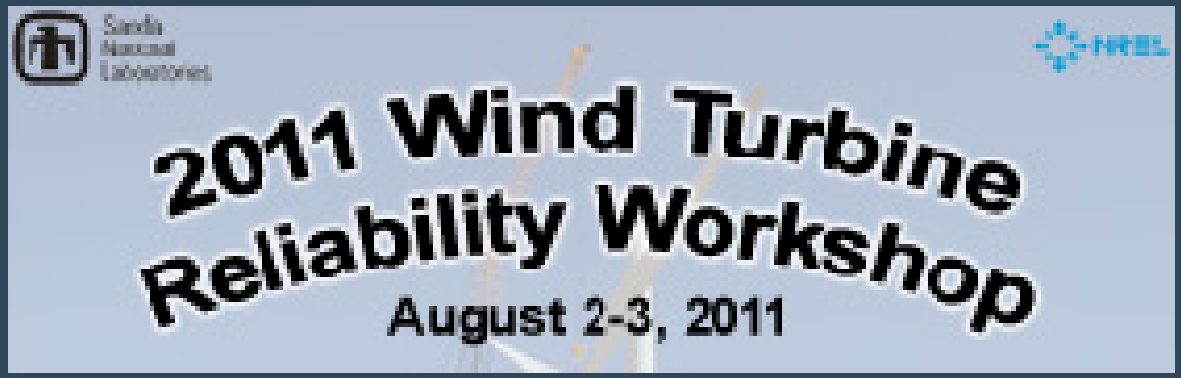


Real-Time Data Infrastructure for Large Scale Wind Fleets – Return on Investment vs. Fundamental Business Requirements

Value now. Value over time.

Reliability – 4 Ws and an H

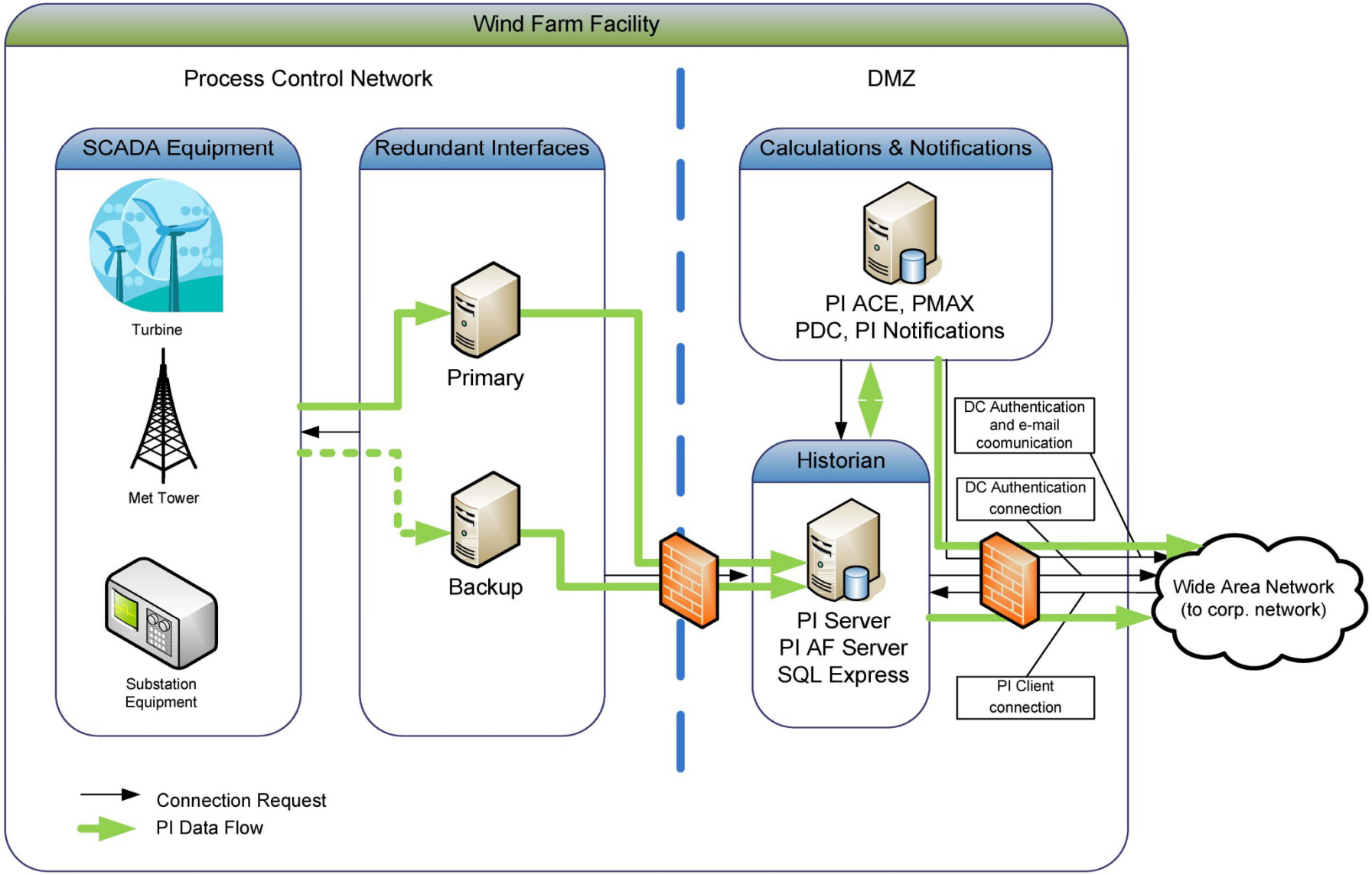
- What is reliability? – Uptime, OEE, profitable wind plants?
  - (OEE = Availability % * Production % * Quality %)
- Why should money be spent to obtain the information?
- Where do I keep the data?
- Who needs to know the numbers?
- How should I design the infrastructure?

The 1% Idea

- Wind Turbine - $5M - $7M per stick (2-4 year old installation)
- Wind Plant – 50 – 100 turbines
- Wind Fleet – 10 – 20 sites
- Total Investment (low end) - $2.5B
- Generation Capability – 1.5MW/turbine = 750 MW
- Potential Revenue – 750 MW * 30% * $60/MW ~ $118M/year

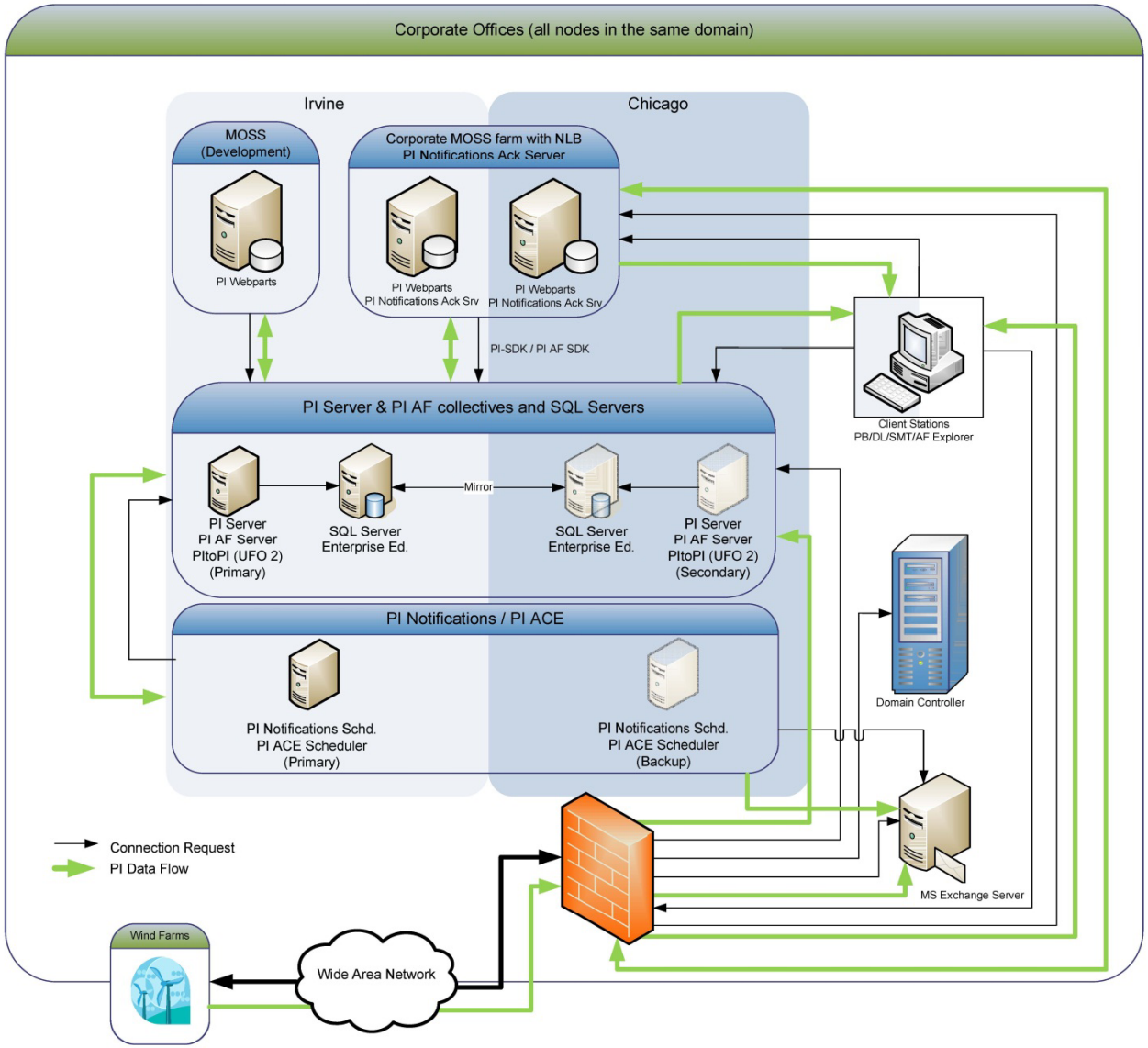
- Increase Reliability/Availability/Production by 1%
  - > $4M additional revenue/year

Typical Architecture – Wind Plant



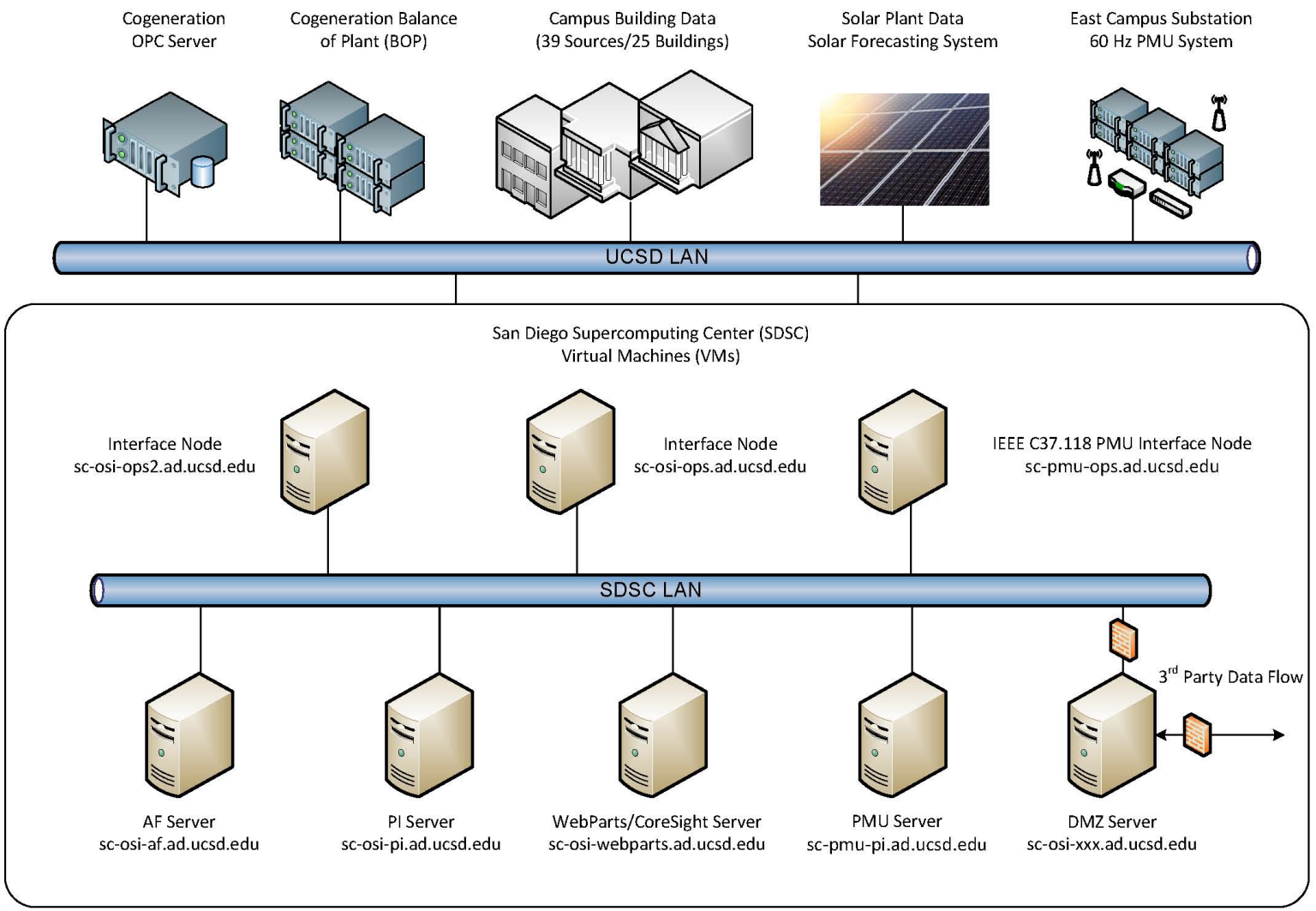
Value now. Value over time.

Typical Architecture – Operations



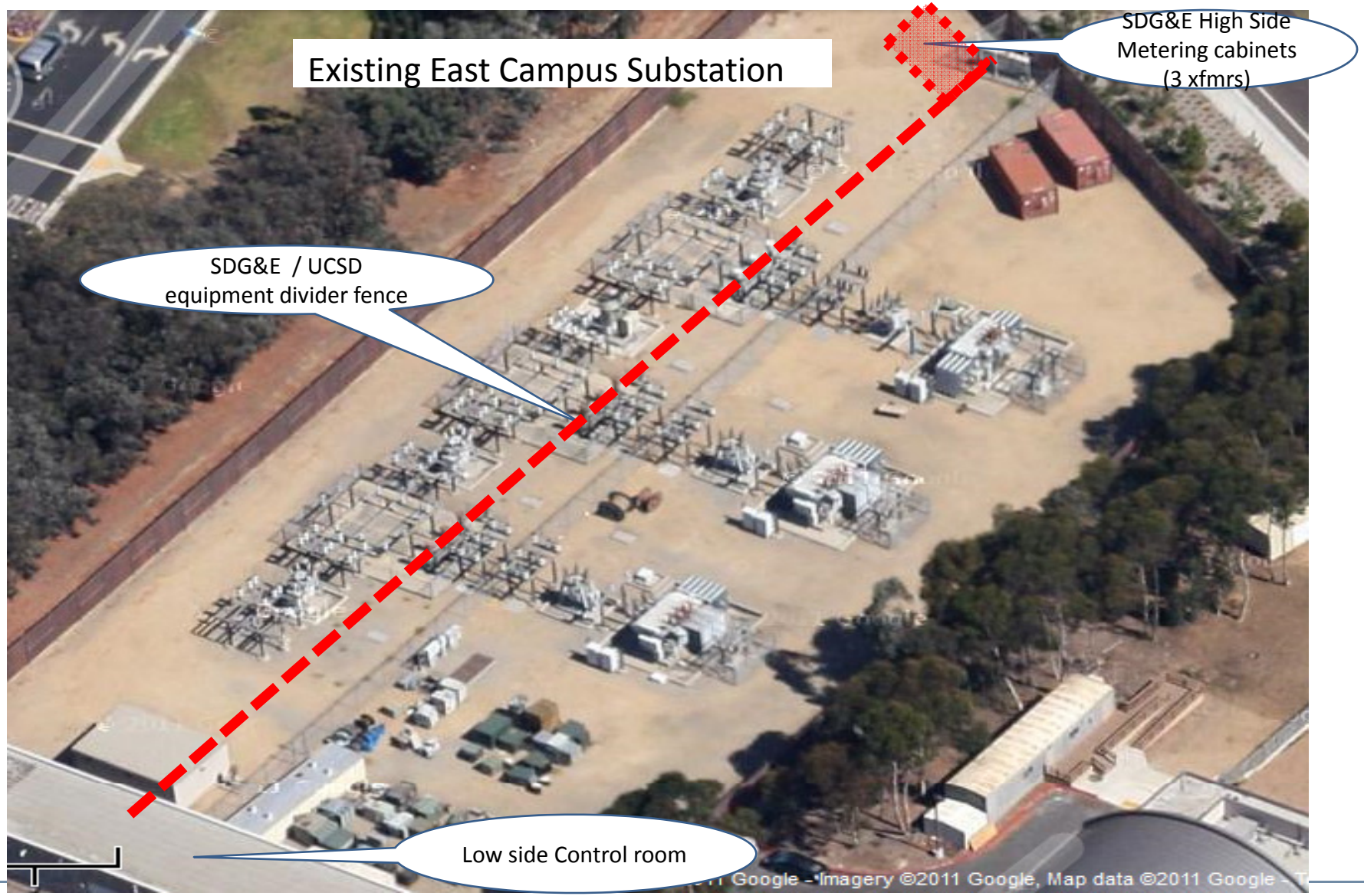
Value now. Value over time.

UCSD Microgrid - Architecture



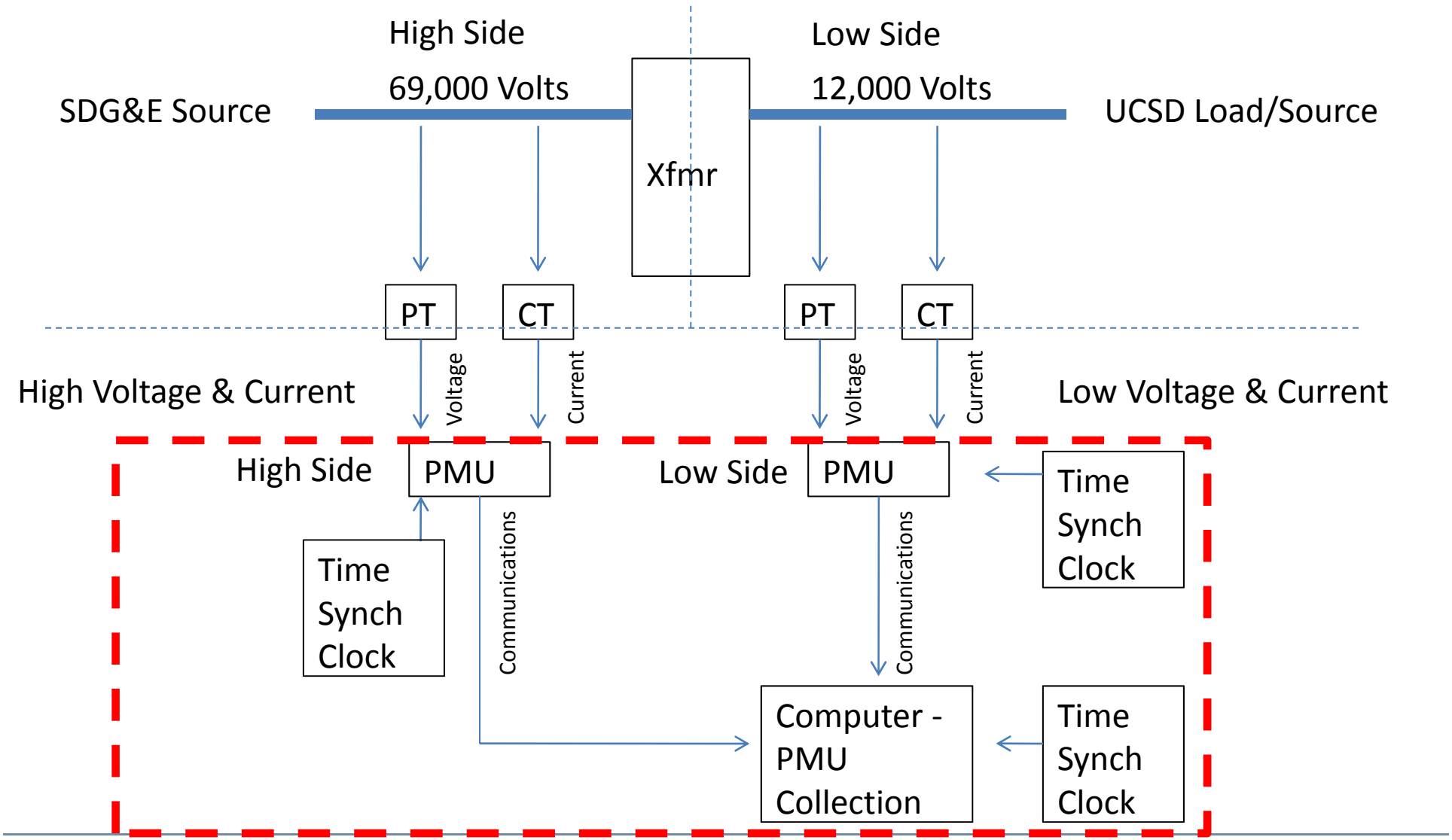
Value now. Value over time.

UCSD Microgrid – PMU Project



Value now. Value over time.

UCSD Microgrid – PMU Project

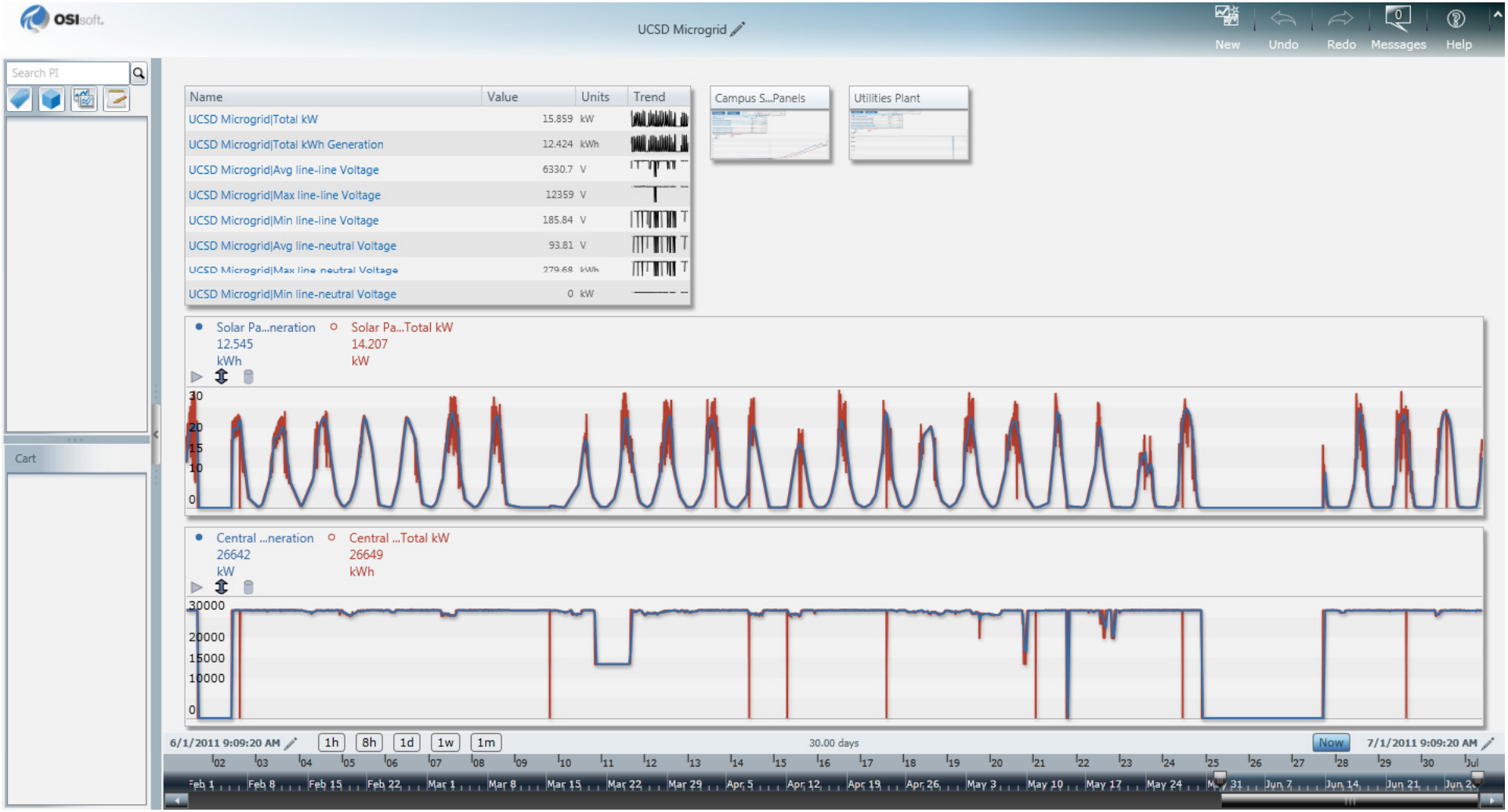


Value now. Value over time.

UCSD Microgrid – Summary, Capabilities

- Data Volume – 67,000+ streams and growing
- Data Frequency – >100 streams at 60 Hz, 1s and 1 min.
- Analysis – Performance Equations, Totalizers, PI DataLink/Excel, ACE
- Visualization – Web Portal, PI ProcessBook, **PI CoreSight**
- 3rd Party Data Consumption – DMZ Server

UCSD Microgrid – Power Home Page



Value now. Value over time.

PI CoreSight – Dashboard, KPIs

More Ws – What to Measure?

- Particulates in Oil – Necessary?
- Vibration – Extent, methodology?
- Synchrophasor – Saleable?
- Power Quality – Unique OEE

Future Projects

- MIT Study
- Direct-to-Controller
- Integration of Other Renewables @ UCSD
- Synchrophasor Network (many, many nodes)

Thank you

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