

Outline of a Road Map



With my best wishes for the Claverton Conference

Paul-Frederik Bach





Energy Shortage or Global Warming?

- **Preventing long term disasters is important**
 - but the next energy crisis will come before the global warming
- **Short term UK problems (5-10 years):**
 - Too much energy lost due to obsolete power plants, slow improvement of buildings and neglected CHP options
 - Shortage of power station capacity after 2016 when 10-20 GW should be decommissioned (EU's LCPD)
 - North Sea oil and gas are rapidly running out causing increased risk of new European energy crises
- **My short term conclusions:**
 - A large amount of wind energy can relieve (but not solve) the short term energy problems
 - There are no other significant short term renewable contributions available
 - Larger stockpiles of oil, gas and coal will be needed

Learn to Walk before Running



- The current Claverton discussion on 100 % renewable energy does not seem to converge
 - There are too many irons in the fire
- **Why not learn from discussing intermediate steps?**
 - Such as 25, 50, 75 and 100 % wind energy (% of traditional electricity consumption)
- Denmark is familiar with 25 % wind energy
 - We are now studying the 50 % case as a target for 2025
- Traditional power plants will still be the work horses at 50 % RE
 - Therefore we can use experience from the present system for identifying and hopefully solve several new operational problems
- The next step towards 75 % will be a different study
 - Because new methods for backup and regulation must be invented

Identifying challenges



- Predictable problems in the following areas:
 - Maintaining **system balance**
 - Increased need for regulating capacity
 - Overflow energy should be utilized
 - Maintaining **market service**
 - Offshore wind parks will add traffic to the grid and cause increased risk of congestion
 - Congestion will destabilize the electricity market
 - Maintaining **power system security**
 - Poor predictability of wind power
 - System operators do not monitor embedded generation
- These problems must be analyzed and proper solutions must be developed and implemented in due time

For more information, see Platts Power UK, issue 174, August 2008, p. 29.

Implementation of short term solutions

- **System balancing**
 - Access to international markets via new interconnections
 - Activation of new national regulating resources
 - Embedded generation, electric vehicles and demand side participation
- **Improved electricity market**
 - Introduction of the necessary new market services
 - Information for active end-users
 - Intelligent appliances
- **System security**
 - Improved grid coordination and monitoring
 - Reinforcement of the primary grid
 - Level of traditional reserve capacity to be adjusted





Long Term Measures

- **A strategy for achieving 100 % renewable electricity**
 - Due to intermittency there will be overflow and shortage
 - Electricity overflow should be utilized for heating and transport
 - Fossil fuel will probably be necessary for reserve capacity and shortage periods
- **Storing electricity can improve efficiency and security**
 - Such as water in tidal power plants, batteries in electric vehicles, hot water in district heating systems
- **Future technologies to be prepared now**
 - Development of a new generation of flexible power plants
 - Development of new storage and conversion technologies
 - Replacement of some rotating units by power electronics
 - Introduction of smart grids and intelligent meters
 - Introduction of district heating and CHP to improve fuel diversity
 - Conversion of heating in urban areas from natural gas to CHP suggested in Denmark

Each Nation should contribute to a Sustainable Future

- **Shared resources are particularly useful to small nations**
 - Denmark was a pioneer in HVDC interconnections since 1965
 - It has been discussed if small nations should provide more than their relative share of the total reserves
 - It is a Danish policy to contribute actively to a sustainable future
- **UK cannot rely too much on foreign resources**
 - The vision of an HVDC super grid supplying Europe with RE from Africa is at best a very long term option and at worst escape from reality
 - The potential short term problems should be recognized and dealt with now
- **Therefore a stepwise strategy is suggested:**
 - A determined action against potential short term energy problems
 - An R&D program aiming at long term security of supply, clean environment and low carbon emissions

