

# GridManager - The “last mile” for smart grids to reach the consumers

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## 1 GridManager – the idea

Automatic Demand Response, is viewed by GridManager as “Respectful interaction between production and consumption”, and is on a global scale viewed as one of the key components, in the human quest to minimize CO<sub>2</sub> emissions.

GridManager has developed an integrated energy management system, focused on the commercial and Industrial segments (C&I). The architecture and implementation has been supported by IBM, and is scalable to national system levels.

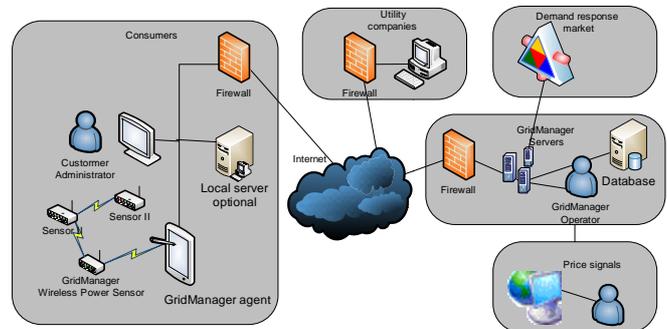
The idea is to provide the consumers with a fully integrated “Plug’n’play” portal solution for Energy Efficiency, Demand Response, Load Shifting and Grid Balancing. Implementing an all-in-one package makes it possible to offer various market opportunities to GridManager clients, effectively turning the burden of consumption into an asset that can be utilized.

## 2 GridManager Solution

The GridManager energy saving solution incorporates modular wireless based monitoring sensors, a wireless network Agent, and a user-friendly interactive web portal, where electricity consumption profiles can be easily analyzed and controlled.

Enabling wireless communication between device level sensors, and utilities, customers can minimize energy costs by responding to time-of-use pricing signals, demand response initiatives, or other customizable variables. Moreover, this real-time consumption management can be actively managed or fully automated, while maintaining complete functionality and dependability for customers.

Customers can allow specific parts of their consumption to be managed remotely by grid operators, enabling the consumer to take advantage of incentive programs for grid balancing.



Through the customer web portal, broad and detailed consumption data insight is accessible in easy-to-understand charts and graphs, where trends and achieved savings are displayed. The portal also equips customers with intuitive analytical tools that continuously monitor usage profiles to help discover new energy saving opportunities.

The GridManager solution provides added-value to the following sectors of the energy industry:

Scope	Description	Savings
<b>Energy efficiency</b>	Insights on the current situation, provides improved behavioral effects	8-12%
<b>Energy management</b>	Taking control enforces the behavioral improvement and extends management capabilities.	5-10%
<b>Emissions tax</b>	Organization wide consumption knowledge provides much improved management of taxations	10-20%
<b>Energy auditing</b>	Interaction with qualified energy consultants becomes natural for the management process.	5-10%
<b>DR/ Load shifting</b>	Forecasted energy prices enables utilization of low price periods of time, avoid high times	5-10%
<b>VPP, OpenADR</b>	Instant interaction combined with load shifting turns consumption into a Virtual Power Plant.	+5-10%

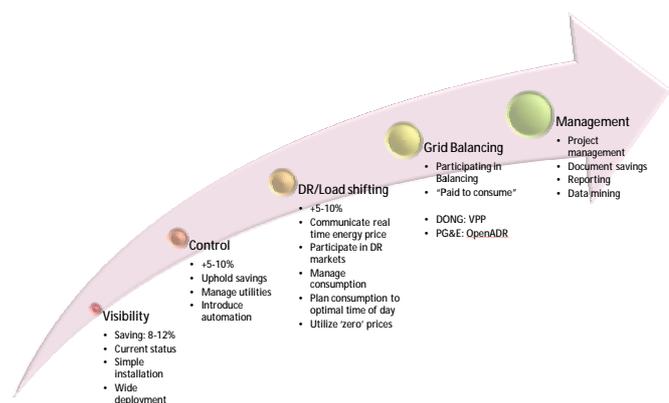
*Please not that the above indications are highly dependent on the type of organization that the consumers operate.*

## 3 Business model

The GridManager business model is based on the approach that we need to meet the customers at their individual levels, and then educate them and add functionality and modules as and when relevant.

An important factor relates to state of awareness they are already in. Some consumers have already conducted some project on Energy efficiency, and have already cashed in, on the lowest hanging fruits; others are novets to all of this.

It doesn't make sense to try and teach a consumer that doesn't know where they are, on advanced market mechanisms.



## 4 Web portal design

Design and Implementation of GridManager was driven by a strong focus on user friendliness and reflection on the users focus in any one screen.

### 4.1 Live view

A systems dashboard provides instant access to a live view. It displays current energy flow, status of meters.

Remote control is provided where the equipment allows.

Access to current prices and grid related activities are also displayed.

GridManager is an online system, so the icons displayed are updated with the actual status.



### 4.2 Modular

The user interface is designed so access to each module can be configured by the admin user.



### 4.3 Historic perspective

Data can also be reviewed in a historic perspective.

Graphs can be configured to display different periods of time or even days of consumptions. It is even possible to compile datasets and display groups of consumption points.

An advanced feature enables the system to display consumption not "yet monitored", effectively creating virtual consumption points.

A dedicated module enables the user to let the system monitor for slow changes in consumption, indicating services and maintenance issues.



### 4.4 Prices

Ensuring focus on current energy prices is provided as a dedicated module. The controllers installed at the client's premises can display the same data.

Automatic notifications on high/low price situations can be generated by the system, whereby the users can prepare for the following day's challenges.

It is very important that the user relates to actual prices, so prices are managed so it's the price relevant for each client that's displayed.

Taxation and negotiations have an effect on this.



### 4.5 "InControl"

Getting in control is vital for the clients – which the system provides in several ways. A manual option is available, but more importantly the system can be configured to take control. This is provided on the basis of an advanced scripting system that reacts on a number of parameters, i.e. day and time of week, energy price, Grid balancing needs and the grid frequency.

If the user credentials allow it, taking control is simply a matter of selecting a rule set and assigning it.

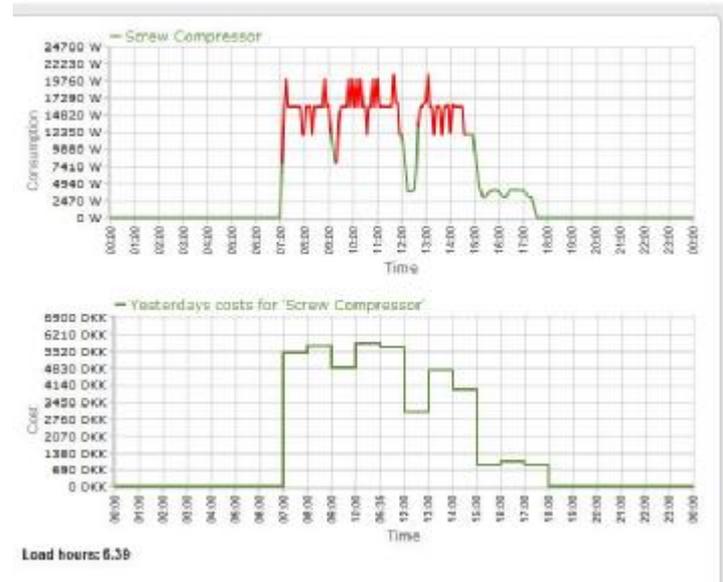


#### 4.6 Demand response and load shifting

Demand response is translated into a set of tools that enables the users to acquire savings by shifting parts of the load. As for the rest of the system the portal enables the user to firstly acquire data, validate the potential for savings, let the system taken control, and lastly to document what has been achieved.

Rule set definition are implemented respecting the complexity and thereby the challenges of defining rules, the management module for this is a dedicated module. Its only users that are trained that can manage rules, and in many cases this task will be provided as a service.

At the final stages of implementation the system takes control over the operation of the equipment, and ensures that the shifting capabilities are complemented with balancing integration. Paring different balancing markets is yet another example of how the system turns challenges into opportunities for the consumer.

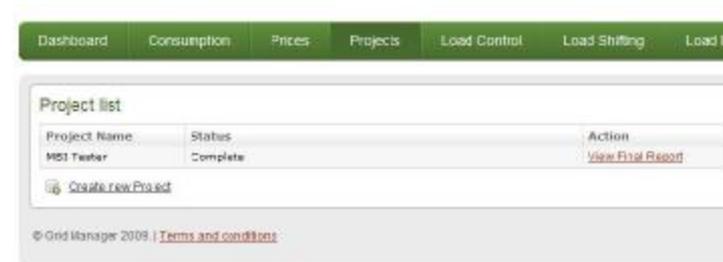


#### 4.7 Document saving

The entire solution is build around the objective of providing and documenting savings achieved.

Projects defined, and when a set of stages has been completed a report is generated that documents the savings for a year.

The reports are designed so they fulfill the needs for energy auditors to use them for external reporting.



### 5 GridManager architecture

The entire system architecture is built around 3 technology clusters:

Measuring equipment	Middleware platform	Web front end
<p>A dedicated controller carries the responsibility for monitoring and control at the client's premises.</p> <p>Its industrial designed makes it robust. It supports a range of communication standards both locally and externally. Current release is suitable for both z-wave and Zigbee.</p> <p>Driving user friendliness it equipped with a color touch screen, giving access to the system by the means of intuitive icons.</p> <p>It provides tools for fault finding and management of the system locally.</p> <p>Forecasted prices are displayed on the screen, whereby switch access to relevant data can be displayed.</p>	<p>GridManager has been honored by becoming an IBM Cleantech Business partner.</p> <p>The aspects of this partnership are that IBM has supported the development of the server platforms, and the solution is provided as a subset of their entire range of middleware products.</p> <p>Servers are designed as an open platform, enabling easy to integrate with</p> <p>The solution contains purpose build services for automatic acquisition of energy prices, integration with Automatic Demand response systems, and messaging for remote control</p> <p>GridManager is working closely with IBM to ensure that the system is scalable, secure and can become SAFE framework compliant.</p>	<p>The web modules are purpose built for the IBM Websphere platform and DB servers.</p> <p>It integrates seamlessly with other IBM application packages.</p> <p>Its design supports skinning, whereby a swift redesign to mimic a partners existing web design can be provided.</p> <p>Its modular design makes introduction of new modules or market specific add-on's straight forward.</p> 