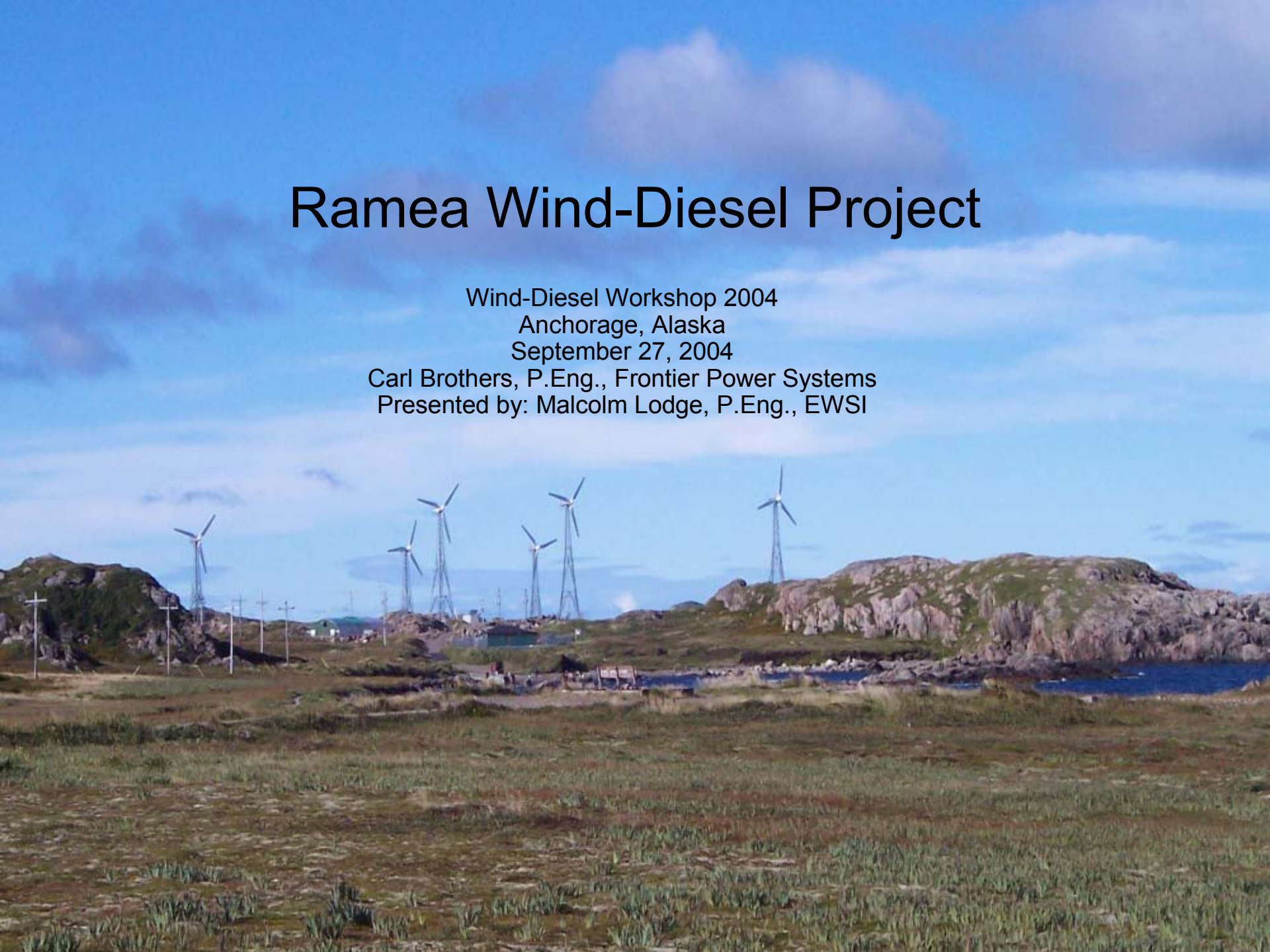
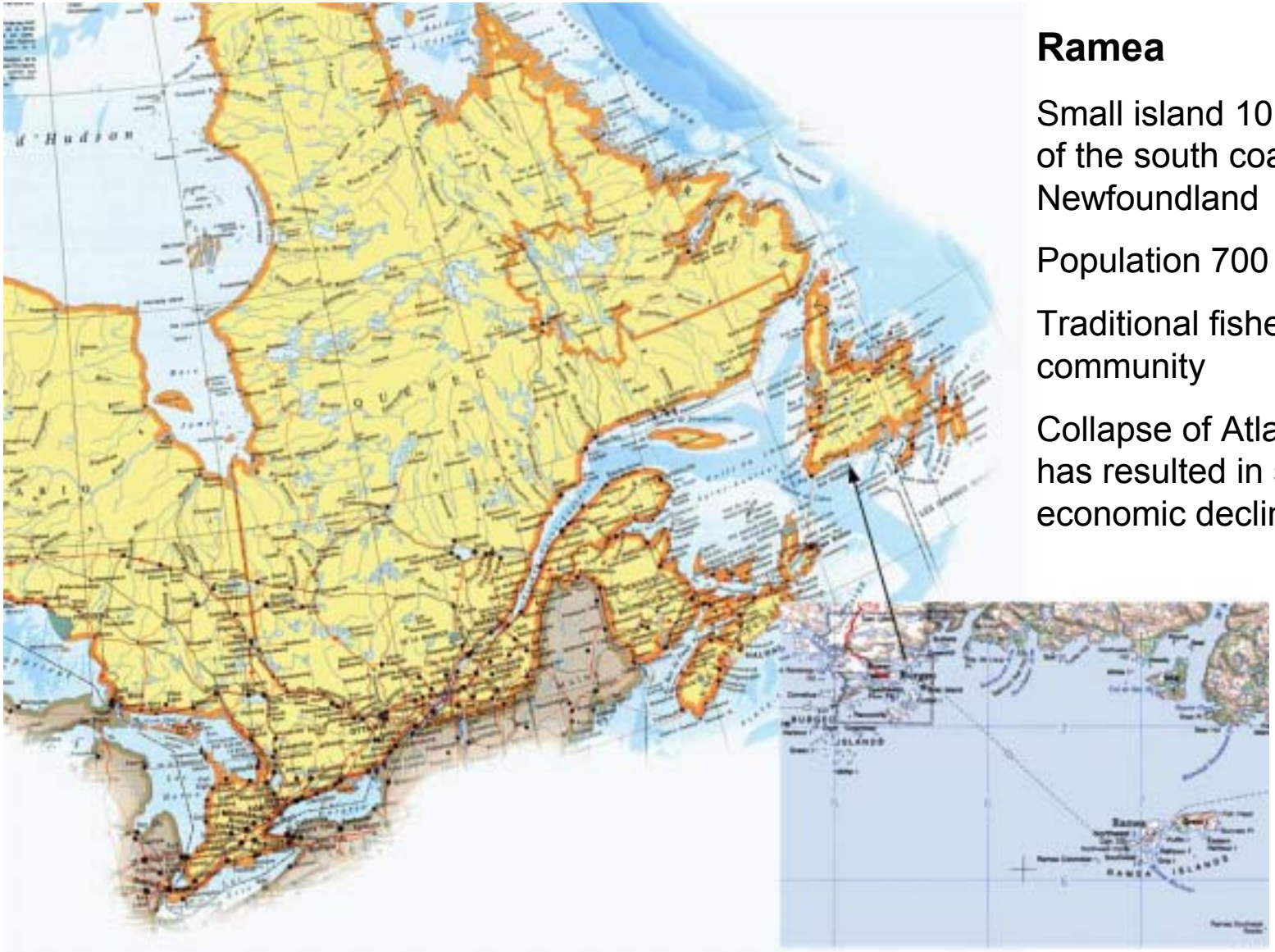
Ramea Wind-Diesel Project

Wind-Diesel Workshop 2004
Anchorage, Alaska
September 27, 2004
Carl Brothers, P.Eng., Frontier Power Systems
Presented by: Malcolm Lodge, P.Eng., EWSI





Ramea

Small island 10 km south of the south coast of Newfoundland

Population 700

Traditional fishery community

Collapse of Atlantic fishery has resulted in serious economic decline

Electrical System

- System
  - Peak Load – 1,211 kW
  - Average Load – 528 kW
  - Minimum Load - 202 kW
  - Annual Energy – 4,556 MWh
- Distribution – 4160 Volts, 2 feeders
- Diesel Plant –
  - 3 - 925 kW Diesels (Cat 3512 – 1200 RPM)
  - Woodward Controls
  - Modicon PLC
  - Fuel Efficiency – 3.9 kWh/liter

Equipment Installed

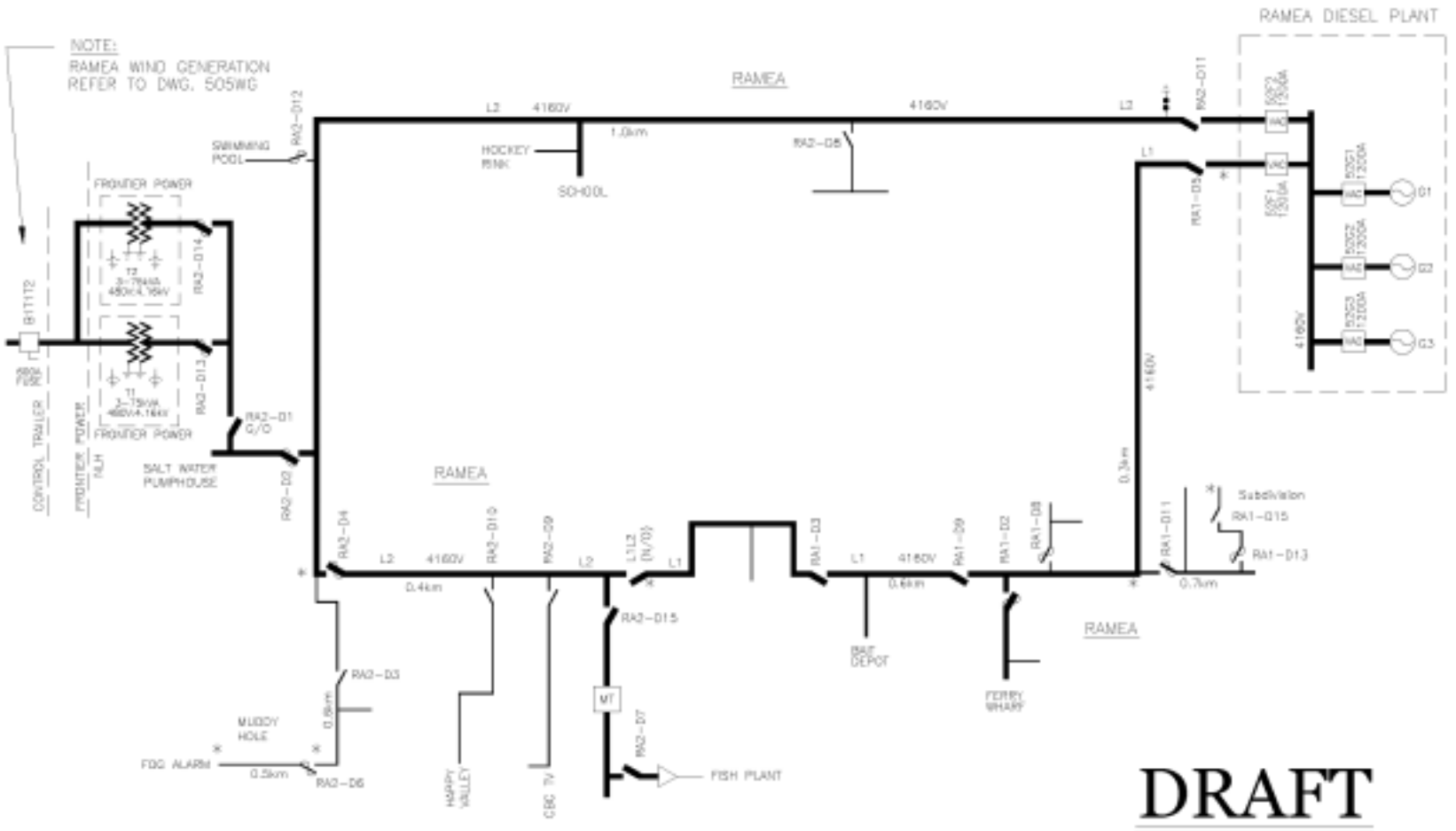
- **6 – 65 kW Windmatic wind turbines**
- **WDICS** (Wind-Diesel Integrated Control System)
  - System Master
  - Wind Plant Master
  - Load Regulator
  - Diesel Plant Communication Package
  - SCADA with internet access (continuous monitoring with 1 Hz and ten minute data acquisition)

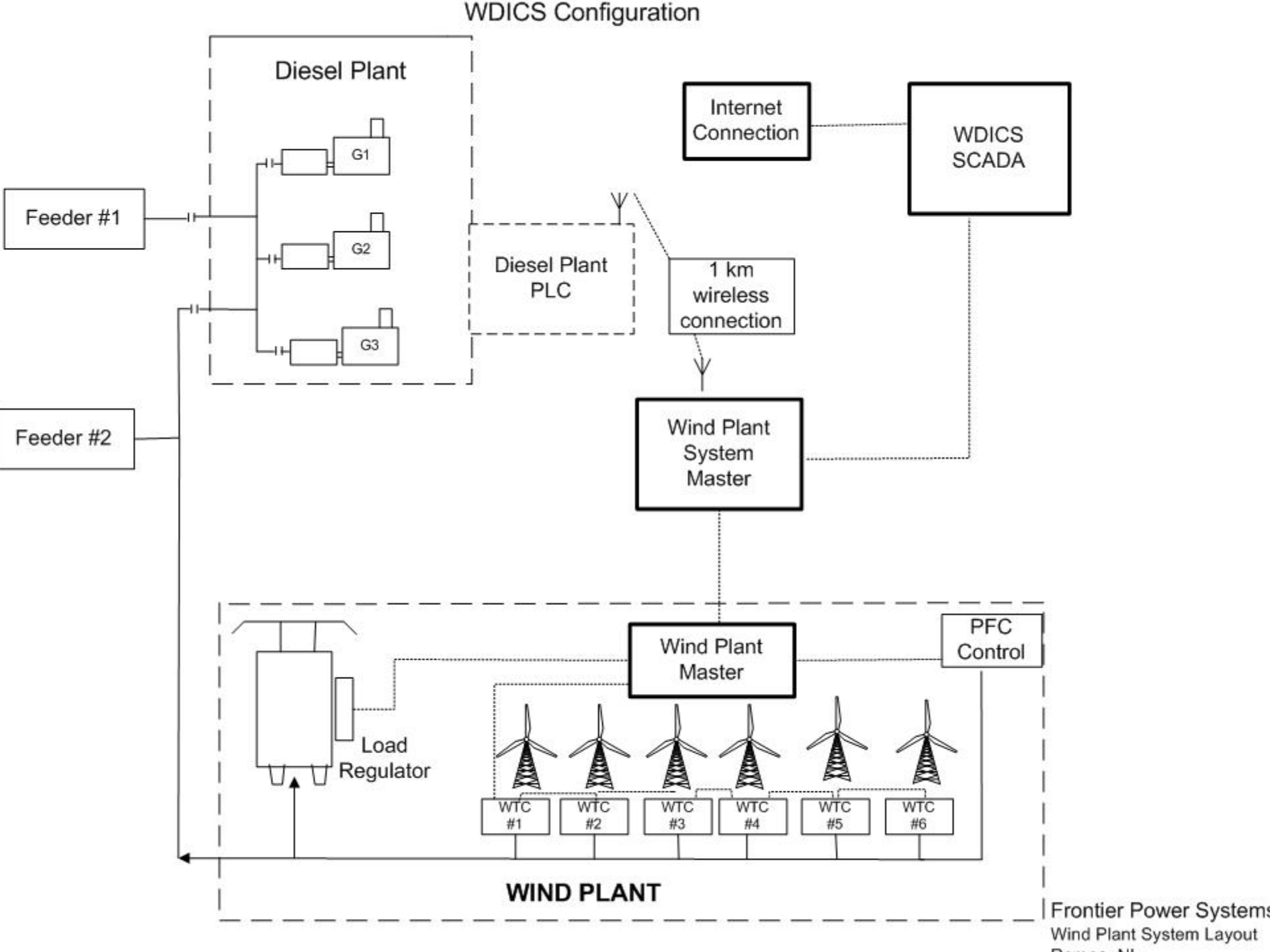
Windmatic WM15S

- 15 meter rotor
- Three blade, stall regulated
- Upwind design, forced yaw
- 25 meter free-standing tower
- Reconditioned by FPS

- Why reconditioned? - $$$$

Ramea Electrical Distribution System




WDICS Configuration
Diesel Plant
G1
G2
G3
Feeder #1
Feeder #2
Diesel Plant PLC
1 km wireless connection
Internet Connection
WDICS SCADA
Wind Plant System Master
Wind Plant Master
PFC Control
Load Regulator
WTC #1
WTC #2
WTC #3
WTC #4
WTC #5
WTC #6
WIND PLANT
Frontier Power Systems
Wind Plant System Layout

Why Ramea?

Low energy costs …. BUT

- **Excellent wind resource**
- **Isolated yet accessible** - 1 day travel to site is ideal to resolve the inevitable problems that will arise
- **Non-Arctic environment** – There are enough uncertainties without adding Arctic challenges at this time
- **Key customer** - NL Hydro is active member of the Prime Power Diesel Industry Users Group, an informal consortium of Canadian utilities which operate prime power diesels. Convincing this group is the key to opening Canadian markets.
- **Enthusiastic community support**

Important to Understand Utility Perspective

Wind-Diesel technology is unproven

- **Reliability has not been demonstrated**
- **Economics are not favourable and**
- **Impact on existing diesel system is unknown**

This view may relate to Canadian utilities only, but probably not

We need to understand utility realities

- Their mandate is to supply reliable electricity at minimum cost
- They have no R&D budgets
- They have no spare resources – neither money nor people. They are nearly overwhelmed just keeping the lights on
- Their interest in wind energy will increase when they view wind as a cost effective alternative.

Project Objectives

- **Select a major Canadian utility with isolated communities and influence among utilities**
- **Demonstrate that**
  - **Wind technology is reliable**
  - **Wind and diesel systems are compatible**
  - **Economics can work under appropriate circumstances**
- **Set the stage for subsequent and more aggressive projects**

Executing the Project

- **Two sources of major delays** (beside cash flow)
- **Bureaucratic**
  - **Crown Land Lease** (expected one month, required four)
  - **Provincial and Federal EAs** (slow process at two levels)
  - **PPA** (PPAs are substantial documents (23 pages) that require time to negotiate – especially when utilities are dealing with unfamiliar technology)
- **Weather**
  - **Winter** (Severe weather delayed road construction and project installation for three months)
  - **Spring/Summer** (Low system loads and low seasonal winds delayed final commissioning of system until autumn. On site with technical crew for 11 days in July – NO wind!)

Present Status

- In automatic operation but further system adjustments required
- Utility require additional witness testing as system loads and winds increase
- Intensive monitoring to continue for one year
- Utility keen to evaluate wind technology reliability and impact on system

Lessons Learned

- **Canadian utilities are not yet ready to embrace wind-diesel** – Ramea should help
- **Regulations and bureaucracy mean it is probably not possible to carry out a wind-diesel project in one year.** This will increase project costs.
- **There is no way to do this without utilities.** We need to offer systems that meet their criteria. Their mandate is unlikely to change.
- **Wind-diesel technology is expensive to install.** Unless we get this technology matured and get costs significantly reduced, the wind-diesel market may be much more modest than some suggest.