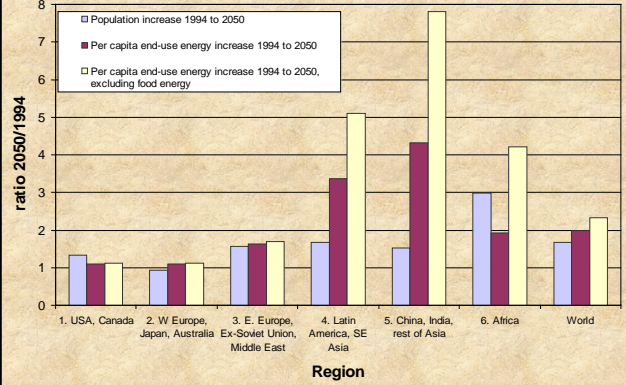


The role of renewable energy in short and long term



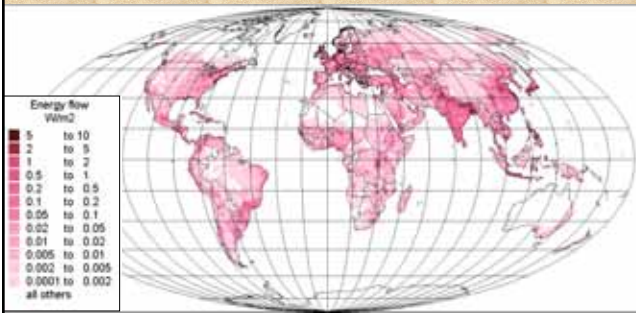
Bent Sørensen, Roskilde University, Denmark

A 2050 global end-use energy scenario



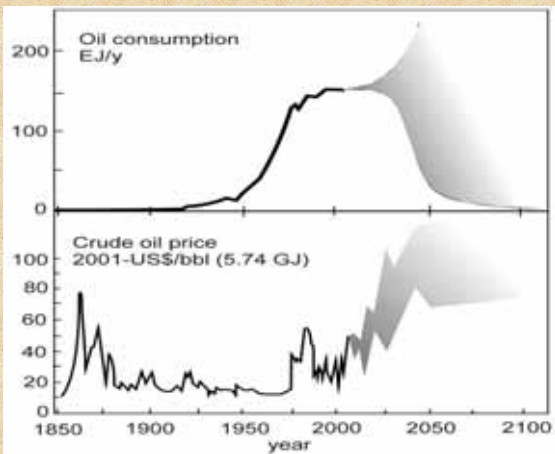
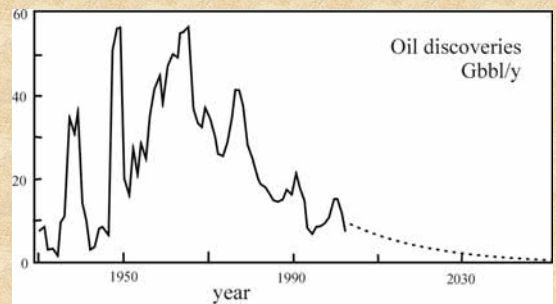
A scenario assuming global solidarity and no major wars....

SCENARIO 2050 END-USE ENERGY CONSUMPTION (INCLUDING FOOD ENERGY AND ENVIRONMENTAL HEAT, W/m²)



This and following figures are based upon monthly calculations for a typical year. Hourly simulations have been performed for Denmark.

Why are alternative fuels urgently needed?



If not oil, then what?

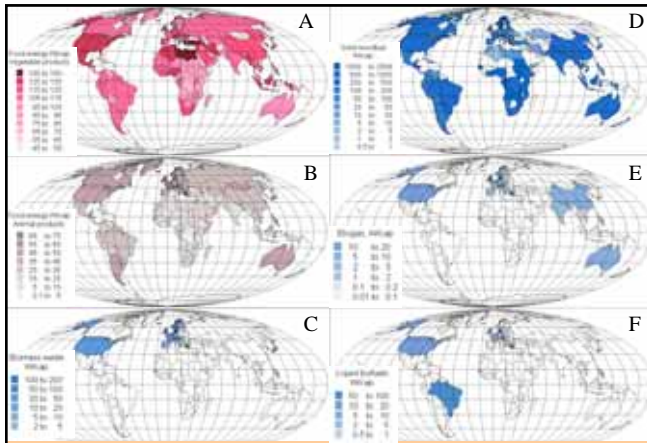
Safe fission reactors takes 25-50 years to develop, safe fusion reactors 50+ years.

Clean coal and natural gas technologies take some 10 years to develop and another 10 to introduce on a large scale. Cost is typically 2+ times current energy cost. Resource sufficiency unclear with environmental concerns.

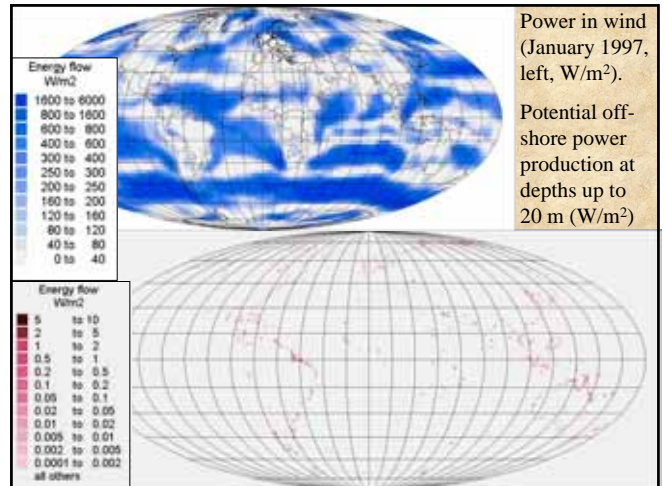
Renewable energy: many technologies are ready. Wind and solar hot water are cost-effective in many places. Solar heating needs seasonal storage, as do solar cells (plus substantial price reduction). Biofuels are currently some 2 times current fuel costs. Resources are sufficient.

Hydrogen is a possible intermediary fuel. Fuel cells need 10-15 years of development and substantial price reduction.

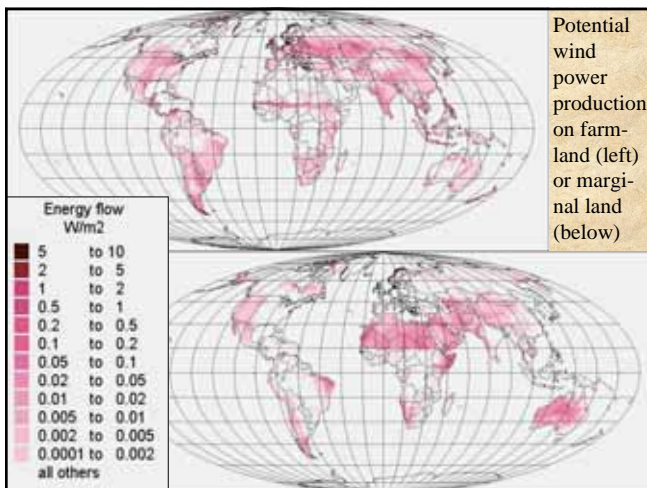
POTENTIAL ANNUAL BIOMASS PRODUCTION (W/m²)
Mature ecosystem: Woods Hole Model (Melillo et al.)



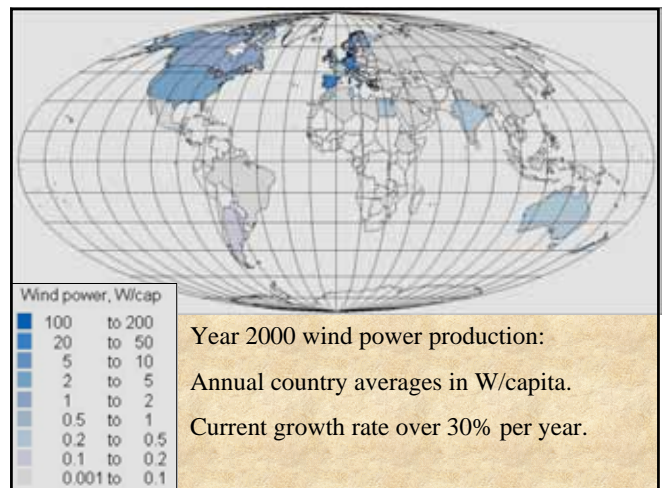
2000 biomass use (W/cap). A: vegetable food. B: animal products. C: Power/heat from waste. D: Woodfuel. E: Biogas. F: Liquid biofuels (presently ethanol and biodiesel).



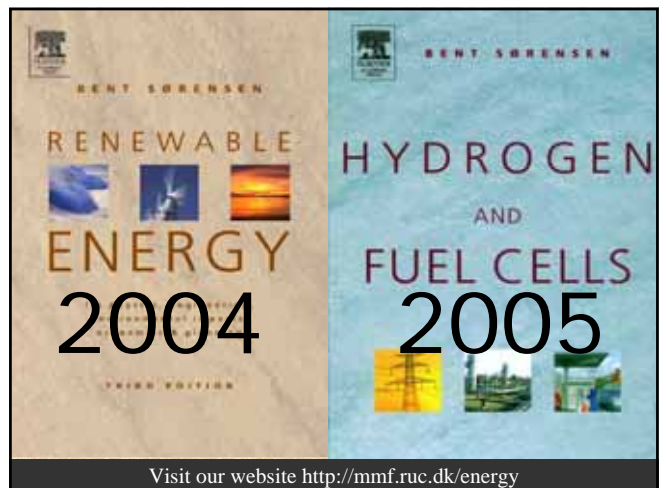
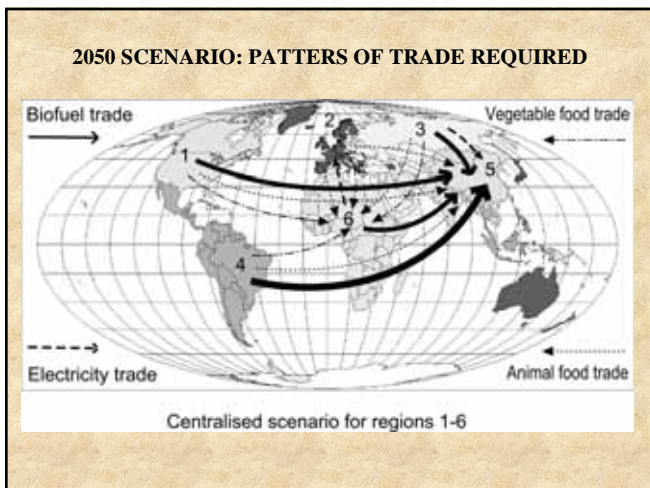
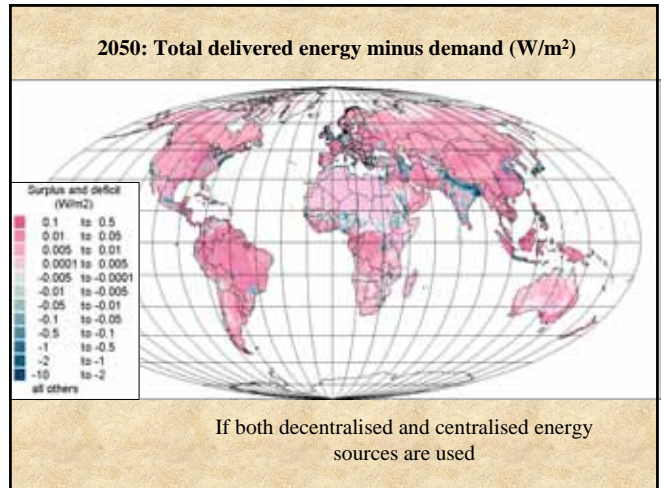
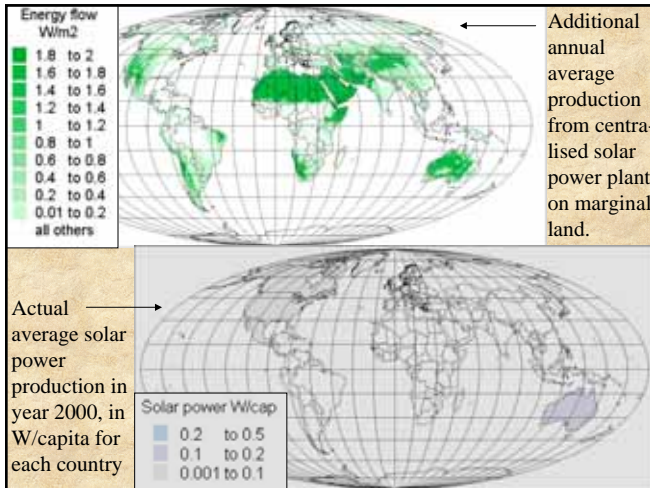
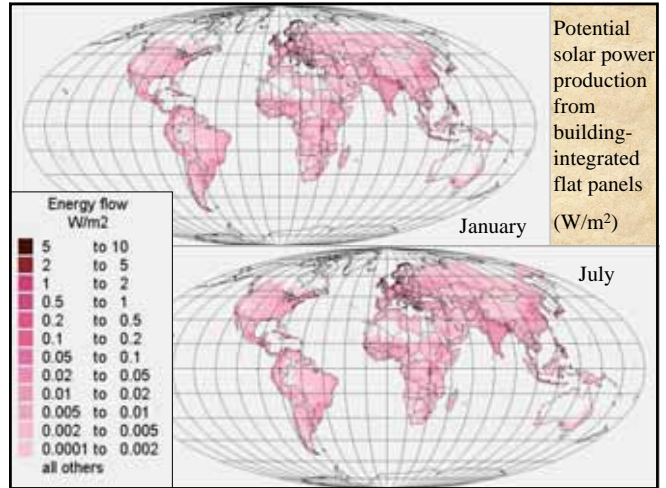
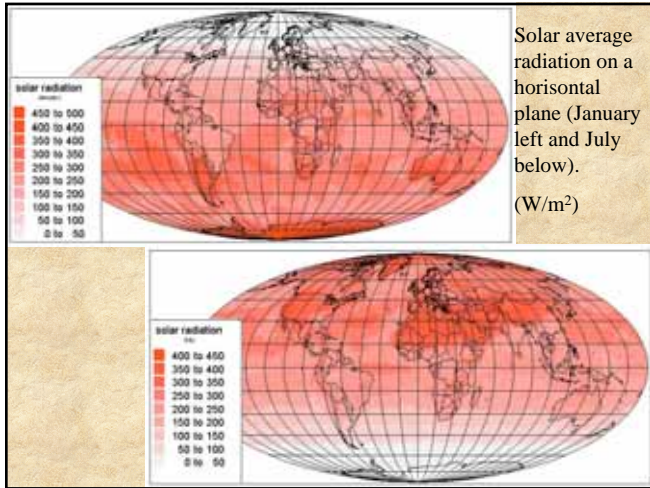
Power in wind (January 1997, left, W/m²).
Potential offshore power production at depths up to 20 m (W/m²)



Potential wind power production on farmland (left) or marginal land (below)



Year 2000 wind power production:
Annual country averages in W/capita.
Current growth rate over 30% per year.





Thank you for
listening.....