

## Presentation notes:

- Slide 2 gives the overview of the presentation
- Slides 3 – 17 contain the presentation graphics. The thoughts they are illustrating are recorded in the notes pages – so please read in “notes pages” view
- If you would like to discuss any of this material further please do not hesitate to contact me:

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# Future Technologies in Smart Homes



The audience: Oliver Kinross conference Milan

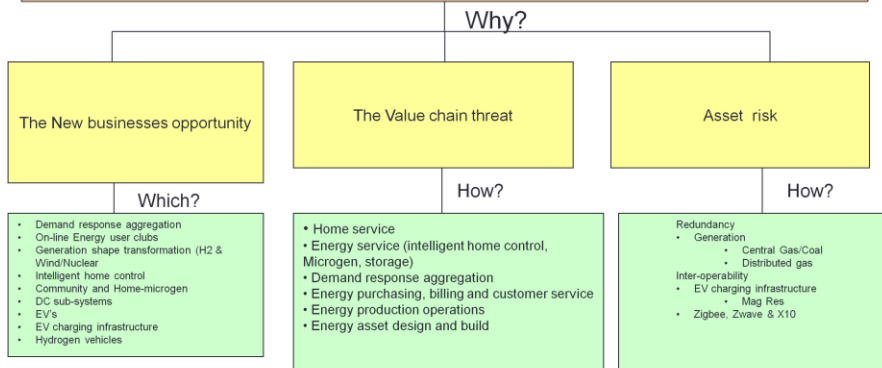
Situation: The move towards low carbon solutions is transforming the energy landscape. Smart metering will be rolled-out across Europe by 2020. Smart Grids will emerge over the decade and beyond. Smart will create new sensor and comms networks. Electric vehicles will emerge – the forgotten factor, Hydrogen will probably impact the whole value chain, as will battery storage technology – the only question is when

Complication: The Smart home is integrating into the Utility business. As well as a host of other service businesses. The Smart home will be part of energy consumption, production (generation) and distribution system (storage, EV charging infrastructure). Smart sensors and comms in the home will be part of the service enablers (Security, Healthcare) and the sensors and comms of other services become part of the energy network (security, healthcare, entertainment, work)

Question: What does this mean for the Utility sector?

Answer: Utilities need to re-visit the design of their business models

GT





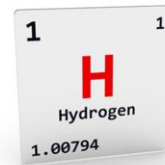
## FUTURE TECHNOLOGIES IN SMART HOMES

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Peter Franklin – Director  
Milan – Sept 2011

- Over the past year I have had the good fortune to meet with many new technology companies as well as doing research into what the world might look like in 2050
- What I will show today are not things that might happen in 2050 – they are all innovations here today
- When thinking about the Smart home – I found myself thinking through the implications of what will be a fundamental change to the energy system
- It is those thoughts that I wish to share with you today

## The Low Carbon Future



- In scenario planning terminology moving to a Low Carbon landscape is a pre-determined element – at least for Europe today. China, and the US are the big question for the future. However, both stand to lose if they do not move onto the same pathway. The US will lose the green economic opportunity. China will lose the Himalayan glaciers.
- By 2020 we will all have followed Italy's lead and embraced Smart metering – perhaps with Germany lagging behind we will see – the implications for the Stadtwerke are profound in that they are too small to fund this investment
- We will see the Smart Grid – and that is why we are all here today
- We will see electric vehicles – only the rate of their penetration into the market place is uncertain. Will we follow China's lead in electric bikes. In China, electric bicycles are leaving cars in the dust. Last year the Chinese bought 21 million e-bikes, compared with 9.4 million cars. While China now has about 25 million cars on the road, it has four times as many e-bikes
- How will battery technology evolve to provide the storage medium needed for the smart grid – balancing intermittent sources and variable demand. More on that later.
- And then there is the “forgotten” technology. Hydrogen. Very fashionable 15 years ago – off the radar today – but may well be ready for a come-back.
- Why H<sub>2</sub>? . Nuclear and wind profile shifting. City air pollution. Fuel cells for heating and cooling, and transportation

## What role for batteries in the Smart Grid?



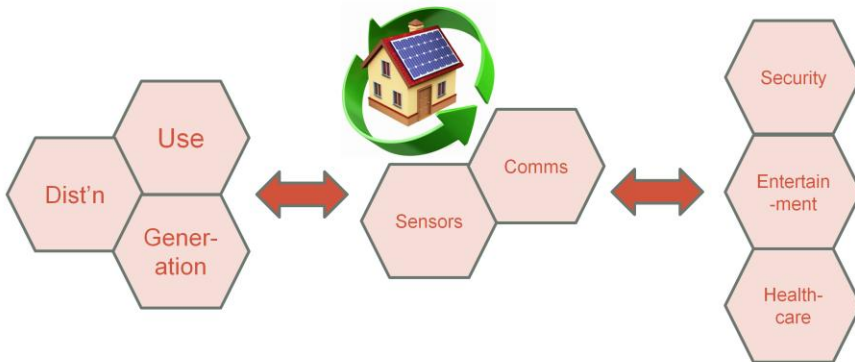
- Flow Batteries
- NaS
- Braun – nano-design



Alaska

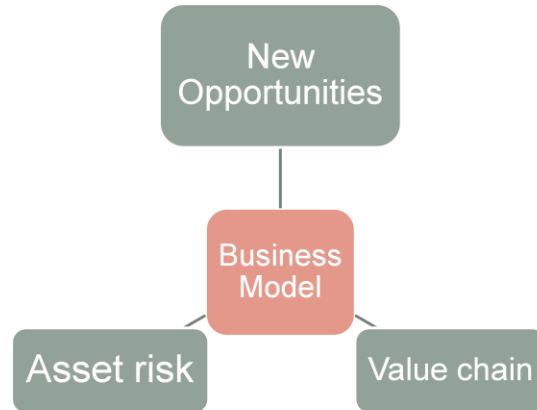
- There are a number of technological advance poised to happen. Sodium Sulphur batteries – Japan. Flow Batteries. University of Illinois nano-design framework for any battery chemistry.
- Alaska. Battery energy storage system for Golden Valley Electric Association. 90,000 people. 2,200 square miles. Battery store the size of a football pitch. Operating since 2004.

## The smart home - a sector integrator



- When we look at the Smart home – the differences from today are the communications and the shared sensor arrays.
- It is the comms and the sensors that link energy, energy services and home services.
- It is this link which changes the value chain and potentially the players operating within it
- The smart home integrates a whole host of different consumer service sectors

## What does this mean for utilities?



- What does the Smart home mean for Utilities?
- It means that the business model that you currently have will need to be revisited
- Why?
- There will be many new business opportunities that you may or may not want to grasp. If you don't someone else will and you will have let a new competitor into the new Smart value chain
- The value chain is extending. The smart home converges the home services and the energy services and energy sectors
- And then there is asset risk – the technology playing field may strand traditional utility assets such as CCGTs
- Let us now look at some of the new opportunities

## New Opportunities

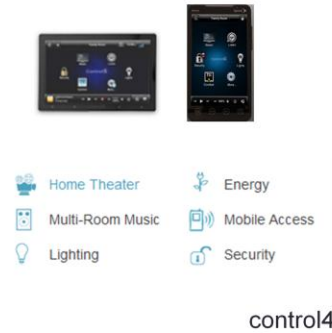
### Power generation in the home



Ceres power

- Domestic fuel cells. Looks like a boiler but is a power station.
- More electricity in the home – less centralised generation.

## New Opportunities Intelligent home control



- Intelligent home control.
- Passiv systems – the apple of energy controllers and control 4
- Will the home services players eclipse the energy services players or vice versa
- Which communication network will be used for energy? Broadband, mobile, radio – will the Smart network be used for this?

## New Opportunities Demand Management

flexitricity  
Unlocking smart grid revenue

ENERNOC  
Get More From Energy

OPower

Lowfoot



- How many of these companies do you know?
- Flexitricity and Enernoc are I&C demand aggregators – will they move into residential
- Opower and lowfoot harness social networking to offer energy efficiency rewards
- Greenlet provide smart demand response through your broadband router

# New Opportunities DC sub-systems



- One third of the planet's landmass is covered by desert, which receives intensive solar radiation every day. Studies have estimated that using just 4% of the total desert area for solar systems is sufficient to supply all the electrical energy requirements of the world.
- Solar technology is moving on. Crystalline and Amorphous. Mitsubishi Chemical Corp. has developed technology that enables solar cells to be applied to buildings, vehicles and even clothing in the same way that paint is applied.
- Solar can be desert scale or home scale. See Moxia
- Solar is DC as are many of the electricity using appliances in the home. Today we convert DC to AC and then back to DC. Losing at least 5% of the energy in each transformation. Why not install DC circuits into the home as illustrated by R&D firm Moixa.

## New Opportunities - EVs

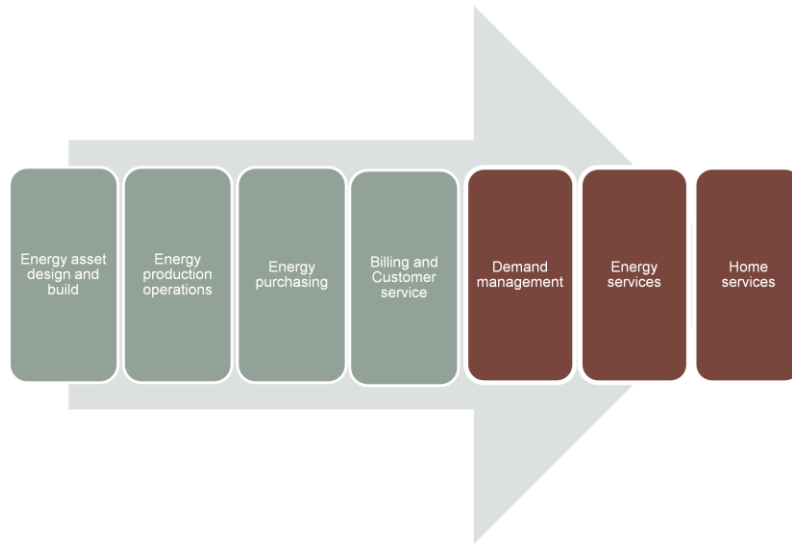


Electricity

Hydrogen

- Then we have EVs. Hybrids, Plug-in hybrids, all electrics and fuel cell.
- EU take up will be slower than china and India due to the maths of replacement vs car park growth

## Value chain expansion



- The old value chain is in grey
- The new additions are in brown
- New players will arrive from the Home services area
- Some utilities will re-trench back to the far left
- You need to pro-actively decide where you want to be
- The future world will be different

## Asset risks - Redundancy Community and Home generation



Ceres power



Bloom energy

- Home generation and community generation such as the solid oxide fuel cells shown here at ebay's offices in the US have the potential to displace centralised generation
- Centralised generation is vulnerable with 12 units of energy in yielding 4 to 5 out....and then another 10%+ being lost in transmission and distribution.
- Installed local and home generation will always run in preference to centralised gas or coal fired power – especially in a high carbon price world
- The risk of redundancy for CCGTs is going up

## Asset Risks

### Interoperability on the road

*The European Standardisation Organisations bodies (CEN-CENELEC and ETSI) will develop a common charging system for electric cars, scooters and bicycles. European Commission Vice-President Antonio Tajani has handed today a European Commission mandate for the development of the relevant standard to the President of CEN-CENELEC David Dossett, CEN-CENELEC's Director General Elena Santiago Cid and ETSI General Assembly Chair John Philips. The new standard ensures that all types of electric vehicles and their batteries are charged both safely and easily in all EU Member States. Thanks to this mandate plugs and connectors will use the same standard all across Europe, providing a true European solution independently of brands or countries. The Commission expects that the standard will be ready by mid-2011.*

Brussels, 29 June 2010



- Hopefully we will have a plug standard – and one system for trailing wires!
- But why not magnetic resonance – charging without wires – the technology used in the electric toothbrush

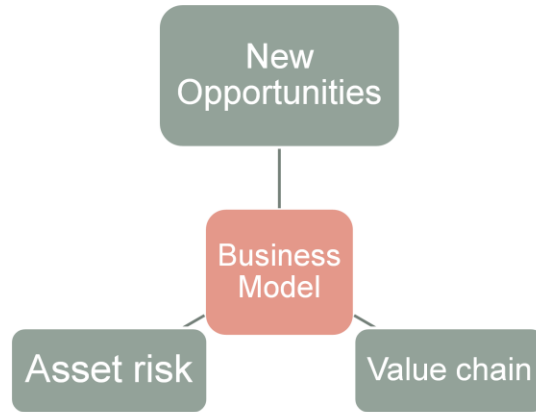
## Asset risks Interoperability in the home



**X10**

- Home standardisation is a mess. It looks like we will have at least three standards operating simultaneously with devices communicating on different frequencies.
- However, companies are coming up with multi-lingual controllers – so we may have a technology solution. Keep an eye on organisations such as wireless glue.
- The utility industry seems to think it is going down the Zigbee route - at least that is my experience in the UK. The risk is that the industry then cuts itself off from other parts of the value chain where alternative standards dominate leaving the market open to the more multi-lingual players

## The smart home will force a change in the utility business model



- The Smart home is heralding a change in the nature of the utility sector and will necessitate a review of where each company wished to play in the new value chain.
- It is not enough to implement smart metering and smart grids because doing that changes the world. The consumer interface will be different – much broader.
- How do you wish to play in this new world?