



talk given at HEAT Conference 2009
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www.hvm-uk.com



Utility Scale Electricity Storage

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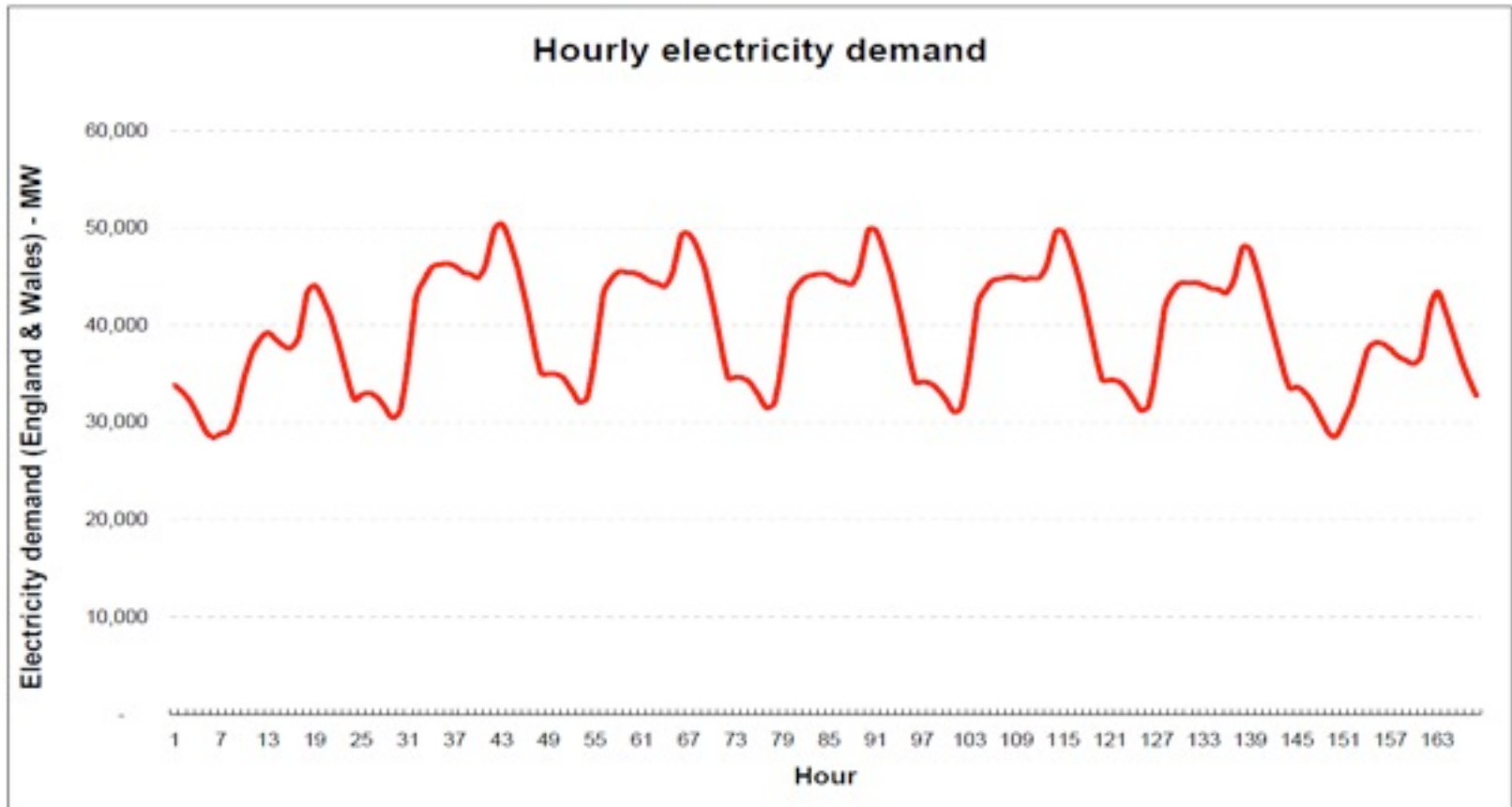


Isentropic Ltd

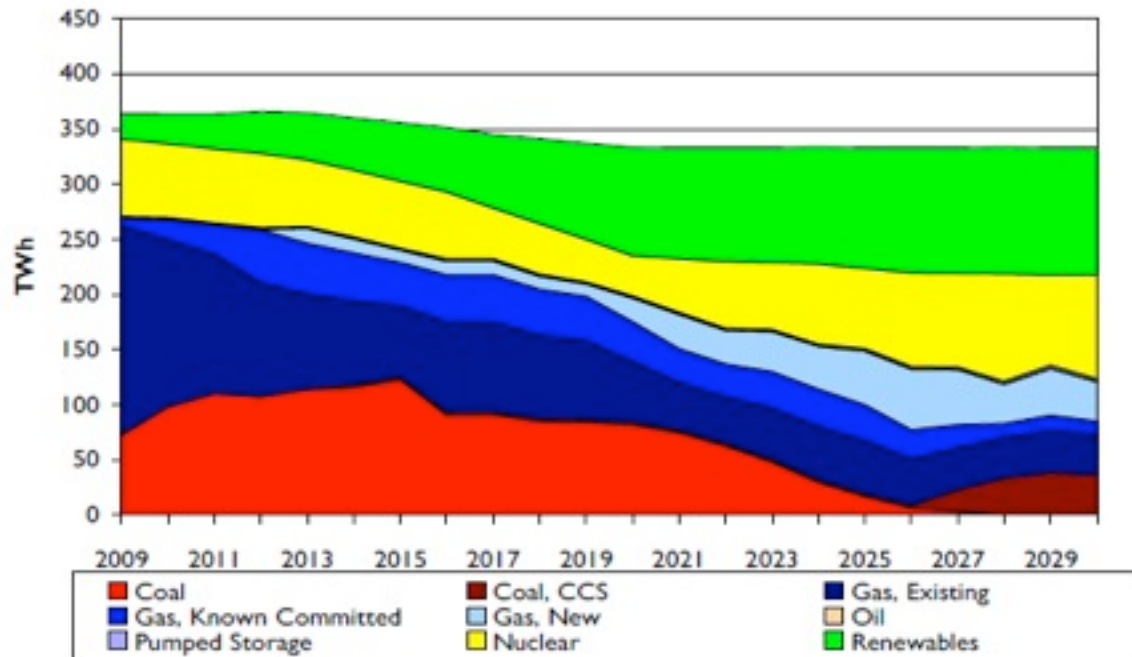


Isentropic is a Cambridge based company developing next generation **Pumped Heat Electricity Storage (PHES)** system that has the potential to revolutionise utility scale energy storage.

- **Diurnal Variation**



Generation output by fuel type



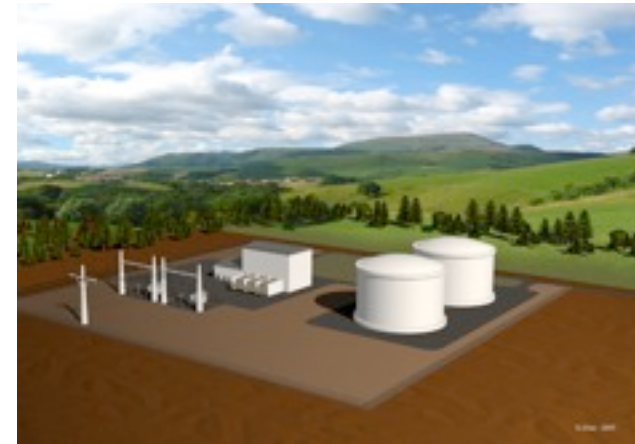
Source: Decarbonising the GB power sector, Redpoint Energy 2009

Options for Storage



• Pumped Hydro	120000	MW
• CAES	400	MW
• Sodium Sulphur	400	MW
• Lead Acid	300	MW
• Flow Batteries	10	MW
• Flywheels	10	MW
• Li Ion	5	MW

- **There is a need for utility scale storage solution that is:**
 - ✓ Low cost - \$1000/kW for 8 hours installed
 - ✓ High efficiency – 70-80%
 - ✓ Not geographically constrained
 - ✓ Safe and environmentally inert
 - ✓ Compact, modular and scalable
 - ✓ Rapid response to load variation
 - ✓ Very large number of cycles
- **Isentropic's Pumped Heat Electricity Storage meets all these objectives.**



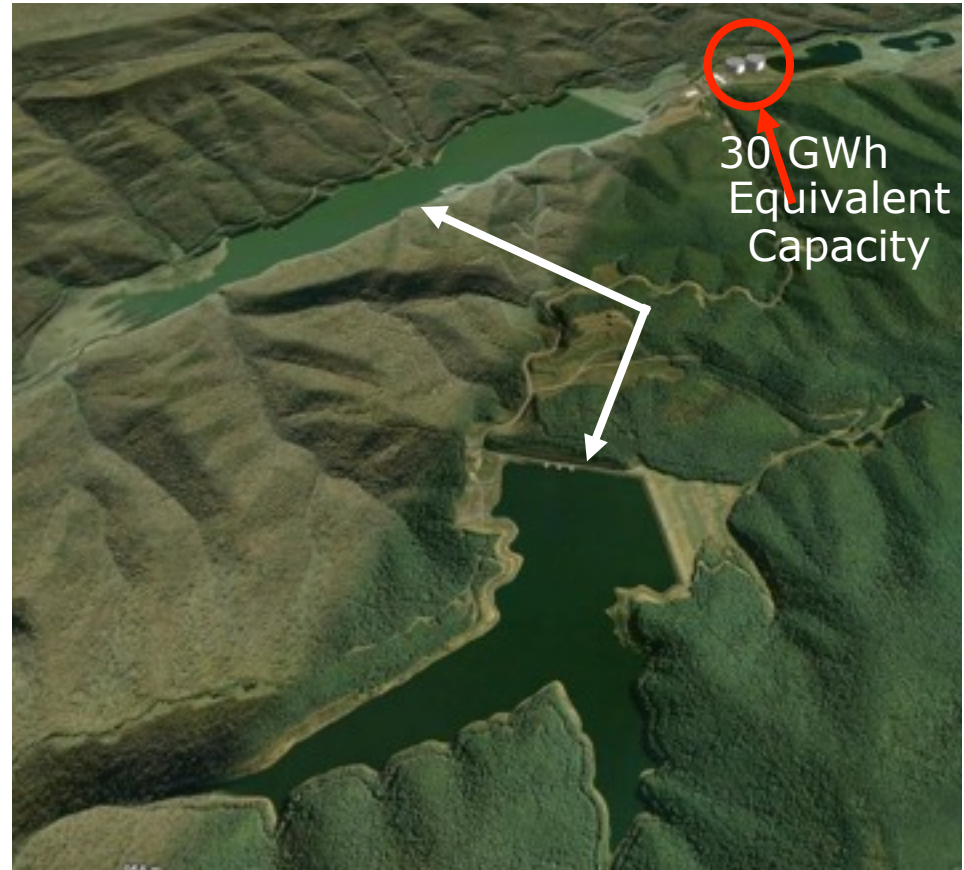
How Does it Work?



- Electrical energy is used to pump heat between 2 vessels
- The energy is stored as sensible heat (+500 deg C) and cold (-160 deg C) in solids (gravel) contained in the insulated vessels
- Electricity is recovered by reversing the process

Compared to Pumped Hydro

- Bath County Pumped Storage, Virginia, USA. Two reservoirs covering 820 surface acres (3.32 sq. km)
- 30 GWh storage capacity (largest in world)
- Pumped Heat Storage Plant of same capacity would occupy 1/300th of the area



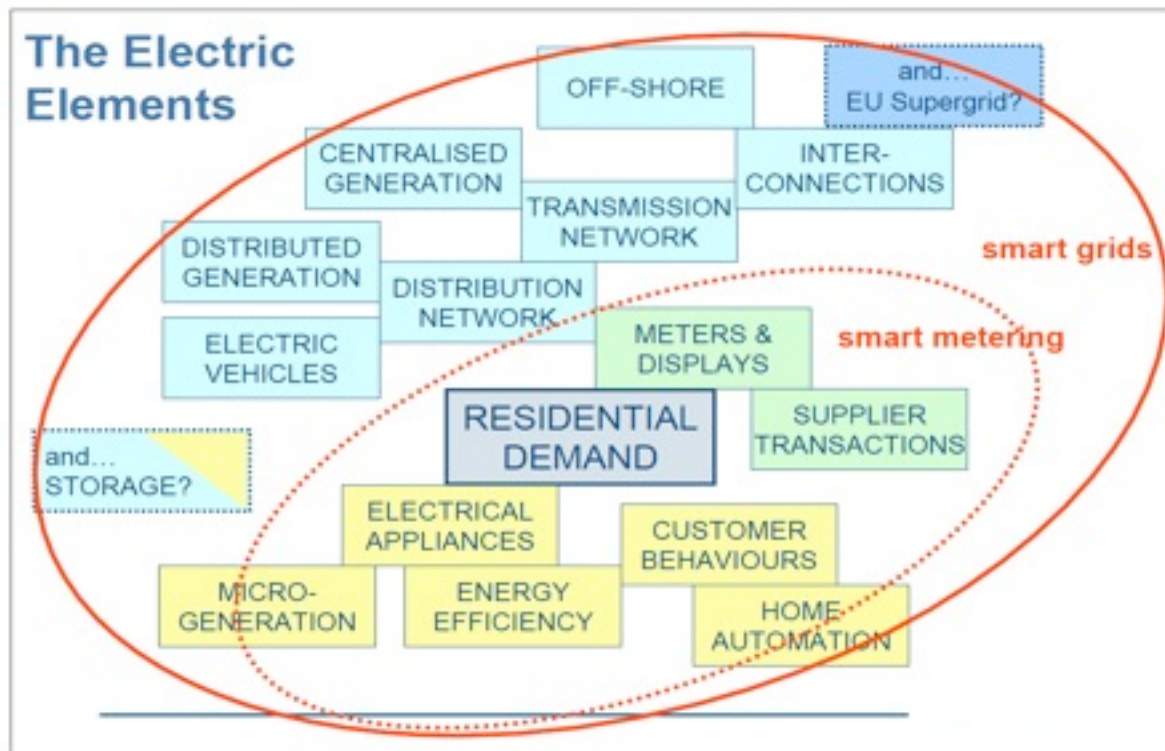


The SMART Grid



- How does this fit with the SMART GRID?

The SMART Grid





Cost of SMART Grid



“**Just** giving out smart meters to every household in the UK will cost £7bn to £9bn according to govt, £13.4bn+ according to Ernst & Young”

The Times, 26th November 2009

Storage

£10 billion buys 10GW pumped hydro for 10 hours
This can absorb 10 GW off peak and generate extra 10
GW on peak. This would completely level current UK
demand.

**You do NOT need to change consumer behaviour at
all.**

Can a SMART meter offer the same benefits?



Change in Regulation



- ROC's currently work against Electricity Storage
- 2011 Germany changing Feed In Tariff



Storage is the Holy Grail



Low cost electricity storage is the holy grail of renewables, yet in the UK it receives every little support and attention.

Isentropic have the lowest cost solution for storage that can be placed anywhere in any size.

We are aiming to have our first demonstration plant completed in 2011 with larger stores following.



Pumped Heat Storage is Coming!

Thank you. Any questions?

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