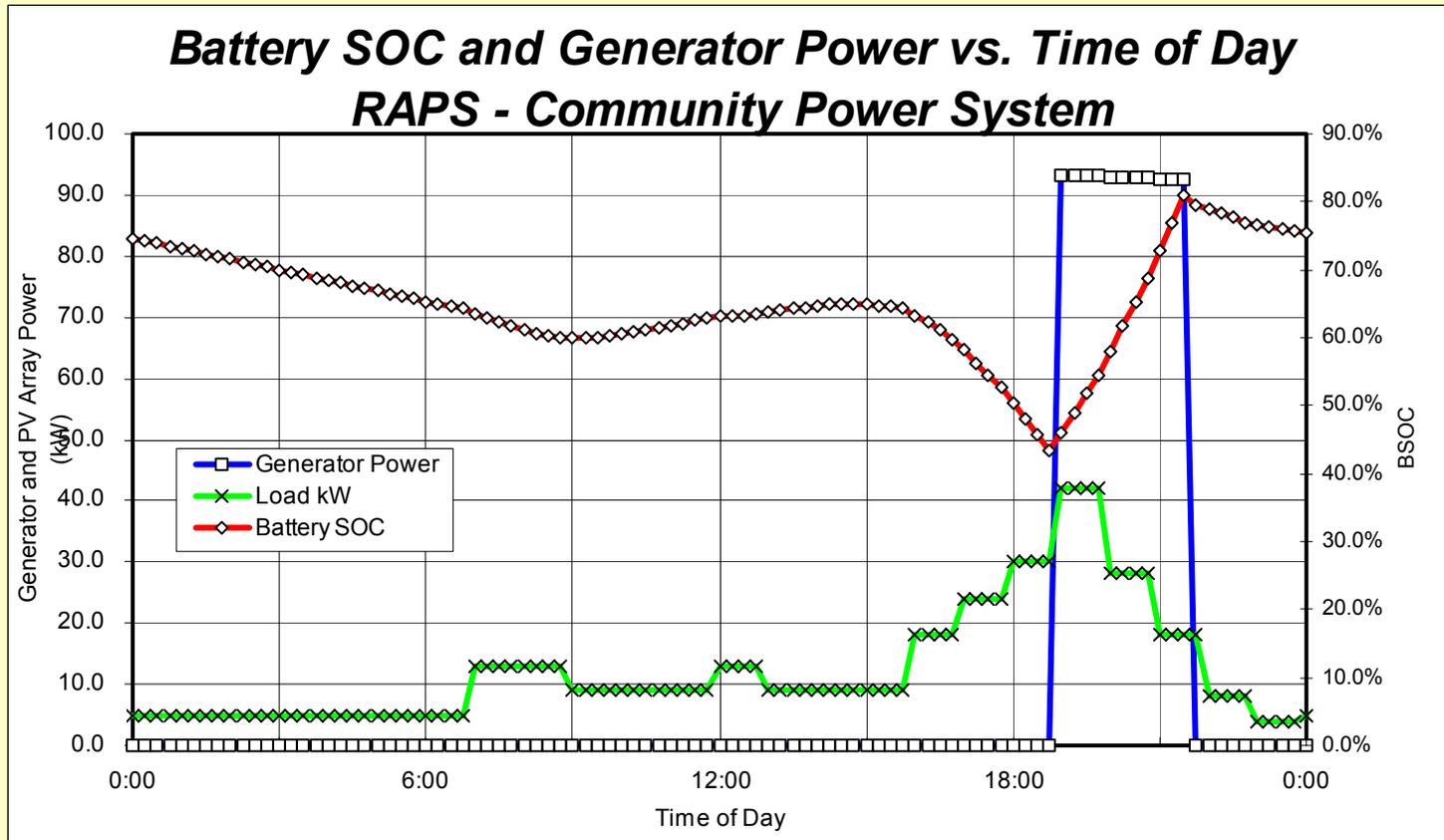
- **240 Households**
- **Est. 300 kWh/day**
- **Planned 100 kW generator**
- **Extensive craft industry**



# Typical Load Profile



# Typical System Operation - Predicted for Padre Cocha

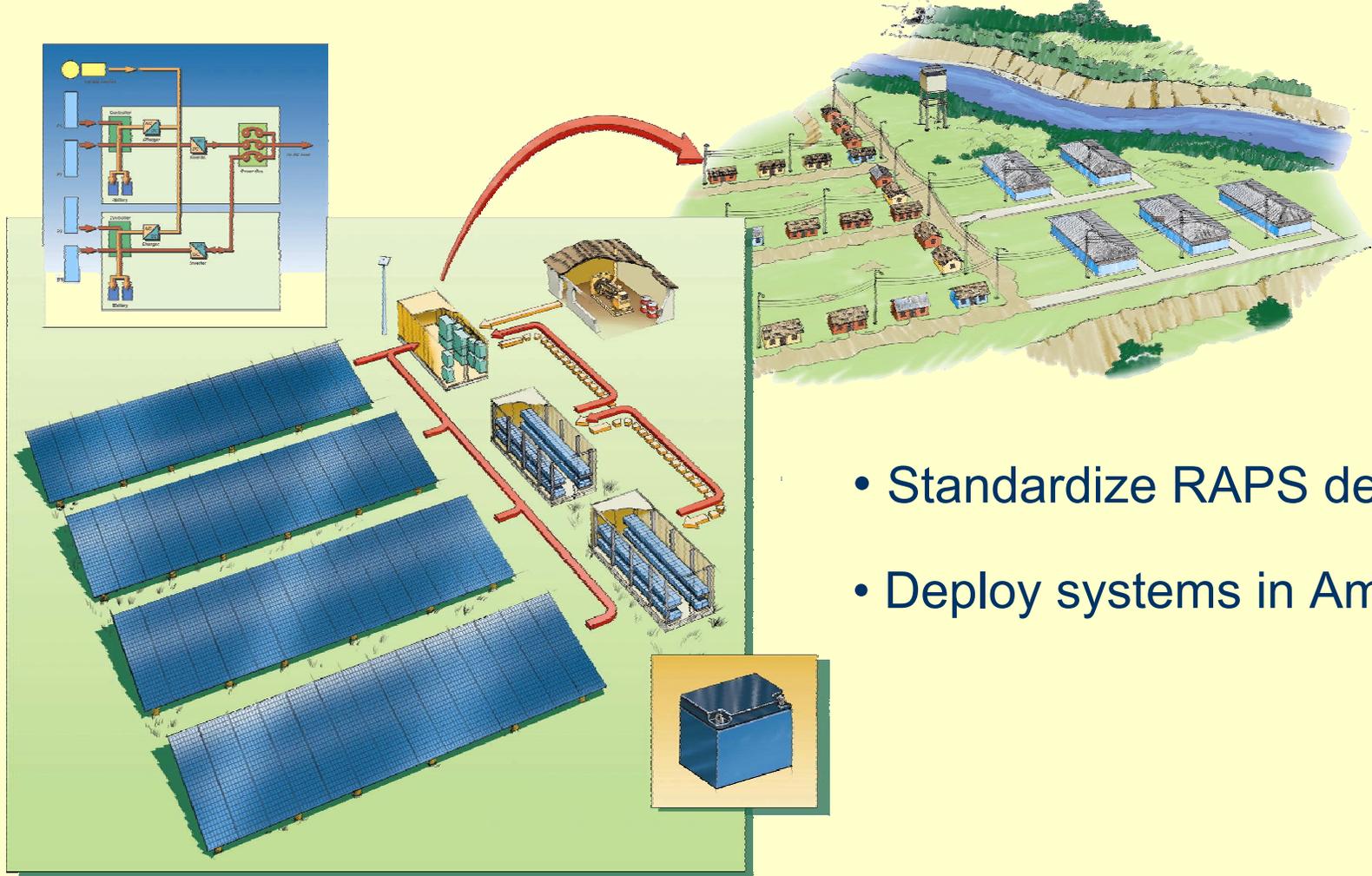


# CSIRO Recommendations

*Based on simulation with new and “aged” battery banks*

- Operate banks at PSoC for 14 days between full recharges
- Adjust SoC regularly based on OCV-SoC relationship
- Charge batteries when SoC < 40% to average of 2.45 V
- Battery conditioning charge each 14 days
  - Equalize to 2.45 V
  - Charge at 10 A to 102% overcharge

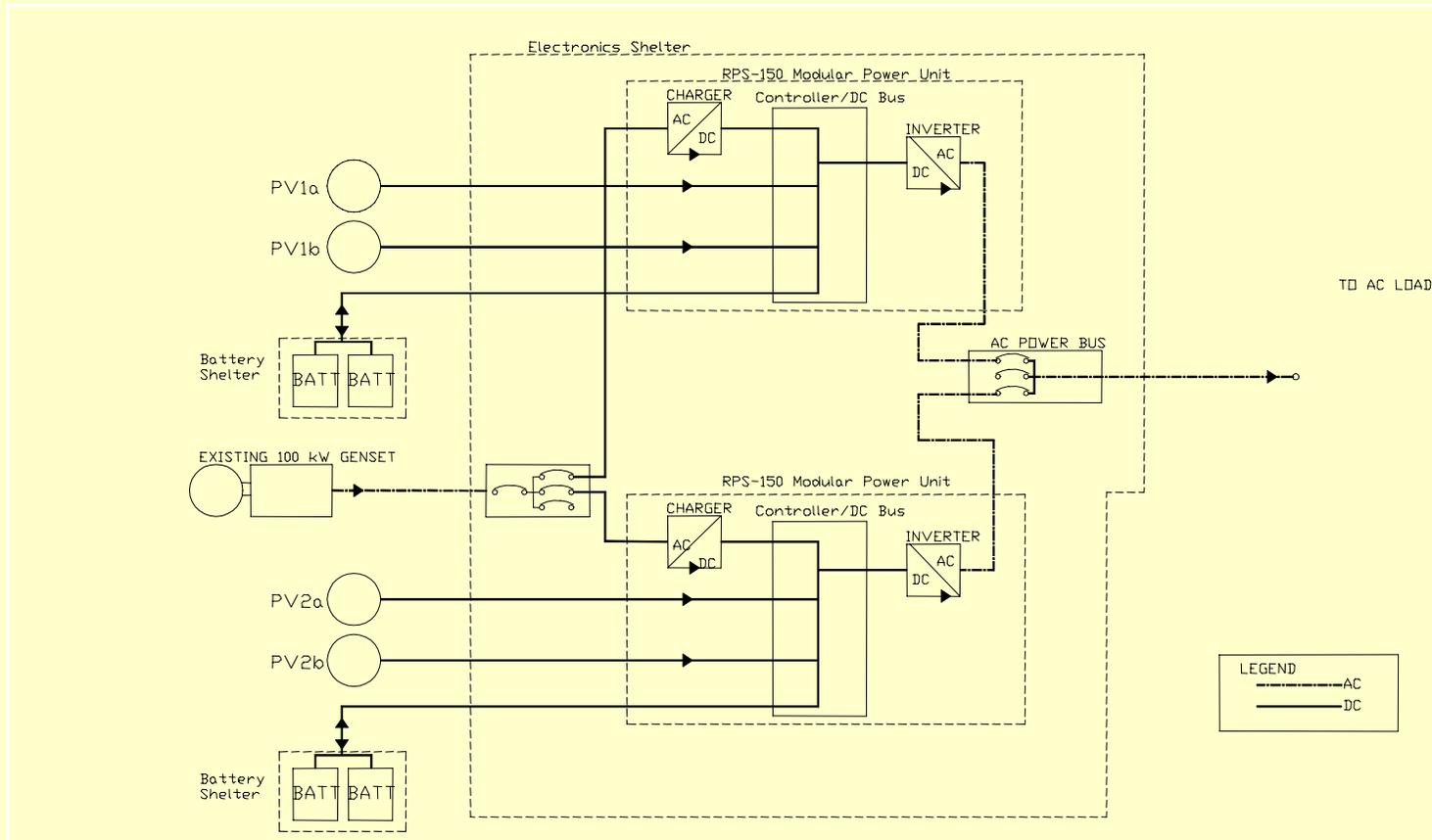
# Remote Area Power Supplies



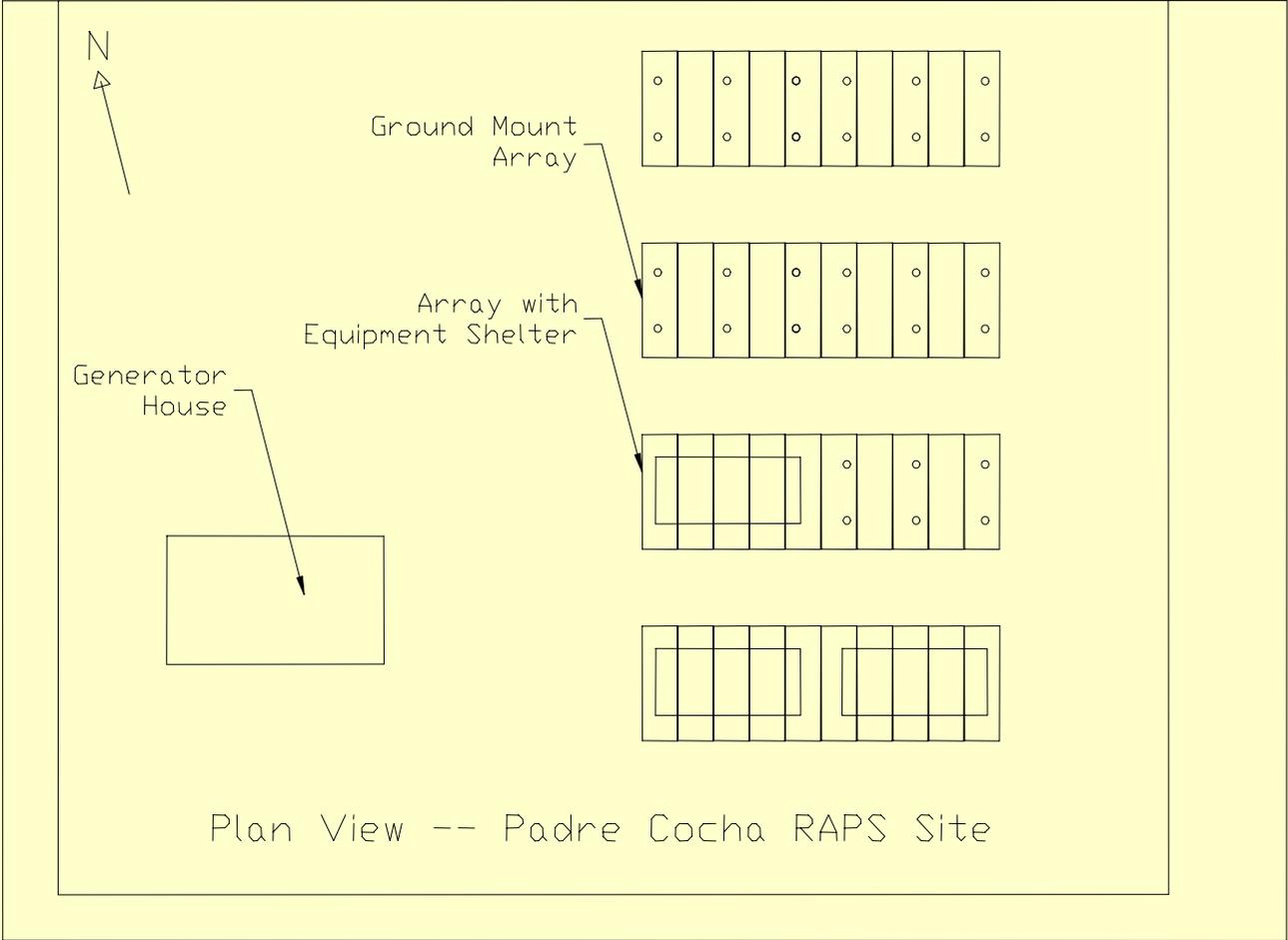
- Standardize RAPS design
- Deploy systems in Amazon

# Hybrid System Configuration

## *Padre Cocha*



# System Layout -- Padre Cocha



# System Batteries

RAPS Project will use Gel-Type VRLA batteries from Battery Energy Power Solutions

- Developed by CSIRO with TELSTRA
- Rated cycle life—2 ,500 cycles to 50% SOC
- Goal is 10 year life with daily cycling with PSOC
- Total of 1,440 cells (1.1 MWh DC) for first two villages
- > 30 tons of lead



# Photovoltaic Cells

- BP Solar SX80 - 80Wp
- 1,134 Modules
- Indiana - 60 kWp
- Padre Cocha - 30 kWp
- PV provides 35% of energy
- 100% Expansion Capability

# Power Electronics

- 40 kW 3-Ph inverters
- Hi Freq PWM IGBT
- 95% efficiency
- 40 kW Battery Charger
- 6 pulse SCR w/ filter
- Controlled set points for optimum charging

# Remote Monitoring

- RAPS Systems will include integral remote satellite monitoring for maintenance purposes
- US Dept. of Energy is funding intensive monitoring of batteries.
- Monitoring incorporates voltage and temperature of 12V blocks of batteries.
- Satellite terminal is INMARSAT MiniM.

# RAPS Participants

- ILZRO
- ILZRO RAPS Peru
- SEIA
- UNDP/GEF
- Common Fund for Commodities
- US Dept of Energy/Sandia
- International Greenhouse Partnership
- CTAR Loreto
- DEP/MEM
- Orion Energy Corp.
- Electro Oriente
- Ferreyros/Orvisa
- BP Solar
- Battery Energy Power Solutions
- Advanced Energy Associates
- International Pb&Zn SG
- Energia Total
- CSIRO

# Project Problems

## Bureaucracy

- 3 Governments
- 5 Energy Ministers
- “Turf” Problems
- Multiple Ministry Involvement

## Shipping

- Sloppy Documentation
- More Bureaucracy



# PROYECTO RAPS

ILZRO RAPS PERU

MUNICIPALIDAD DIST DE PUNCHANA

DIRECCION EJECUTIVA DE PROYECTOS

MINISTERIO DE ENERGIA Y MINAS

CTAR LORETO

ELECTRO ORIENTE SA

CASA DE FUERZA  
PADRE COCHA

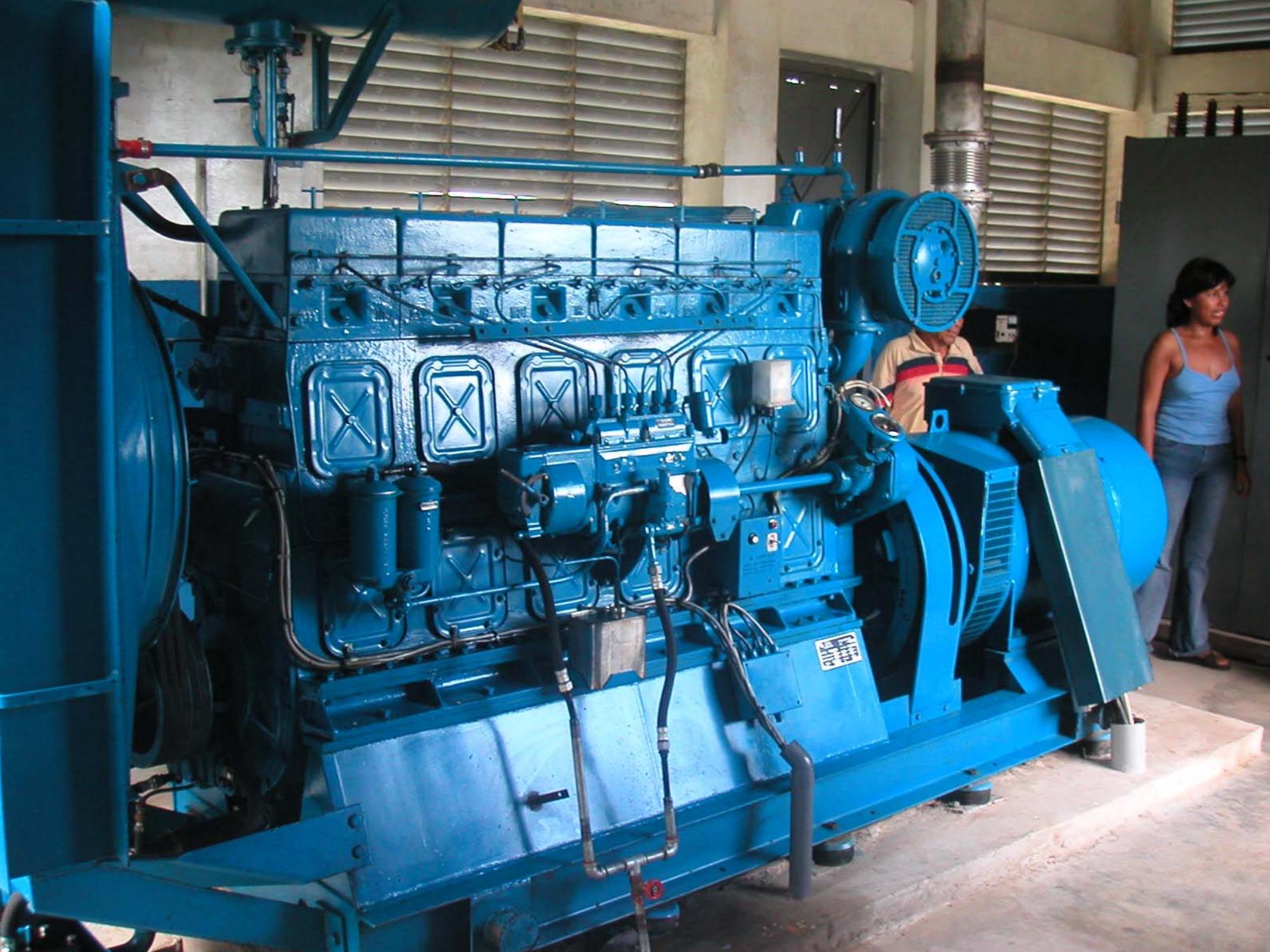








CASA DE FUERZA  
PADRE COCHA















HELISUR

DB-1585































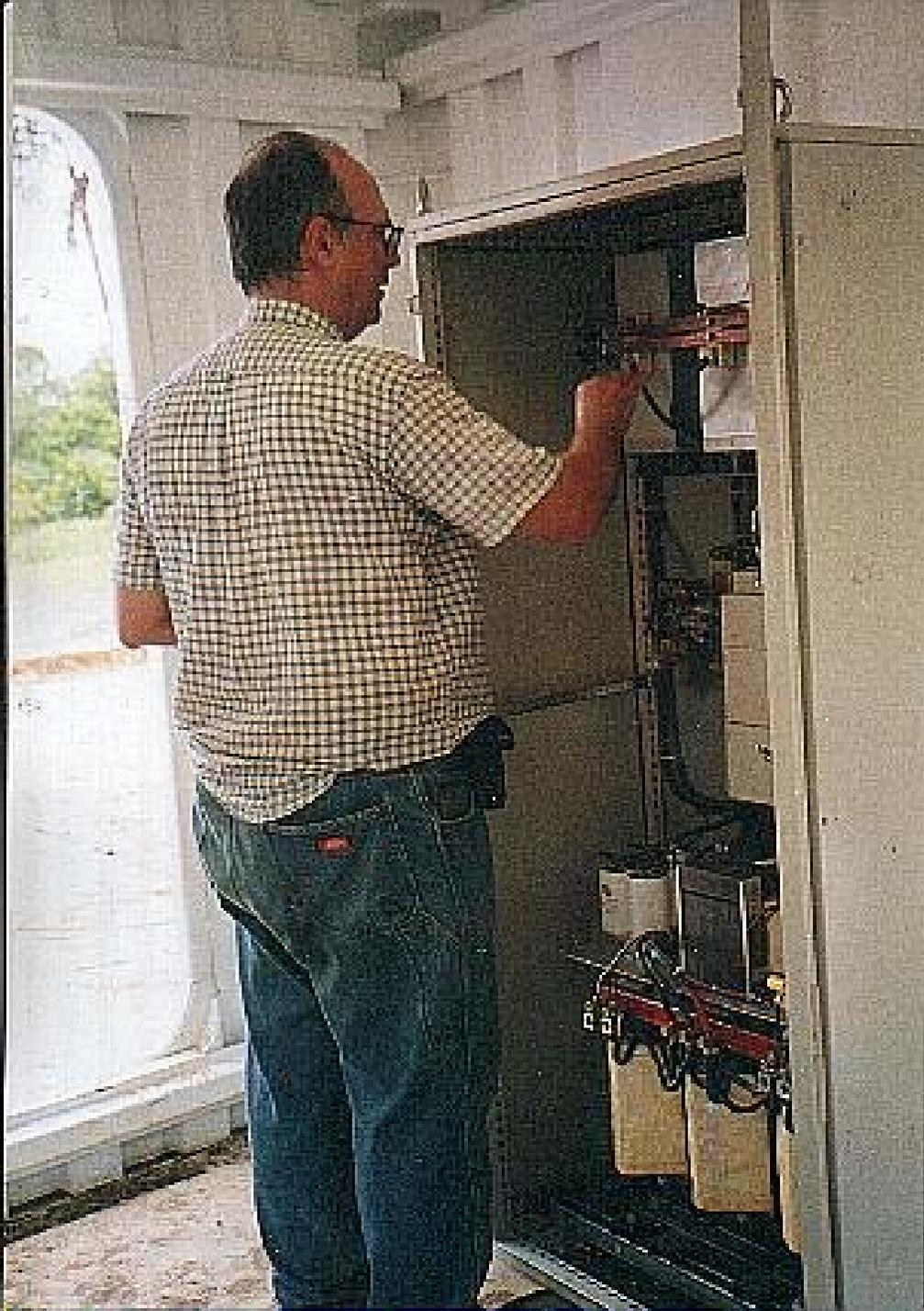






## **“Sharing the burden”**

*Padre Cocha girls  
carrying battery to site.*



**Chief Engineer  
Doug Danley**

**making connections  
inside shelter at site**





# RAPS—

*--state of the art*

*--financially sound*

*--right for Peru*



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