MARCHMENT HILL consulting

Smart Grids

MHC Presentation for Oracle Live Webcast

August 2009

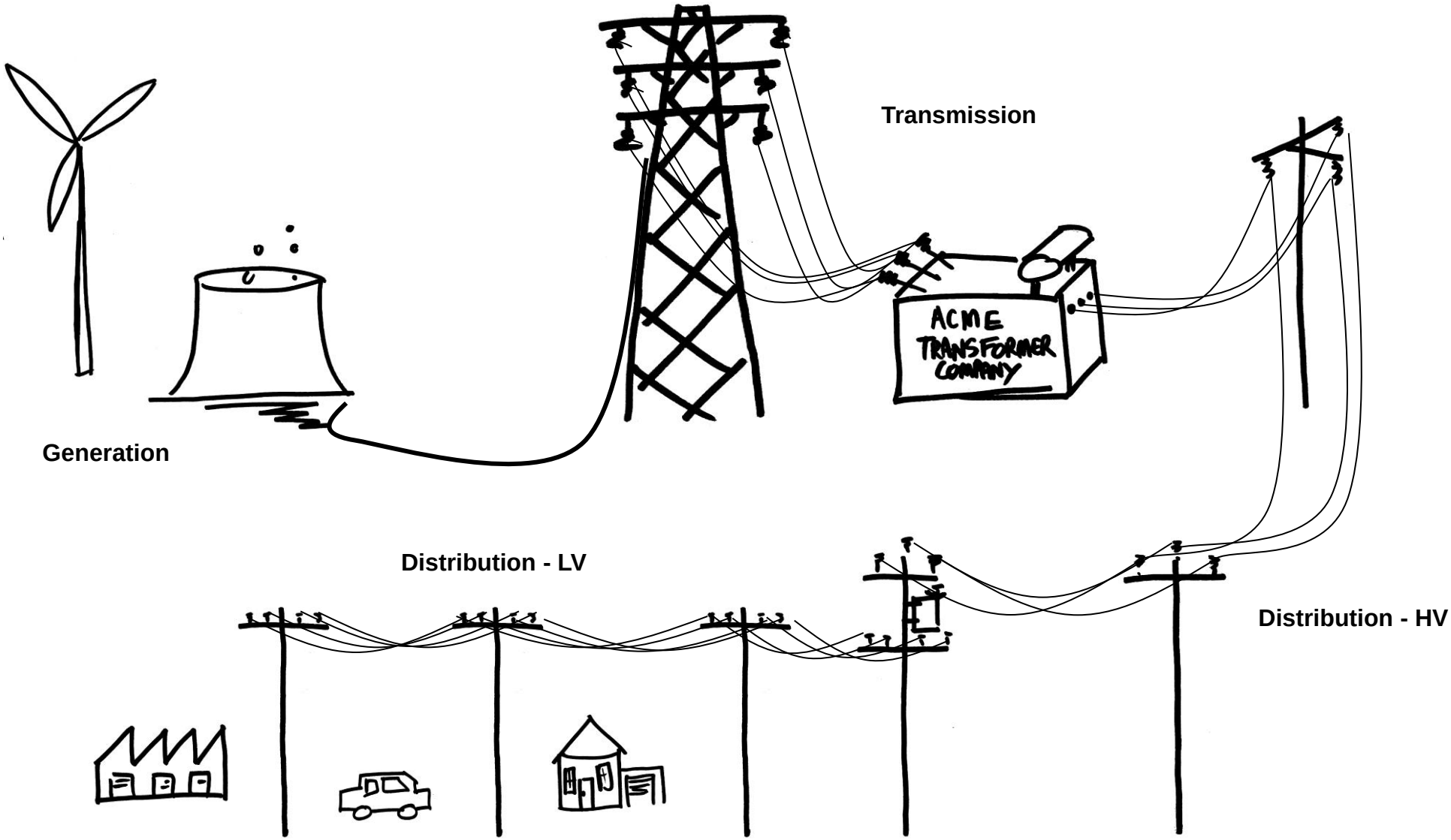
Marchment Hill Consulting

Introducing …

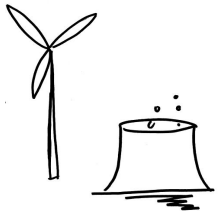
- Bruce Macfarlane, Marchment Hill Consulting, Business Systems Practice Leader
  - 2007 – 2009 Marchment Hill Consulting
  - 2004 – 2007 AGL Retail Energy, Phoenix Program Manager
  - 2001 – 2004 Cap Gemini, Energy Utilities Practice

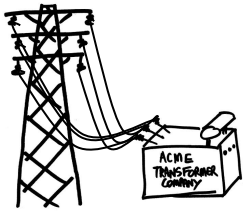
- Bruce has been involved in Smart Metering since 2002 when he developed a response on the costs of interval metering to the ESC's draft IMRO business case, on behalf of AGL, Origin Energy and TRUenergy. More recently, Bruce led the delivery of MHC's AMI studies for Sydney Water and South East Water Limited, developed cost data for the National Smart Metering Cost Benefit Analysis and was involved in the Victorian Industries AMI Program Office. Bruce led the project establishment phase of the Victorian Department of Sustainability and Environment's Smart Water Metering Cost Benefit Study and led the development of the cost stream of the project.

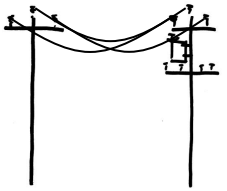
Overview of a traditional electricity network

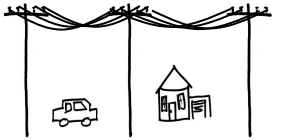


Features of a traditional electricity network









	Generation	Transmission	Distribution – HV	Distribution – LV
Customers ultimately connected:	• Many	• Many	• Many	• Millions
Criticality:	• High	• High	• Mid	• Low
Availability / Reliability:	• High	• High	• Mid	• Low
	• High level of security • High level of automation • Expensive and fast protection devices with multiple redundancy • Usually has control centres monitoring every nut and bolt of the plant	• High level of security • High level of automation • Expensive and fast protection devices with multiple redundancy • Network topology is usually mesh • Usually has a control centre managing power flows, outages, looking for alarms etc	• Some security • Some automation (but mainly in CBDs) • Reasonably speedy protective devices • Network topology is usually radial, with interconnection in built up areas • Control centre function is often limited to identifying outages at the feeder circuit breaker (at the interface between transmission and distribution), otherwise fault are identified when a customer calls to say they have no power	• Low security • No automation • Slow protective devices (standard fuses) • Network topology is typically radial with interconnection • There is no communication with this part of the network • Limited control centre oversight other than dispatch of fault crews • Outages are primarily identified though customer calls

In summary a traditional network is…

- Based on a central generation model with one-way power flow from large, often distant generating stations, via transmission and distribution lines to end consumers
- Ageing infrastructure with some equipment dating back 60 years+
- Limited communications at the distribution level enabling grid automation & monitoring capabilities
- Limited consumer participation
- Customer calls used to detect outage location

What are the challenges electricity distributors are going to have to manage today and into the future?

- Distributors have ageing infrastructure and it is being ‘pushed’ harder
- Reliability targets are becoming more onerous (frequency and duration of outages)
- There is an increased focus on quality of electricity supply
- Customers are less accepting of network outages, both planned and unplanned
- There are increased expectations for network performance from customers and regulators
- Networks would like to manage customer behaviour in terms of energy usage
- Networks seek to reduce peak load requirements
- There is increased density of energy usage (aircons, plasma screens, Singstar on the playstation, etc)
- Growth in embedded generation (renewable, EV batteries, industrial sites) must be addressed
- Greater flexibility is required in operation of the network
- New energy consuming technologies (EV) are being introduced
- New technologies available to manage the network are emerging
- There is an increased focus on energy conservation

So what is a smart grid?

A Working Definition:

An integrated system of in-home applications and grid-side devices …

... that provides increased customer engagement in energy usage, distributed demand management and distributed generation management

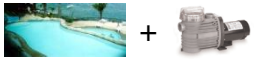
… linked together by communications and IT systems …

... that delivers benefits both higher or societal level, i.e. GHG reductions, or directly financial.

Note, with financial returns the issue being that the investor may not reap the full benefit.

Smart grids are an integrated system of in-home applications and grid-side devices …

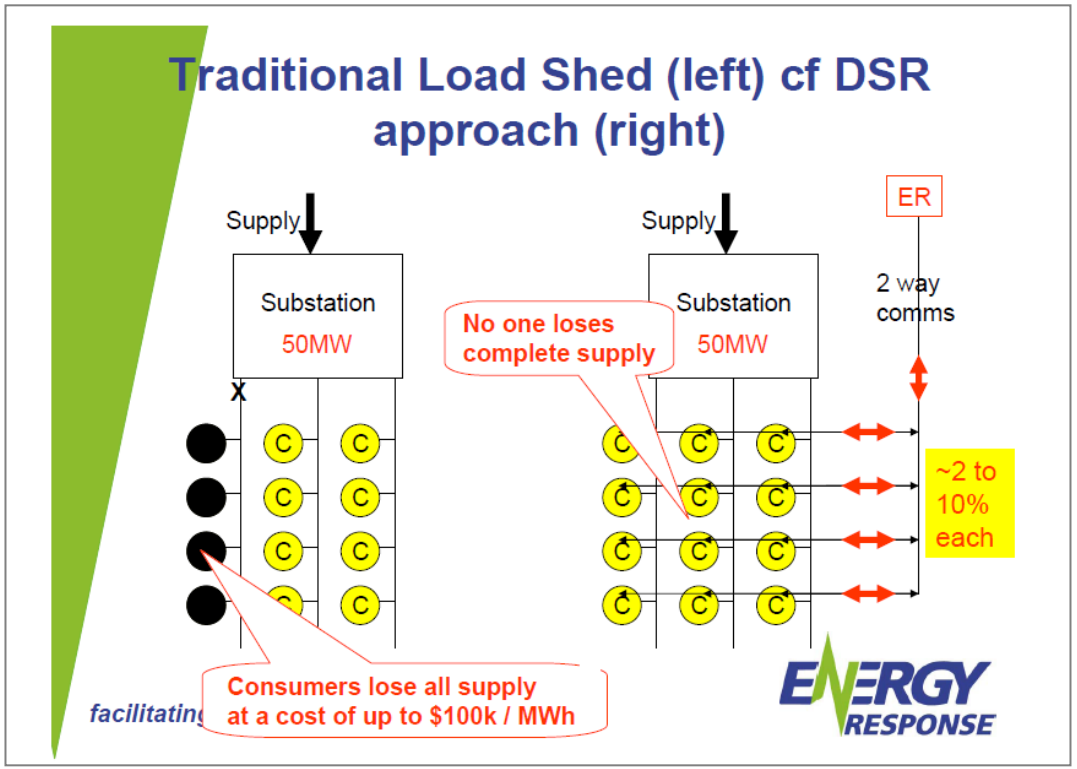
Increasingly in-home devices are becoming available however the financial benefits to customers rely on interval meter data being available to measure changes in demand.

Delivers …	Service Offering		Potential Features
Customer Engagement	Energy Management System		USB ZB radio + Downloadable or pre-installed software
	In-Home Display		• Portable Displays • Dashboards
	Repeater Display		• Price Indicator • ZB Repeater
	Prepayment electricity		•Credit card pre-payment
	Gas / Water Meters		• Contract Meter Reading • Provide consumption to EMS
Distributed Demand Management	Programmable Communicating Thermostat		• Models ZB certified & commercially available in US market
	Smart Appliances		• Energy aware
	Outlet Load Control Switch		• Simple metrology • Simple ON/OFF Load Switch
	Pool Pump LCS		• Simple ON/OFF Load Switch
Distributed Generation and Storage	Plug-in Electricity Vehicles		• Price responsive • Capable of charging/ discharging in response to grid events
	Distributed Generation		• ZB-equipped Inverter • Provide production information to EMS

Source: SCE Presentation + MHC Analysis

Innovative business models may take advantage of the opportunities these devices provide

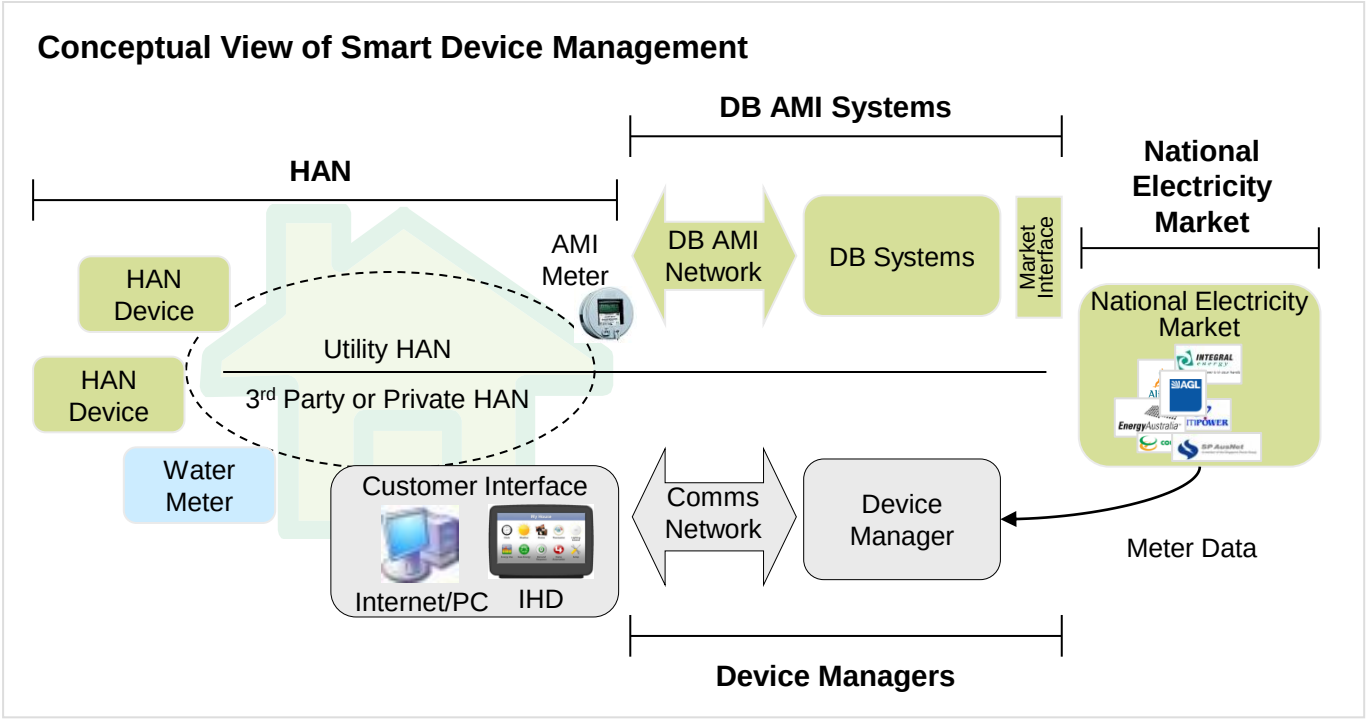
It seems likely that Demand Side Response will increasingly move to the mass market – enabled through customer uptake of smart devices and encouraged through innovative products.



Source: Ross Fraser, Chairman, Energy Response, Australian Energy and Utility Summit 2009

… linked together by communications and IT systems …

Device managers are likely to use a least cost method of communicating with devices but will require access to customers meter data to capture value from devices.



… that delivers benefits both societal and/or directly financial.

MHC recently asked stakeholders their views on what they saw as being the benefits to customers and the economy of smart grids?

Executive Manager - Advanced Metering

Distribution Company

- Reduced losses from ageing grids and improved network control.
- More efficient response to outage events to minimise network damage from excessive loads (during outage).
- Some safety aspects (through improved response).
- Reduced investment (through load shifting and improved planning).
- Hidden benefits that could be achieved through improved monitoring of network equipment and better information on why failures occur, and the current condition of equipment.
- Potential for remote field force integration.

CIO

Australian Energy Retailer

- Smart grids are probably going to require long lead times to achieve.
- Likely to be implemented by ‘left field’ organisations.

CTO

Whiteware Manufacturer

- Benefit to the ‘electricity suppliers’, as somewhere in the vicinity of 10% of generation capacity and 25% of distribution capacity is required for peak load demand (USA figures).
- Concern is how will customers capture the true value of technology.
- A key concern was that two way communication would be required to facilitate remote control, diagnostics, firmware upgrades and product customisation ,but utilities to date had been reluctant to provide this capability.

Do these features and technologies deliver on the DBs challenges?

- ☒ Distributors have ageing infrastructure and it is being ‘pushed’ harder
- ☑ Reliability targets are becoming more onerous (frequency and duration of outages)
- ☑ There is an increased focus on quality of electricity supply
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- ☑ There are increased expectations for network performance from customers and regulators
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- ☒ There is increased density of energy usage (aircons, plasma screens, Singstar on the playstation, etc)
- ☑ Growth in embedded generation (renewable, EV batteries, industrial sites) must be addressed
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Questions to ponder

- **What can smart grids do for others?**
  - *Retailers*: innovative products and targeted offers
  - *Regulators*: increased performance targets, mandated rollout out of smart grid technology
  - *Generators*: Enable cost effective embedded generation
  - *Land Developers*: Build ‘high security’ precincts to encourage investment by tech companies

Contact Details

Marchment Hill's experience and capabilities span the breadth of the energy industry, including business strategy, performance assessment & improvement, organisation design, performance management, supply strategy, electricity market design and development, and the management of major utility reform programs.

Marchment Hill is committed to driving outcomes for its clients in the creation and delivery of strategy, organisational excellence and enhanced performance.

For more information about Smart Grids or Marchment Hill's capabilities, please contact:

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