Web-enabled Instrumentation with Aquisuite

Meeting the needs

As we integrate state-of-the-art instrumentation for commercial solar electric power, we are sought to meet the needs of both the solar-system engineer, and the purchasing customer. The customer desires ongoing power-costs reports; the installer monitors system performance. With an internet-enabled browser, all elements of the instrumentation system are to be readily accessible.

Toward this end, we construct small instrumentation networks, each hosted by the Obvius Aquisuite, with power, temperature, and solar transducers from Veris, Power Measurements, and Davis Instruments all contributing data. On the other end of Aquisuite's internet connection is the SolarQuest® data server, which processes the data and hosts the Web site.

With Web access, customer accountants tracks power generation and usage costs, spanning hours, workdays, and seasons; executives advertise green business practices. The installer monitors the solar power system for detailed efficiency and performance, comparing generated power with the solar radiation.

About the installation

See Figure 1, for an illustration of the measurement system. The site is a small construction company, with a shop and an office situated across a small yard. The facility is powered by a grid-intertied Sunny Boy inverter farm. For this site, the system engineer also has diagnostic access to individual inverters in the solar array, using Sunny Boy equipment.

For power measurements, we have standardized on the Modbus RS-485 connection. Configurable channels, aboard the Aquisuite, enable custom measurement points, such as our solar pyranometer, and optional rooftop and solar-panel temperatures monitoring.

Using our tone-finder, we were able to identify a spare twisted pair on an existing telephone trunk that ran underneath the construction yard out to the shop. There we clamped on the Veris 8035 Modbus power consumption/demand transducer set, establishing the combined PV-power measurement point. The Aquisuite soon found the connected transducer, and measurements began showing up in its logs.

Note that the solar power installation re-defines the shop sub panel as a bi-directional power bus, dependent upon the PV power and shop loads.

Normally, we utilize a pair of Veris 8035 or 8036 clamp sets, measuring the PV generation, and the facility load. In our database, we then calculate the utility net power usage for each measured interval:

KWh Net = (kWh Load) – (kWh Generated).

However, this installation proved to be the exception to the rule. A combined load point was not physically accessible: The inverters were wired into the facility's electrical system at the existing shop sub panel. Within the power mains panel, only the bi-directional power mains were accessible. The office sub-panels, plus an array of 208-Volt air handlers, were all wired onto the main buss.

Fortunately, the Aquisuite newly supports the Power Measurement Ion6200, a bi-directional power consumption/demand transducer set. Thus we derive the load from the available measurement points:

KWh Net = (kWh Import) – (kWh Export)
KWh Load = (kWh Net) + (kWh Generated)
(Here: imported from utility, exported to utility)

Figure 2 details panel wiring for the power transducers. These specialty transducers measure all relevant power variables, and electronically derive corrected power meter results in Kilo Watt Hours. The PV Power measurement is unidirectional; the Main Panel measurement is bi-directional.

Getting to results

Figure 3 shows a sample Web page that graphs Plane Solar Radiation (Watt per square meter); together with Photo-Voltaic generated power, the tenant aggregate Load, and the resultant Net power to the utility.

Figure 4 shows a popular bar graph, showing the quantitative solar power contribution. Similar graphs show dollars saved, or tons of CO_2 displaced.

These graphs never fail to highlight the benefits and performance of a solar power system.

Conclusion

We have found that, for building state-of-the-art, Web-enabled instrumentation systems, the Aquisuite field logger, Veris power transducers, complemented with solar radiation, temperature sensors, and standard networking equipment, really has made it practical to go online with our SolarQuest® renewable energy information services.

The keys: the instrumentation network and its Aquisuite host are straightforward and robust; the data processing and presentation services are hosted where the computing power is centered: at the server. Thus, a system that makes sense.

For additional information on Web-enabled instrumentation for your project, contact:

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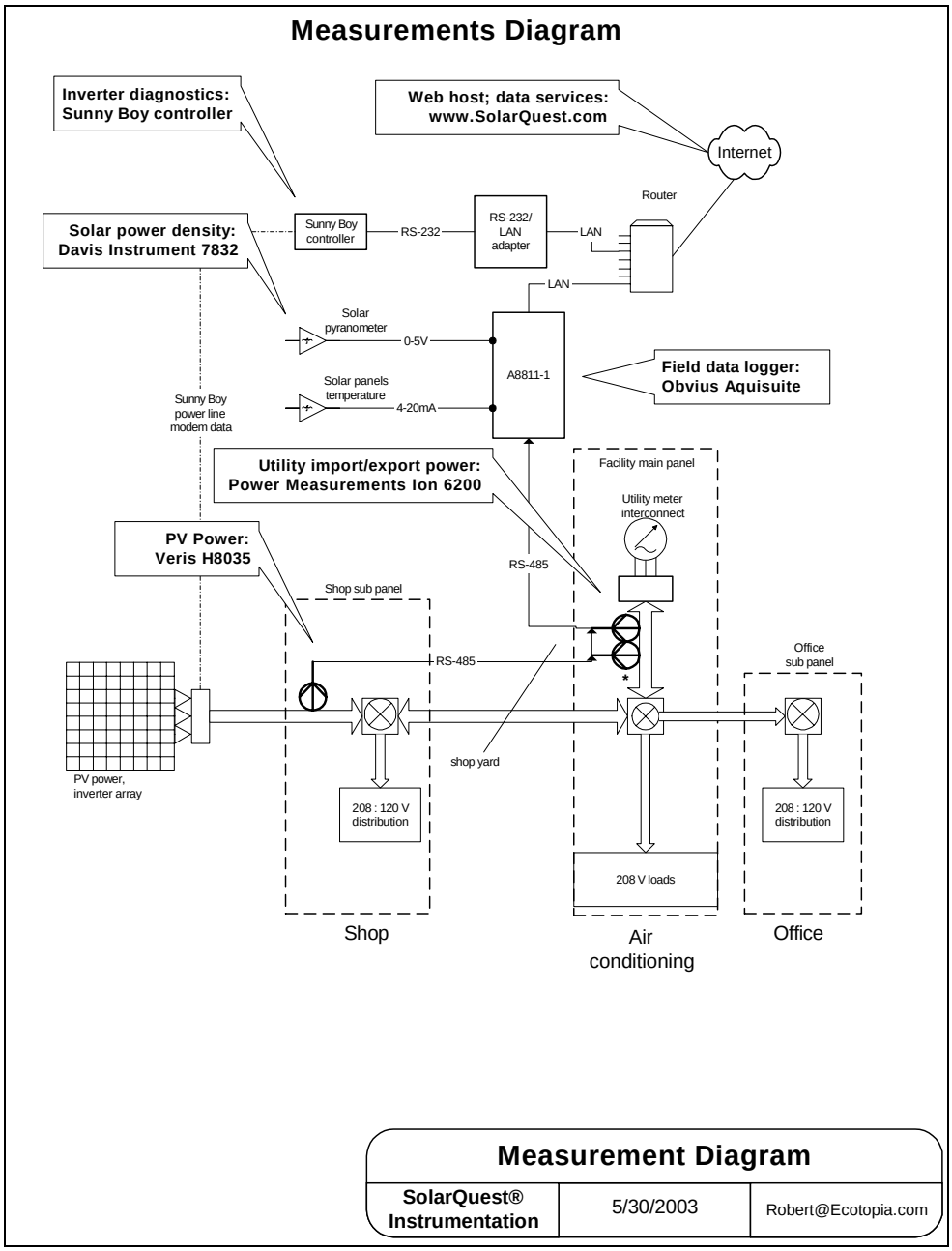
Measurements Diagram
Inverter diagnostics: Sunny Boy controller
Web host; data services: www.SolarQuest.com
Internet
Router
Solar power density: Davis Instrument 7832
Sunny Boy controller
RS-232
RS-232/ LAN adapter
LAN
LAN
Solar pyranometer
0-5V
A8811-1
Field data logger: Obvius Aquisuite
Solar panels temperature
4-20mA
Sunny Boy power line modem data
Utility import/export power: Power Measurements Ion 6200
Facility main panel
Utility meter interconnect
PV Power: Veris H8035
RS-485
Shop sub panel
RS-485
Office sub panel
shop yard
PV power, inverter array
208 : 120 V distribution
208 : 120 V distribution
208 V loads
Shop
Air conditioning
Office
Measurement Diagram
SolarQuest® Instrumentation
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Figure 1

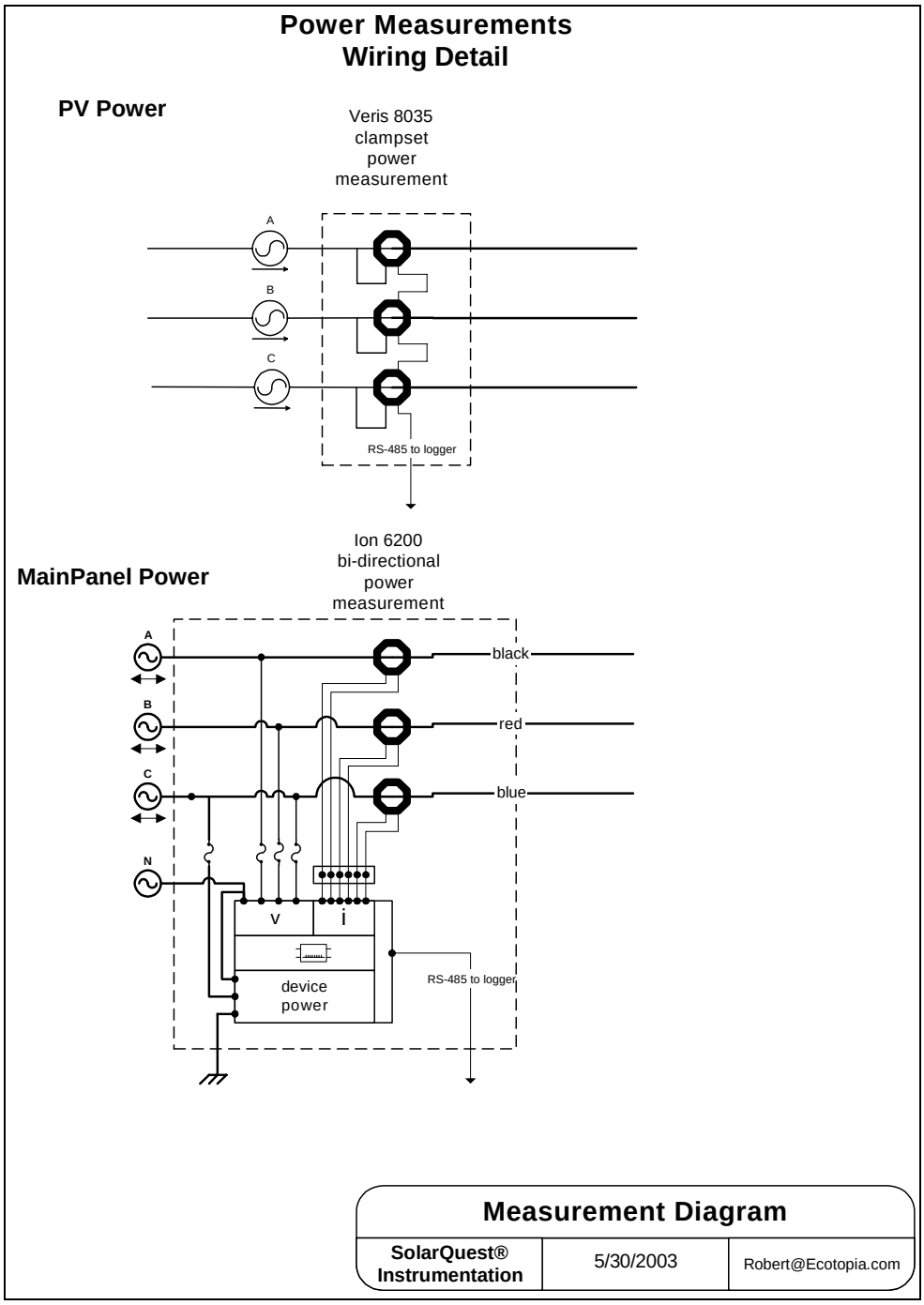
Power Measurements
Wiring Detail
PV Power
Veris 8035
clampset
power
measurement
A
B
C
RS-485 to logger
MainPanel Power
Ion 6200
bi-directional
power
measurement
A
B
C
N
black
red
blue
V
I
device
power
RS-485 to logger
Measurement Diagram
SolarQuest®
Instrumentation
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Figure 2

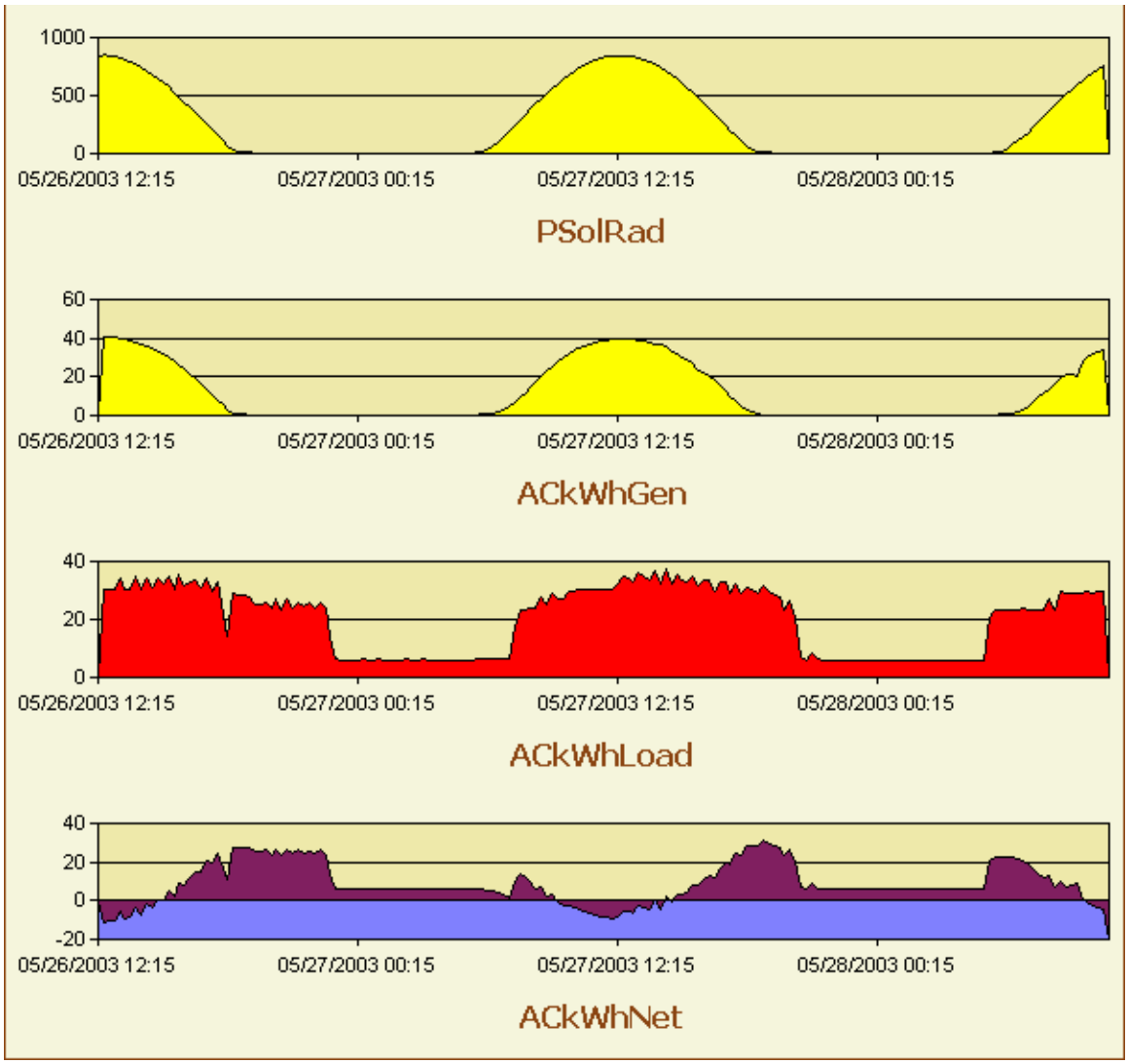

Figure 3: Graphical overview of renewable power system performance.
PSolRad: solar radiation in the 30° solar-panels plane -- Watts per square meter.
Remaining quantities in kilo Watt hours.

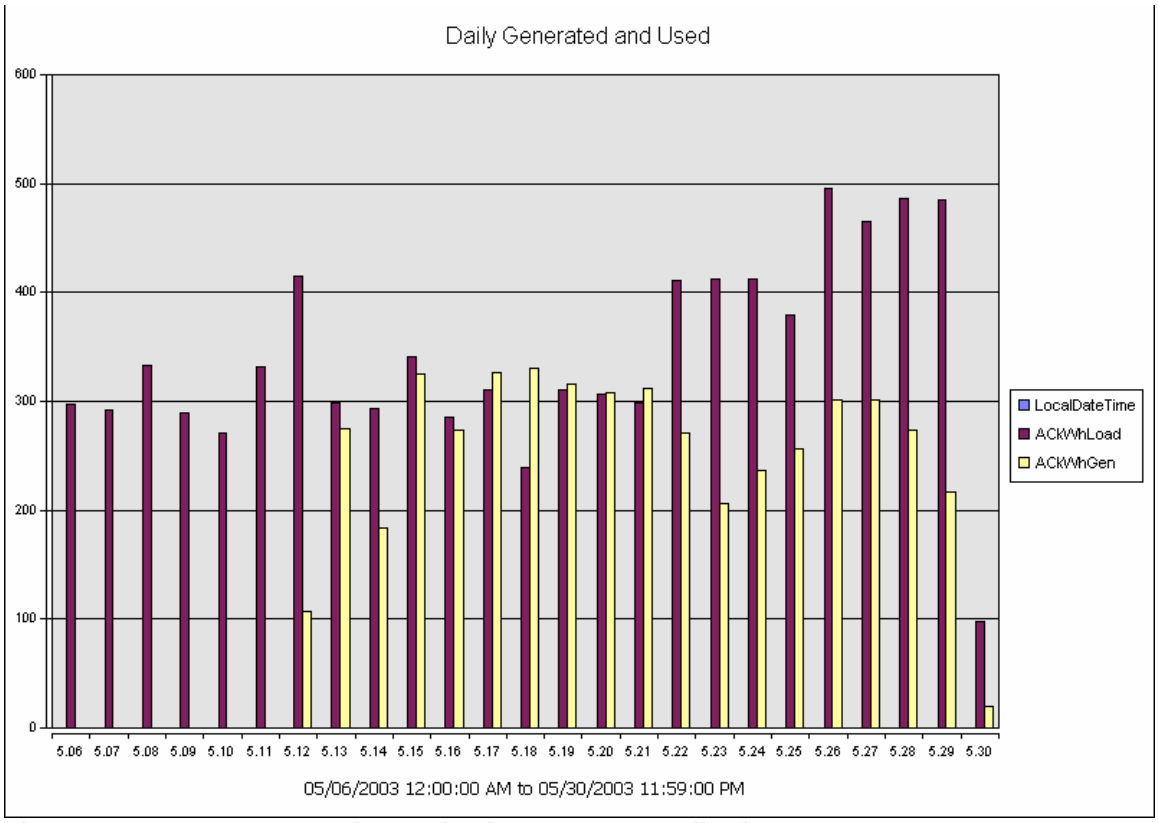

Figure 4: Tenant consumption and solar system contribution.
(Note startup May 12th.)