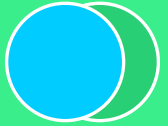


Unplugged Hydrogen House



Project Aims



- BHA Housing Association
- How to meet the energy demand for domestic housing
 - With little impact on homeowner lifestyle
- Research project to see if we can make it work
- Establish how we might expand this to an estate/village wide

Why?



- Establishment orthodoxy remains Carbon abatement
 - Continuous availability of fossil fuel!?
 - Concern over impact on energy costs
 - Can they continue to pay their rent
- Housing association stock 50 years
- Tenants are often for life
- If energy costs too much
 - May not pay rent
 - House may deteriorate faster
 - Energy costs could skew housing association revenues

Energy Sources



- Wind
 - Proven on 9m Tower
 - 6kW 5000kWh/pa
- PV
 - PV 32 Sharp panel array – 42m²
 - 5.76kWp 5300kWh/pa
- Solar Thermal
 - 60 Evacuated Tubes,
 - 6.26m² Collector area

Energy Storage



- Battery sufficient for 1 day
 - Lead acid battery 48V DC bus
- Hydrogen
 - 2 x 4600L underground vessels
 - 18.5 bar design pressure
 - Approx 90m³ storage at 10 Bar
 - 250kWh total storage
- Thermal,
 - 1000l calorifier
- Fuel cell
 - 5kW Idatech PEM
 - Meets electricity shortfall when battery voltage drops



Energy Hierarchy



- Electricity meets (wind/PV)
 - Load
 - Excess goes to battery
 - Hydrogen
 - Water
 - Then exported to grid
- Hot water
 - Solar thermal to tank
 - Waste heat from electrolyser and fuel cell to water tank
 - Space heating and hot water from single tank
- All thermal loads hot water and space heating delivered from storage tank

What next



- Recall this was a research exercise
- It is not appropriate for each individual house
- Deployment needs to be estate or community wide
 - Easiest to start with a new site
 - Then apply progressively to existing stock



How might this work



- First is the site,
 - if possible select a site with high energy yield
- Second is the architecture.
 - Suppress demand,
 - Engineer building for energy needs including solar mass
 - Maximise passive solar,
 - including appropriate thermal mass
- Space heating currently 60% can be close to zero

On site energy production



- Maximise the free energy sources at the house
 - Passive solar, PV and solar thermal
- Energy Storage at house
 - Battery & Thermal
- Involve the builder to
 - Use building integrated energy systems
 - To reduce construction costs
- Energy display in the house
 - Show energy demand, production energy storage left
 - How long your energy will last
- Energy short fall?
 - One central wind turbine to contribute to electrical demand
 - Exporting excess
 - You can have a single hydrogen production plant
 - Larger electrolyser, larger storage tank



Estate wide Hydrogen



- What if you have a local hydrogen store
- Meets electricity shortfall
 - importing much less from the grid
- Transport fuel?
 - for the next generation cars
- Hydrogen gas pipeline to each house
 - Gas Hobb/Oven
 - In house Fuel Cell CHP?
- SAFETY?
 - Every agency now recognises Hydrogen is safer than NS gas
 - Town gas was most hydrogen gas from coal



Conclusions



- There is no single solution
 - PV, wind, solar thermal are not in competition.
 - Integration of skills, architect, builder, engineer
- Significant suppress demand
- Meet as much as we can
 - at the house with some energy storage
 - then estate, with estate based hydrogen storage
 - then the surrounding community
- It can be done,
 - technically it is easy
- It will cost more but over the next 20 years, where energy costs?
 - With volume costs will decline
- Post peak oil where will we get our energy?



Unplugged energy Community?

It is possible if we choose to
Thank you

