

Micro-Grids for Colonias A Technology Development/Transfer Project

Presentation to the
DOE 2010 Smart Grid Peer Review

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The Problem

- They call it “Luz Verde”
 - Colonias: Communities along the US – Mexico border lacking one or more essential services: water, wastewater, or electricity
 - Usually illegally subdivided
 - Small to large acreages
 - Low socioeconomic opportunities



The Problem

- Texas Model Subdivision Rules are in place to prevent additional Colonia development
- Many residents economically cannot meet requirement in the near term

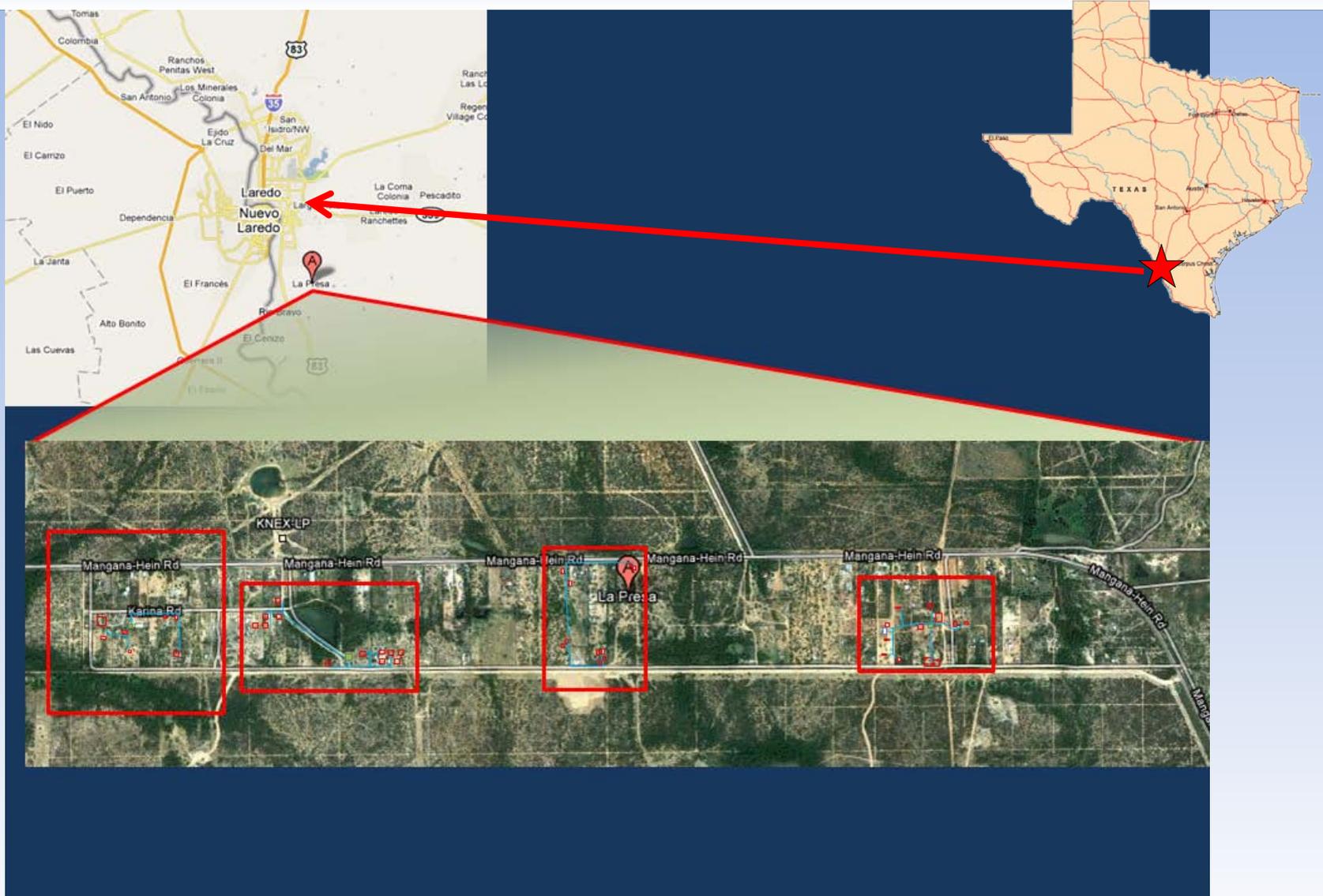
A Solution

- Install *temporary* micro-grid systems designed to provide essential levels of electric power to residents without access to the grid
 - Nominal size: 20-35KW peak capacity
 - Services 10-20 dwellings depending upon service level installed and available cluster size
 - Provides 1 – 15 Amp lighting circuit on stanchion installed outside or dwelling
 - Prepaid power – residents pre-purchase power blocks uploaded to their meters

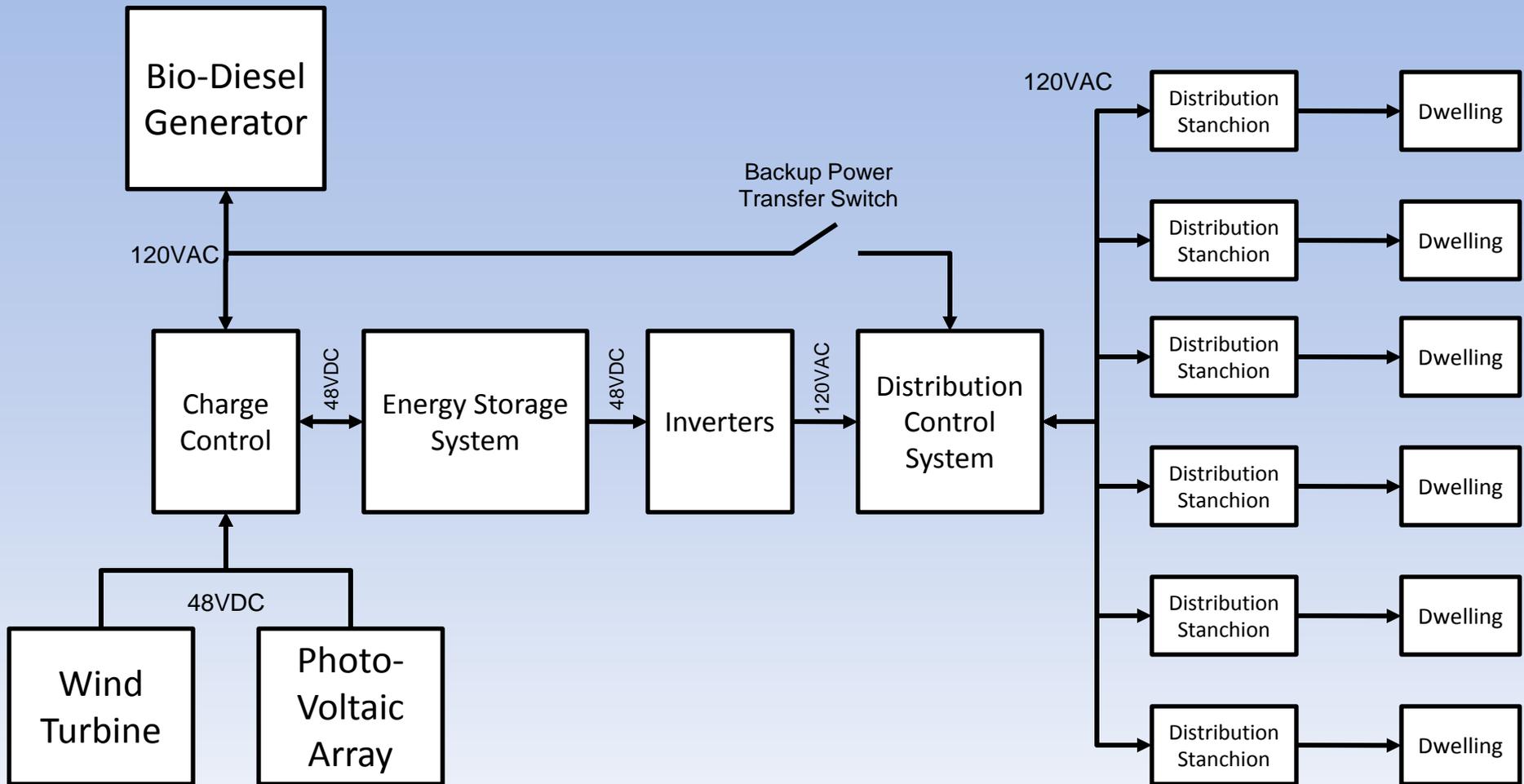
Technology Development

- Funded by Texas State Energy Conservation Office (SECO) for initial development and deployment
- Deployed at La Presa Community south of Laredo, Texas serving 43 dwellings
- SECO project initiated in 2007, initial deployment in 2008, subsequent deployment in 2009

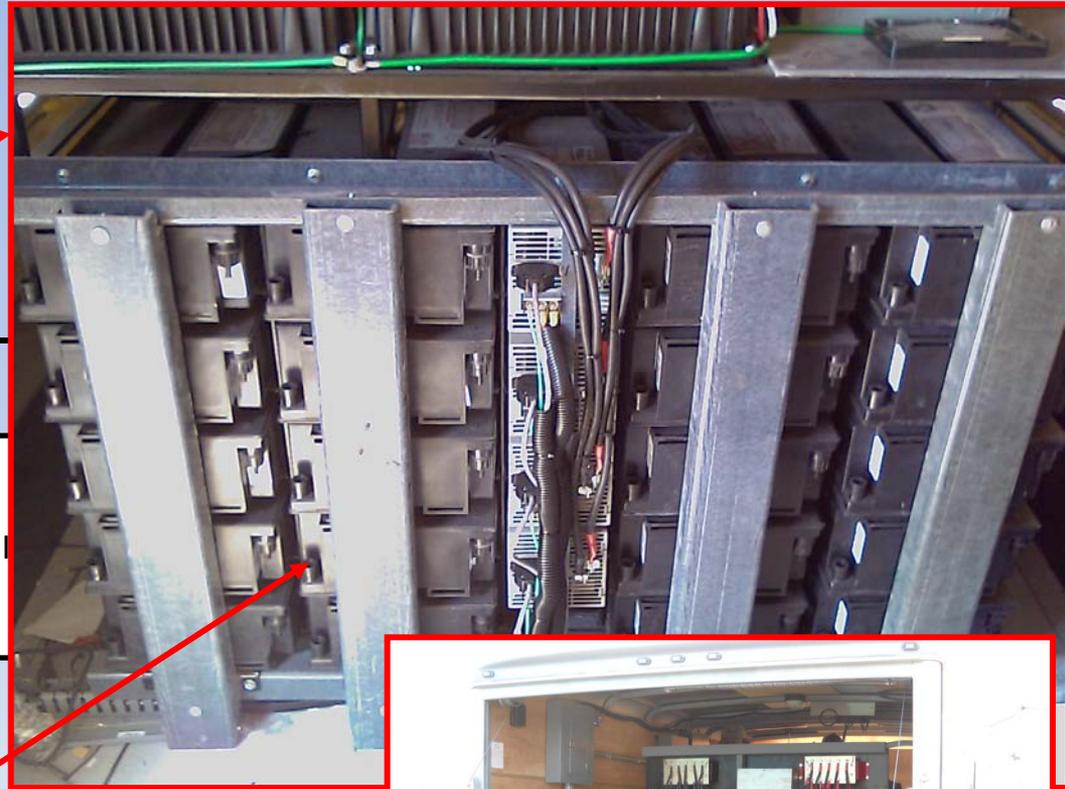
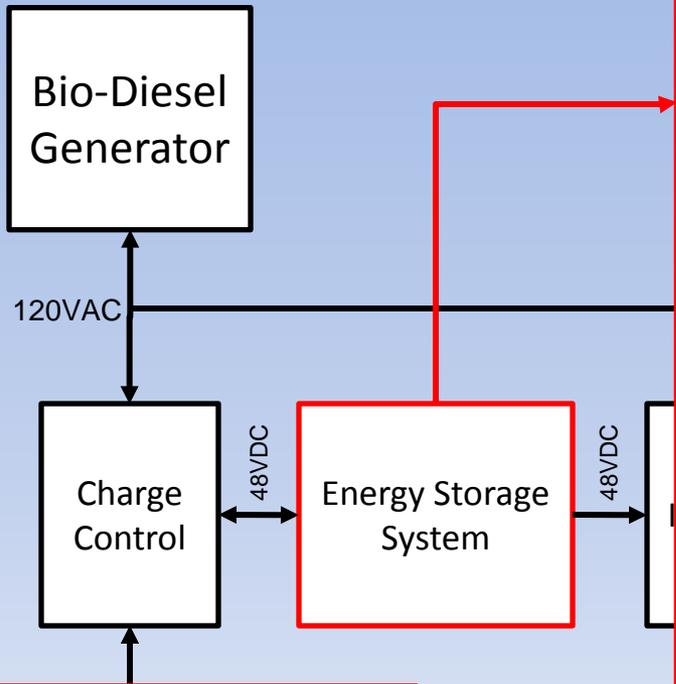
La Presa Subdivision, Texas



System Description

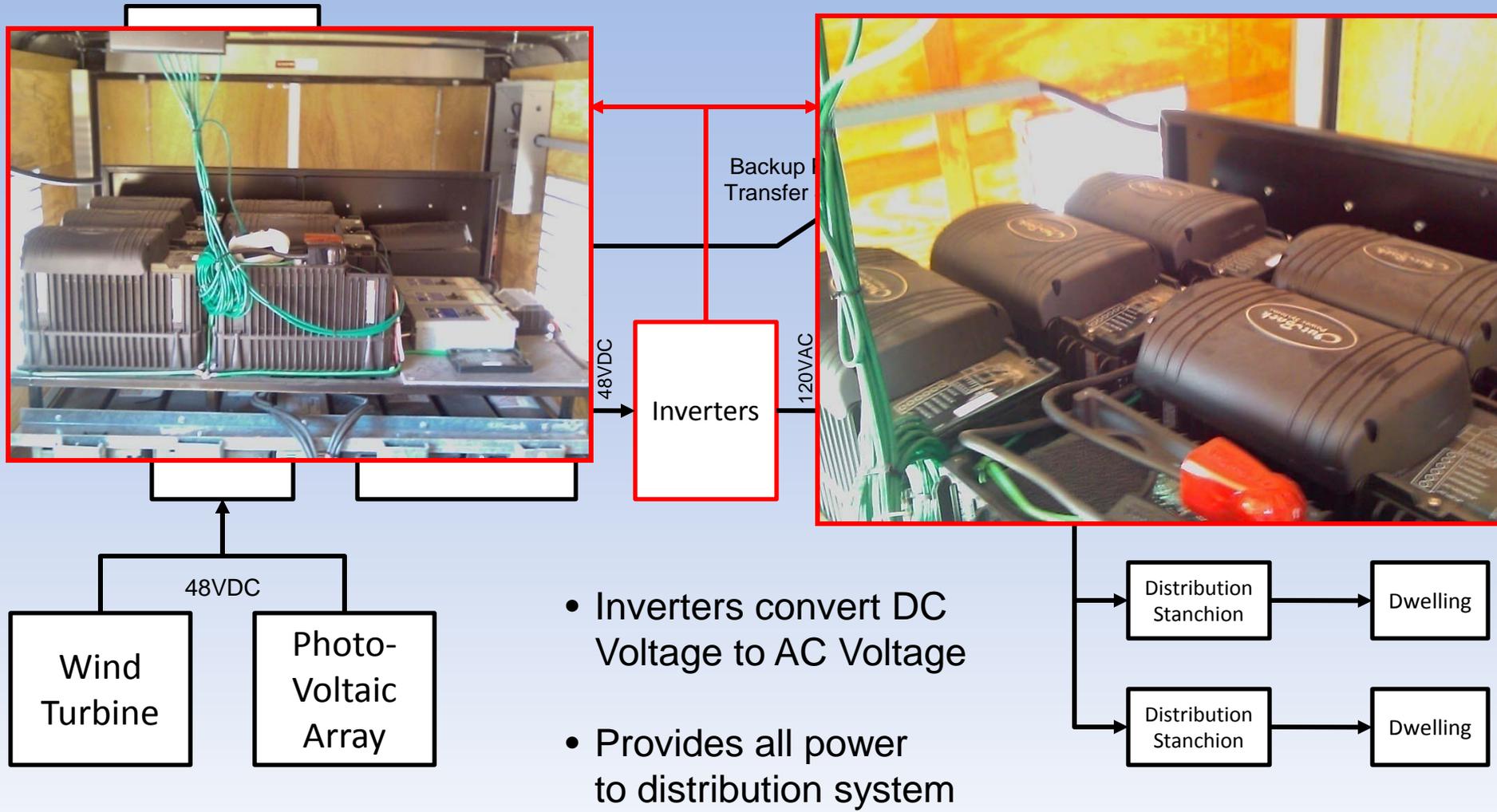


System Description

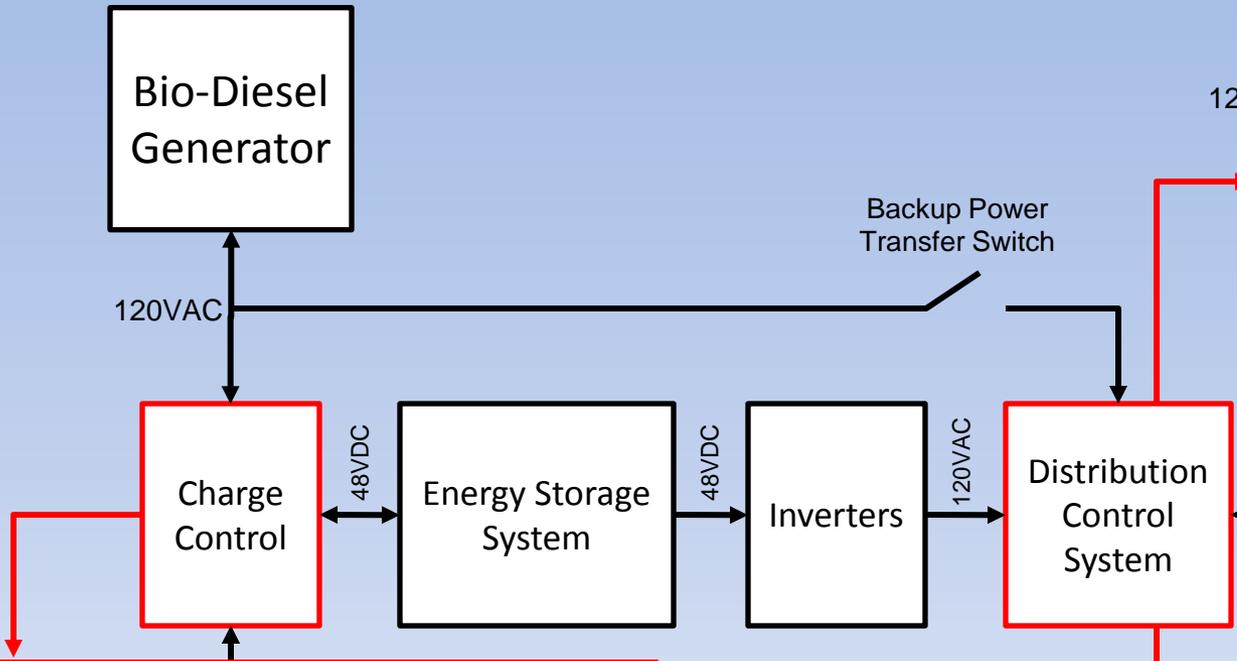


Xtreme PowerCell
12VDC
1KWhr capacity each
40 cells total

System Description



System Description



Charge Control and System Operation is controlled by a Programmable Logic Controller (PLC)

System Description

Bio-Diesel
Generator



Distribution
Stanchion

Dwelling

Bio-diesel operates at its most efficient point, charges the PowerCells only when required

System Description



120VAC

Distribution

Dwelling



buti
ntro
stem

Wind
Turbine

Photo-
Voltaic
Array

Distribution
ion

Dwelling

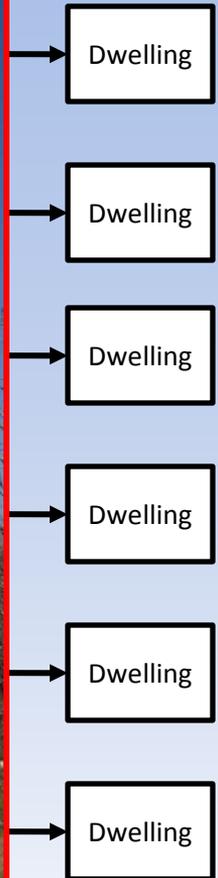
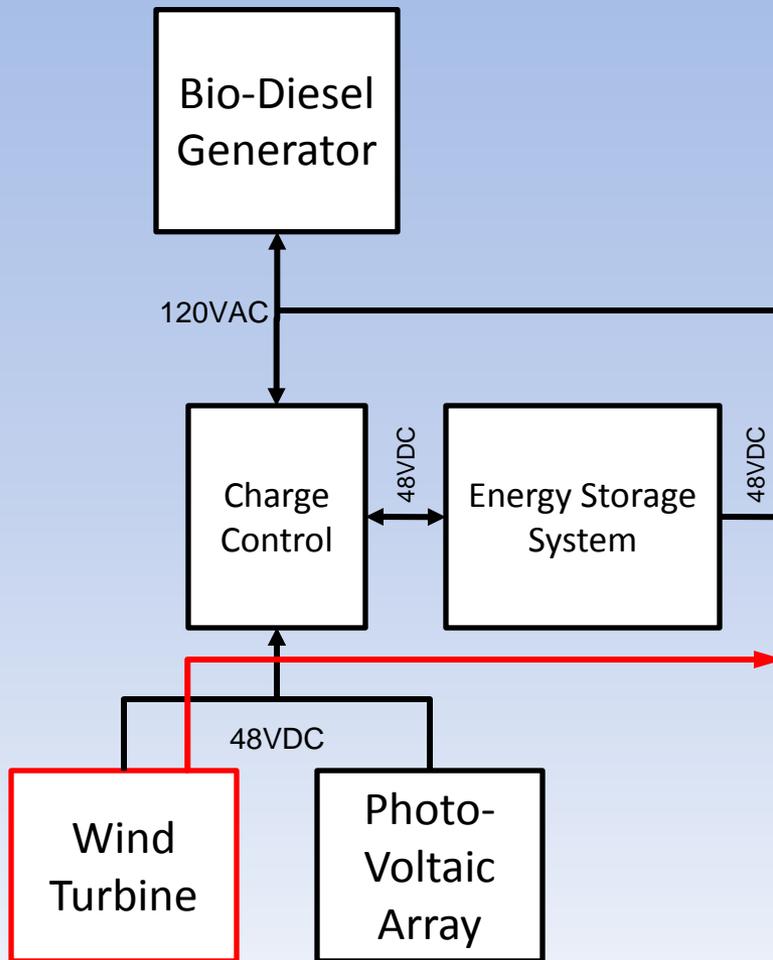
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Dwelling



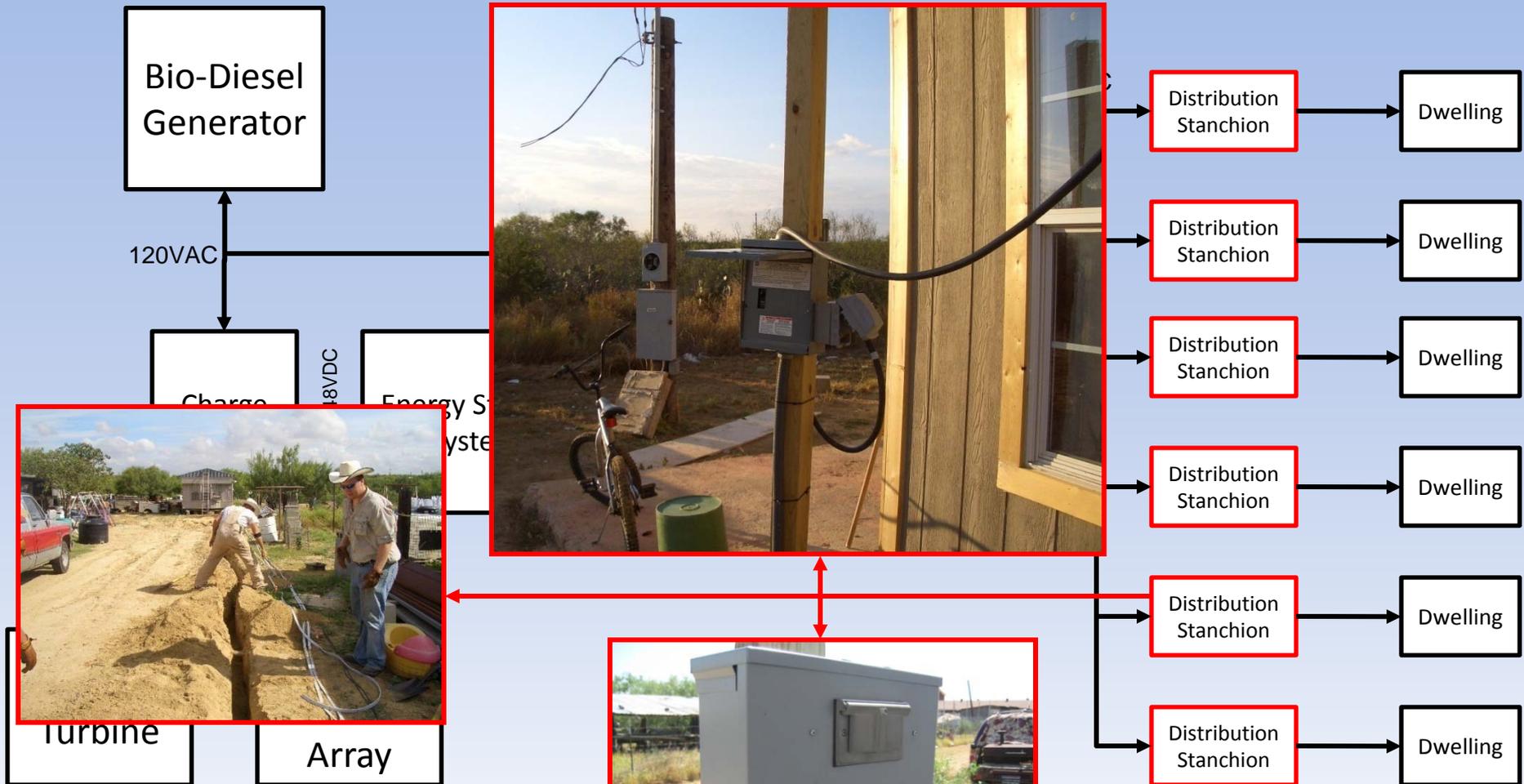
A 10.5 KW PV array powers
the entire grid on a sunny day

System Description



Every watt-hour generated by renewable sources is a watt-hour that doesn't have to be generated by the diesel generator

System Description



Power provided at the dwelling by power stanchions that include watt-hour meters

FY09 DOE Congressional Project

- Objectives:
 - Expand demonstration to additional areas
 - Continue development of hybrid systems
 - Data collection
 - System capacity optimization
 - Control system optimization
 - Increase reliability
 - Finalize production engineering documentation to ensure commercial availability

FY09 DOE CDP

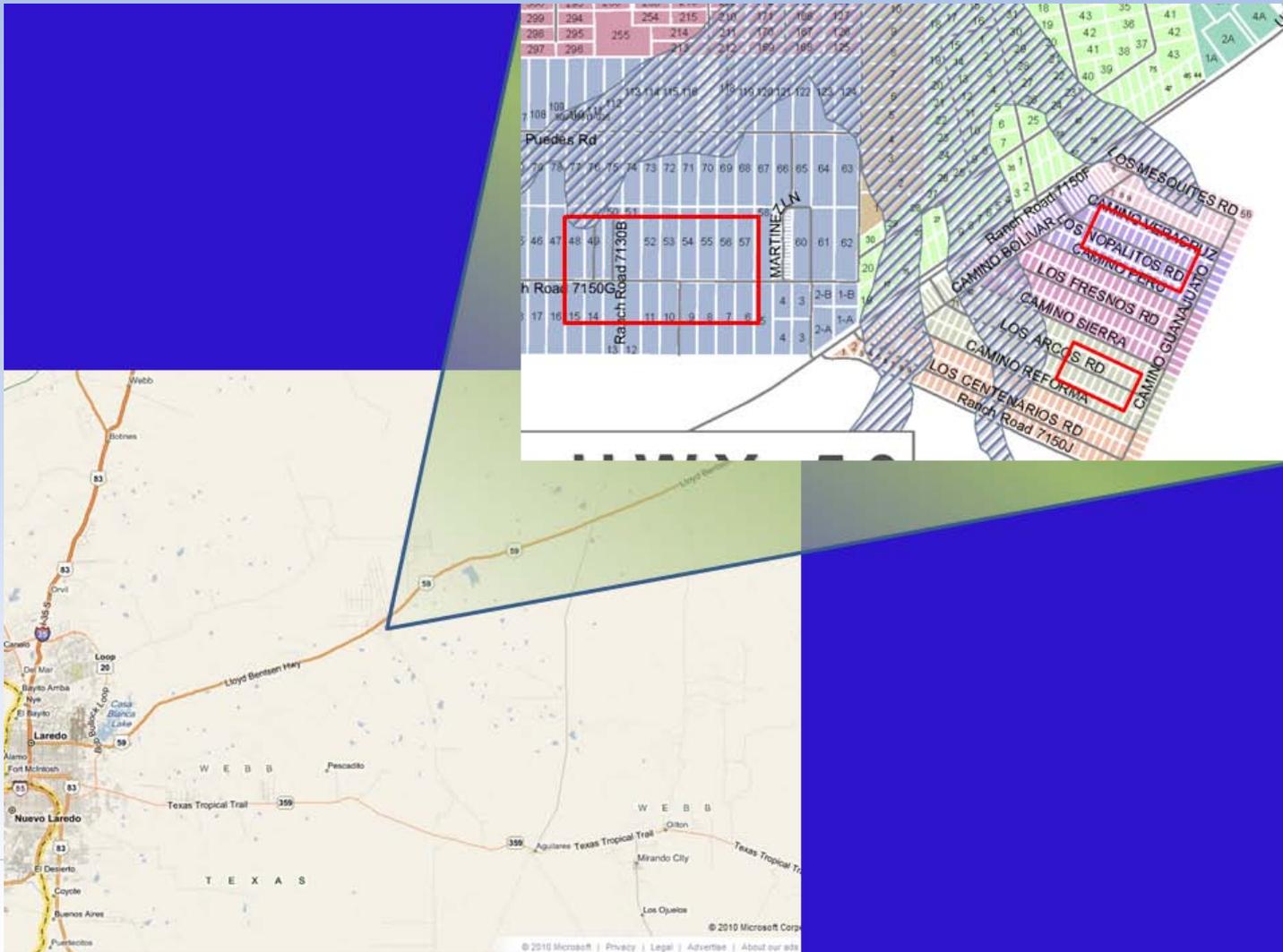
- Initiated Fall 2009
- Year 1
 - Planning
 - Site Selection and Environmental Analysis
 - Easement acquisition
- Year 2
 - Detail design
 - Installation
 - Microgrid Operation

FY09 DOE CDP

- Year 1 Results
 - Program Management Plan complete
 - Site selection and scoping complete
 - Los Nopalitos Colonia
 - Los Arcos Colonia
 - Las Lomas Colonia
 - Proposed to serve ~30 dwellings
 - Year 2 funding approved for execution
 - NEPA review completed – entering into detail design, construction, and installation phase

FY09 DOE CDP

- Site Selection: Santa Teresita Area



FY09 DOE CDP

- Issues in site selection
 - Community cohesion and organization
 - Changes in state law alleviating most grid connection prerequisites
 - Community density and distribution line easement acquisition

FY10 DOE Congressional Project

- Renewable Microgrid STEM Education & Colonias Outreach Program
- Objective
 - Use renewable energy microgrid technologies as basis for STEM education in secondary schools
 - Provide microgrid outreach to Colonias residents and training to students in community college and trades programs

FY10 DOE CDP

- Partner: Texas Education Agency Transformation STEM 2013 Center
- Year 1 Planning
 - Program structure & curriculum development and recruitment of school districts and engineering mentors
 - System hardware acquisition (both training system and school level experimental systems)
- Years 2 & 3: Program Delivery

Conclusion

- Our technology partnership has created a new product, useful in many areas:
 - Remote power applications for
 - Emergency recovery operations
 - Off-grid medium scale (20-30KW) power
 - Military applications (with appropriate militarization of the components)
 - Backup power for municipalities
 - Emergency operation centers
 - Water utility backup
 - Load shifting