Open Source Solution
(no vendor lock in)

SolarNetwork and SolarBilling

a solution from Greenstage Power Ltd.


Version 1.2
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greenstage

Overview

The Open Source SolarNetwork and SolarBilling platforms with their web and mobile enabled front end provides the basis for a modern smart grid and billing solution in an evolving business environment. In its foundations it has the ability to support a wide range of Solar PV Inverters and metering hardware from a variety of manufacturers and to provide DSR services via its ability to aggregate distributed data and to control loads via remotely controlled switches. This allows for the management and enforcement of prepaid metering. Additionally, because the system is built from the ground up to record a full history of consumption and generation for every customer (plus any other data that may be of interest), time of use (TOU) billing is easily configured.

The combined solution of the SolarNetwork and SolarBilling platforms creates a fully integrated electricity billing solution for grid metered electricity combined with on-site PV generated electricity.
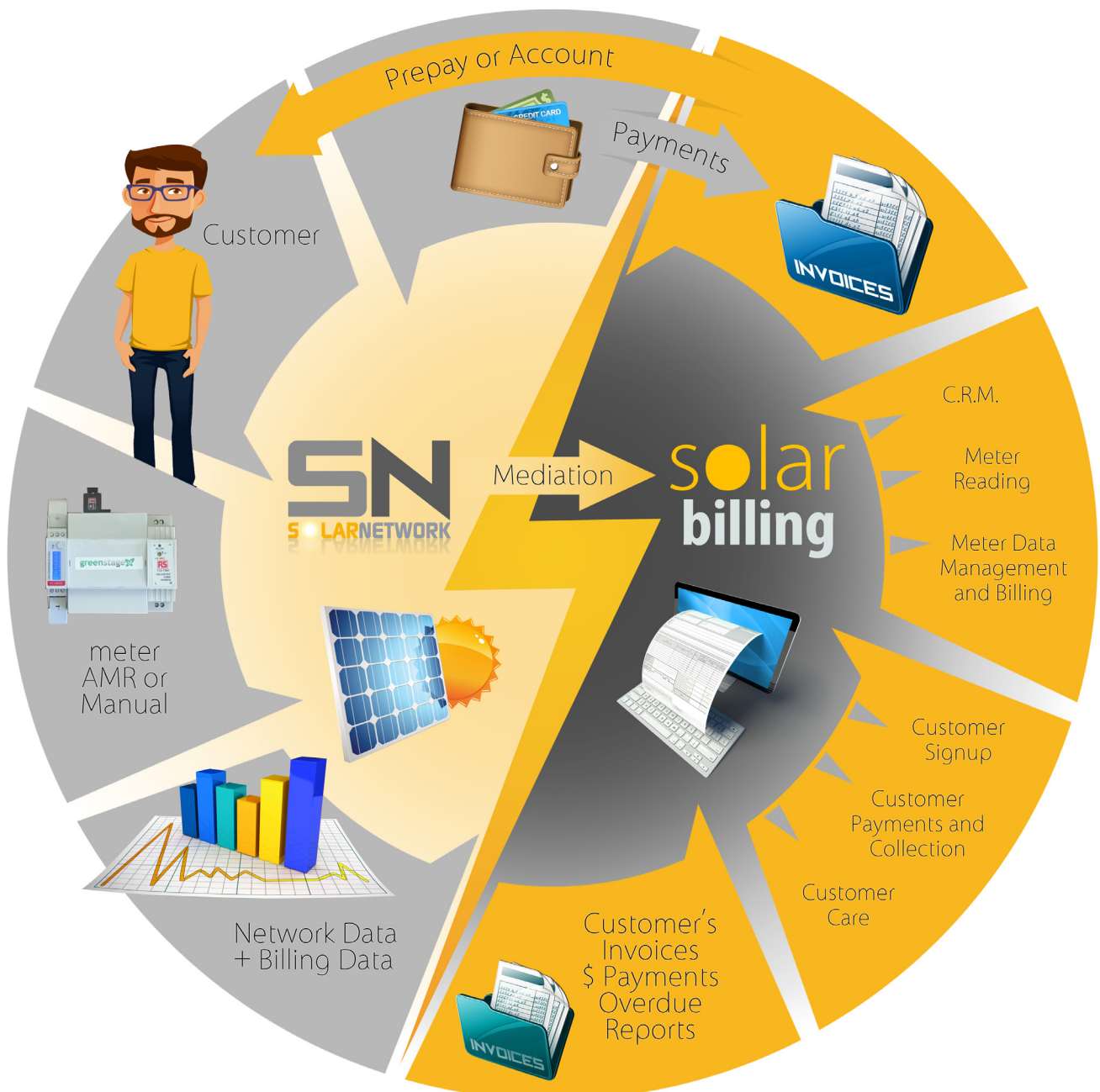
SolarBilling (combined with the SolarNetwork) provides a number of core features:

Schedule Meter Reads

SolarBilling can be configured to schedule invoice generation for each customer at different times of the month to match with a manual meter reader's schedule. This will be needed if automatic and real time data connections are not configured within the network or provided for at a specific customer's site.

Automated Data Collection

By providing our SuperMeter with permanent (or regular) TCP/IP connectivity, the SolarBilling solution can provide for fully automated meter reading (AMR). If permanent connectivity is not an option (i.e. in remote areas without internet), a mobile WiFi hotspot can be carried by meter readers to allow the SuperMeter to upload its data automatically as the hotspot comes into range.

On Demand

On Demand Meter Reads can be easily achieved if permanent TCP/IP connectivity is provided at the customer site. Once collected, the meter read can be invoiced by generating a one off invoice using the data captured in SolarBilling, or by using manually collected and entered meter data if required.

On Demand Remote Connects (and Disconnects) can easily be achieved by leveraging an optional SuperMeter relay control component. If it is a new customer connect, it is a simple matter of creating a new customer record within SolarBilling and activating the associated node within the SolarNetwork.

SolarNetwork

SolarNetwork is a platform for the collection of data from distributed nodes. These nodes typically monitor consumption and generation of electricity at multiple distributed locations.

A SolarNode can be combined with a range of peripherals including electricity meters, solar PV inverters, PLCs etc to create a range of solutions. If required, new devices (such as a new brand of solar inverter or electricity meter) can be easily supported within the system by developing a new software driver for the device and adding this to the SolarNetwork platform (Greenstage Power Ltd or any suitably qualified software team can provide these services if and when required).

Metering

SolarBilling can function with manual or Automated Meter Reading (AMR). AMR can be provided via any new or existing Modbus enabled electricity meter.

Below is the metering system configuration which is likely to satisfy the needs of many projects. It includes a single phase 45A Modbus meter (three phase 100A also available) and a SolarNode with WiFi connectivity for wireless meter reading and Solar PV metering. Communication from this system to the back office is achieved using common TCP/IP protocols which are agnostic to the type of physical communication (e.g. 3G, CAT5, WiFi). This metering solution is the core part of what we call a SuperMeter. A SuperMeter is effectively a Smart Meter which is designed from the ground up to be easily expanded, both functionally and physically, (the Open Source software license also helps facilitate this). For example the SuperMeter provides for the ability to be expanded to include remotely controlled switches for DSR, the management and enforcement of prepaid metering and remote connects/disconnects. Additionally its software platform is part of the SolarNetwork and hence it is Open Source and highly secure (see the "Data Security and Non Repudiation" section below).

The beauty of the SolarNetwork framework and the v1.0 SuperMeter is that any type of Modbus enabled electricity meter can be supported (so existing electricity meters do not necessarily need to be replaced and this solution enables hardware flexibility options into the future).

SuperMeter v1.0

Adding new components is easy:
http://www.solarnetwork.net/pluginFramework.php

Currently supported devices are listed here and new devices can easily be added if required:
https://github.com/SolarNetwork/solarnetwork/wiki/Node-Supported-Devices

Physically this involves adding new modules to the system as required to support the required functionality of the application, e.g:
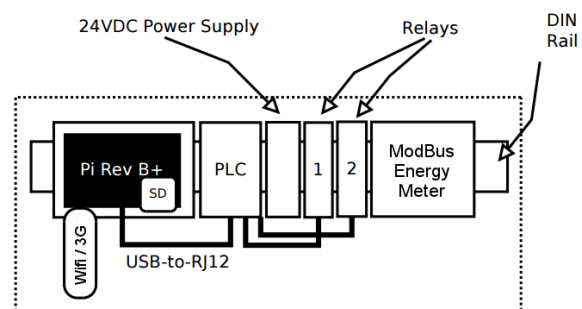
SuperMeter Schematic

The SuperMeter is expandable to support applications such as Pre-Paid Electricity, Solar Monitoring with Active Power Limitation, Demand Response, Time of Use Pricing and even EV charging.

Applications:

| Pre-Paid Electricity	Solar Monitoring with Active Power Limitation	Demand Response	TOU Pricing	EV Charging

Customer Functionality

With the SolarNetwork solution, all customers will have the option of accessing and viewing their own personal energy consumption data and monthly bills online.

Below are some examples of easy to understand graphs that customers can view to understand what their daily and weekly consumption looks like.
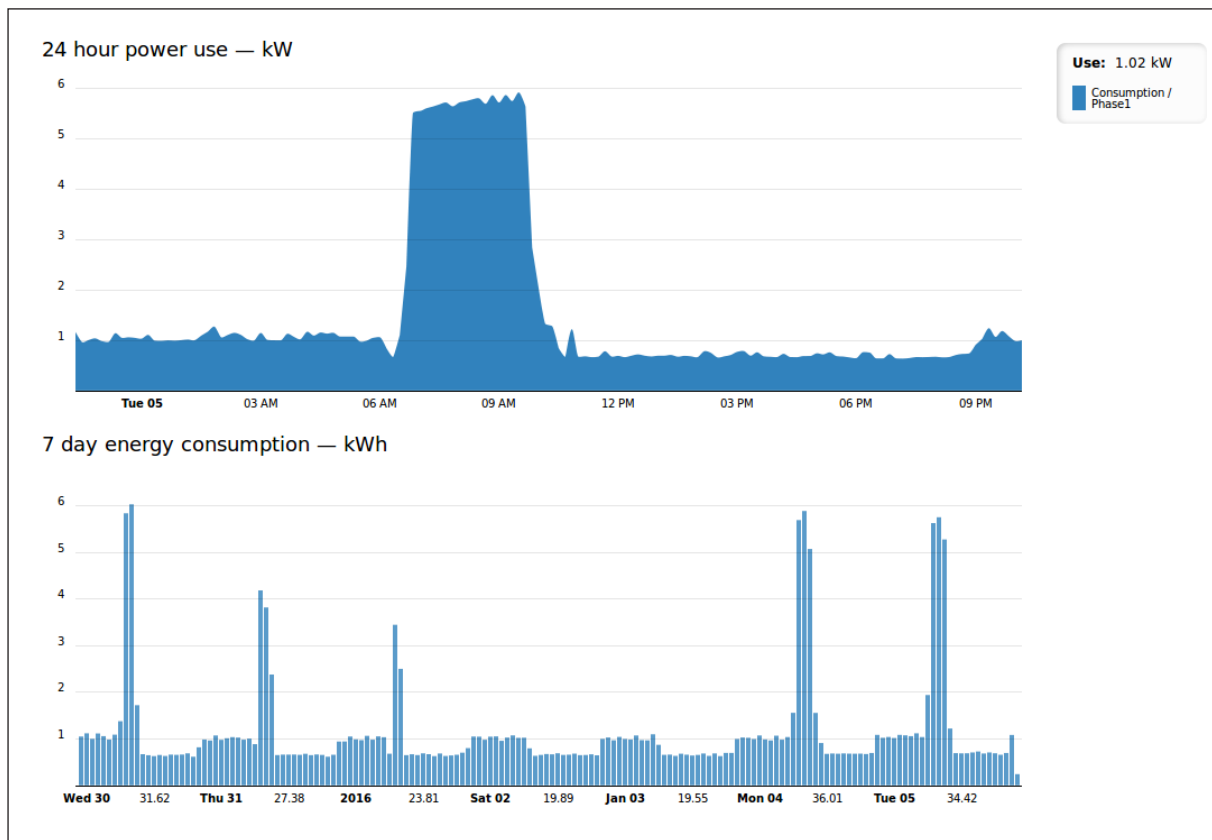

Customer's Electricity Consumption Graph
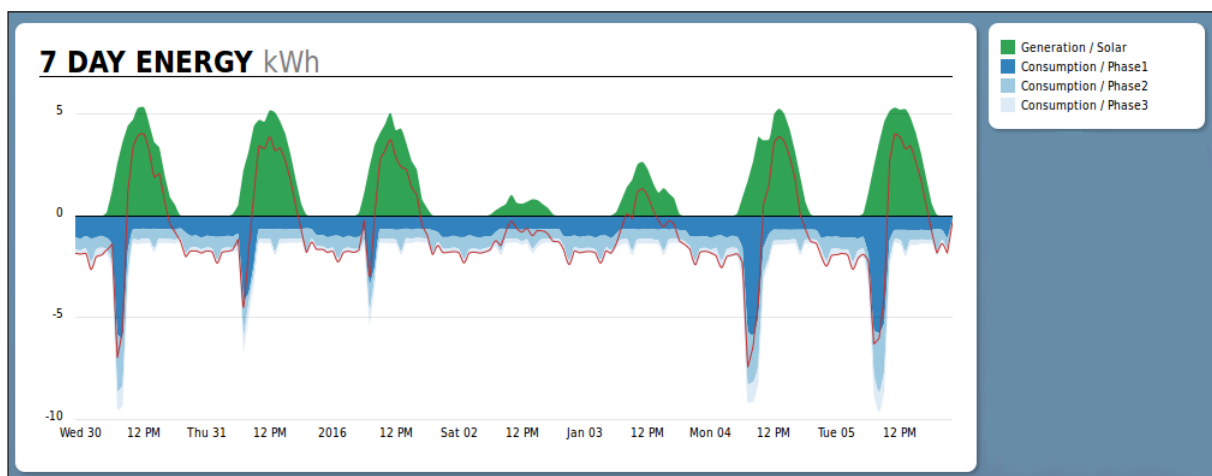
Customer's Consumption and on-site Solar Generation

Network Engineer Functionality

With the SolarNetwork solution, network engineers will have access to low level data being collected at every customer site (where that customer has a SuperMeter with permanent (or regular) TCP/IP connectivity).

Below are some examples of network data that can be captured from a Modbus enabled meter.
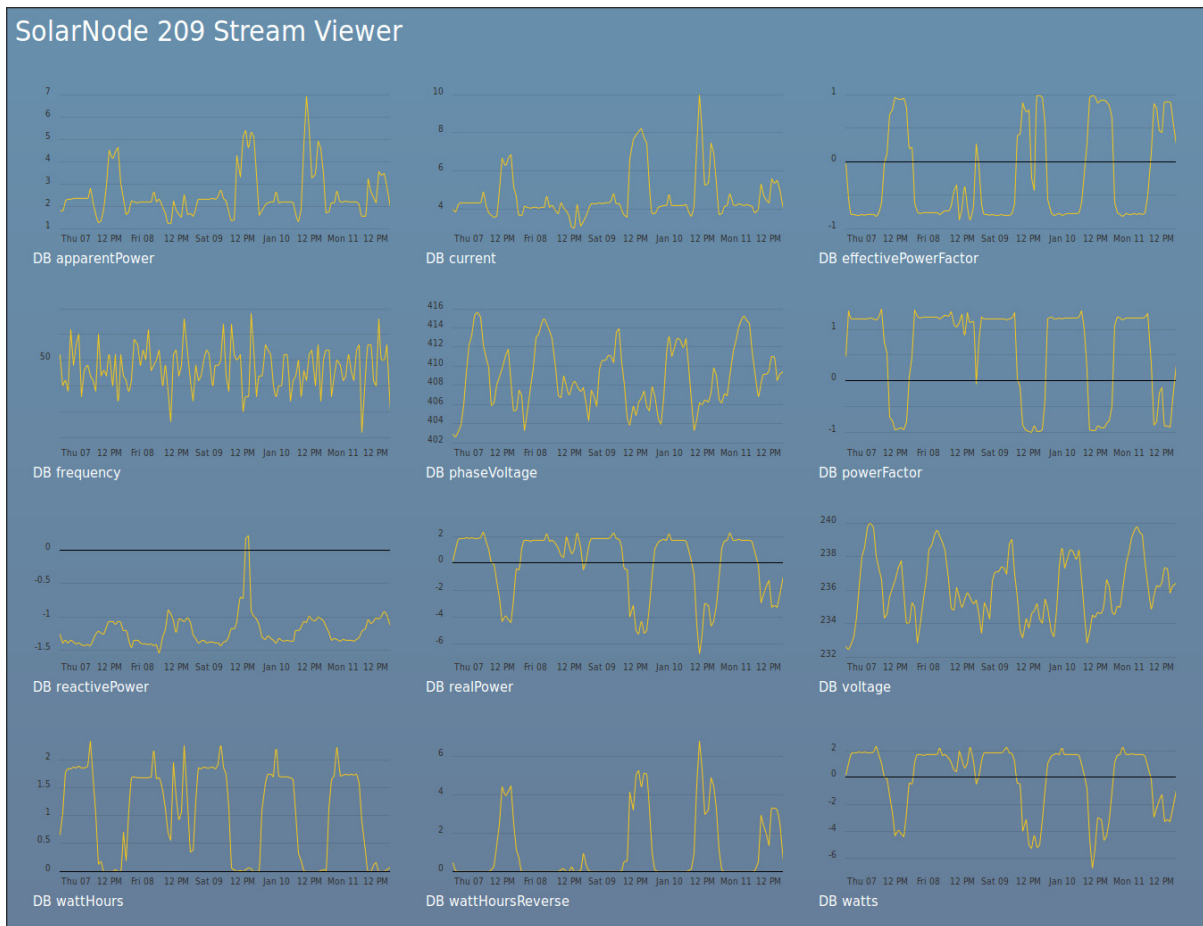
Network data captured by a SuperMeter

Software Interfaces

SolarNetwork and SolarBilling support a fully featured set of APIs that allow easy integration with other systems should that be required.

Software and API Technology that these components use for system expansion and integration are detailed here:

SolarNetwork API: *https://github.com/SolarNetwork/solarnetwork/wiki/API-Developer-Guide*
SolarBilling API: *http://greenstage.co.nz/SolarBilling/webservice_doc.html*

Integration

Our team of experienced developers are able to integrate any components that may be required for the smooth day to day running of your business. .

Data Security and Non-Repudiation

Our Approach: Any data being collected for the purposes of billing must be secure and verifiably correct. Our approach is to use the best Open Source technology available and to leverage state of the art security protocols and techniques within these platforms. Our commitment is to provide the best services with industry leading security techniques. This is demonstrated by our current overall SSL Labs score for our server's security configuration which is an "A". A full summary of our latest and most up to date security configuration is available online *here*.
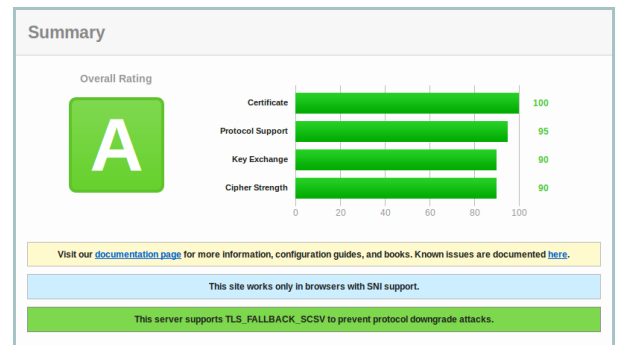
Security Specifics: All communication between remote SolarNode units (i.e. the SuperMeters) and the SolarNetwork server services use HTTPS, with the minimum supported encryption version being TLS1.0. We no longer support the old and now insecure SSL v1, v2 and v3 protocols.

Posting data to the SolarNetwork server requires a SolarNet-issued X.509 client certificate for authentication (this ensures non-repudiation of the source of the data collected, i.e. we know and can prove 100% where each piece of billing data came from).
Additionally, all actionable services performed by a SolarNode require a specifically allocated token with a paired secret key. This prevents unauthorised agents from accessing the actionable services.

If you desire additional security measures or if your security policy requires solutions to be deployed and accessed over a VPN, or behind a HTTPS proxy server or similar, then Greenstage Power can deploy the solution with these measures in place.

Open Source

By using Open Source software you are avoiding vendor lock in and opening up the possibility to empower you local community to own the solution 100% For further details on the benefits of Open Source please see:
https://opensource.org/advocacy/case_for_business.php

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