Global Energy Supply and Demand Model

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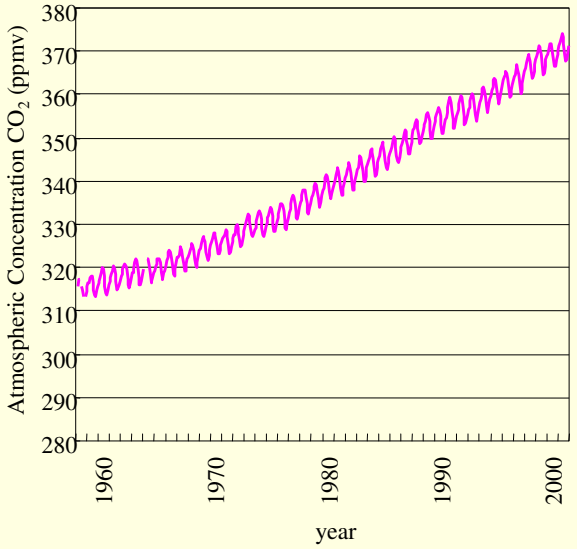
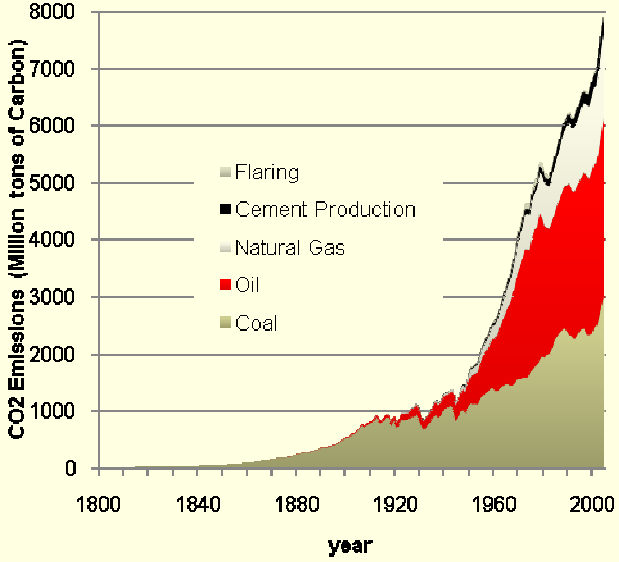
Background

- Concerns about the global warming issue due to the increases in the atmospheric CO_2 concentration
- Rapidly growing energy demand projected in developing countries

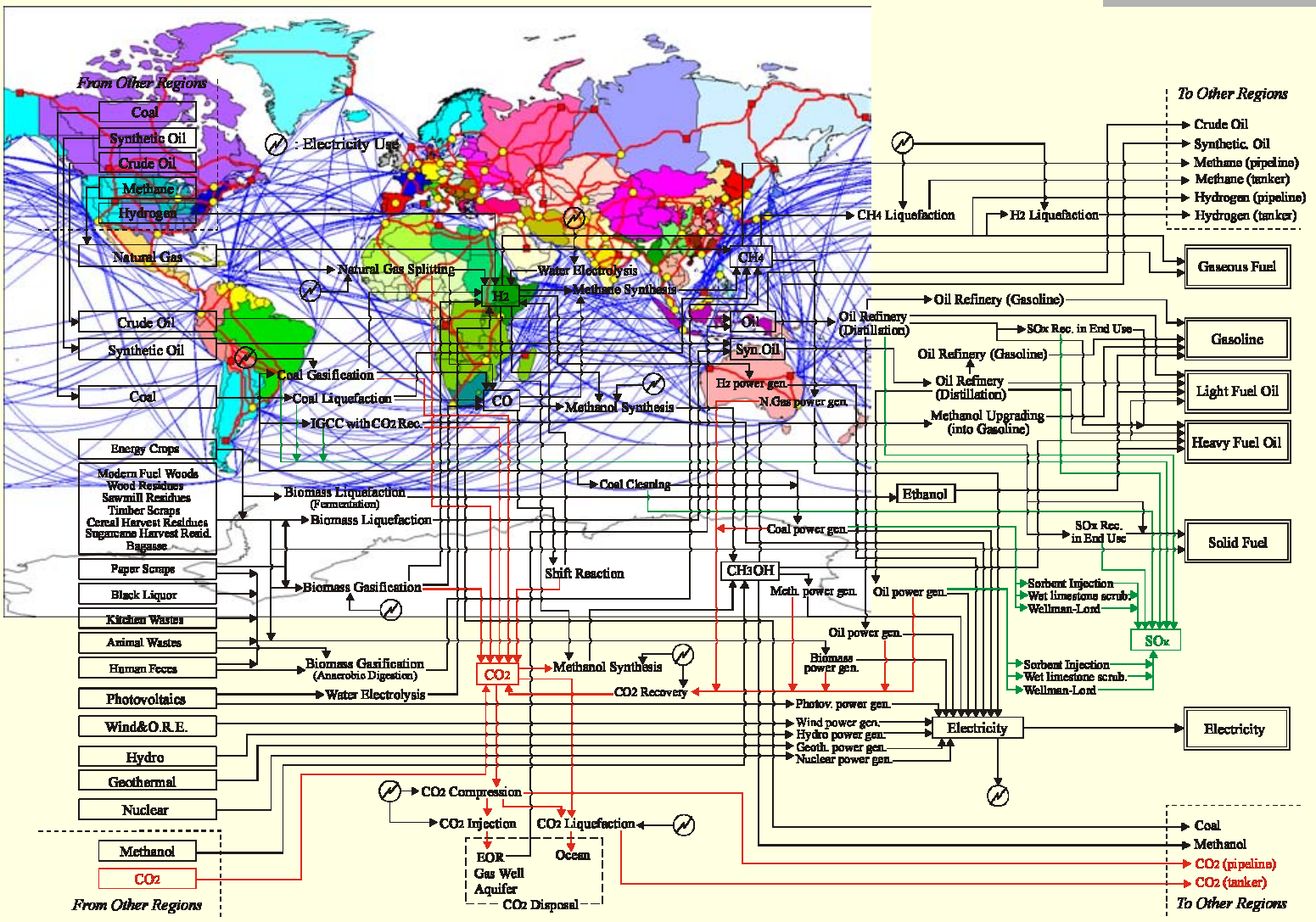




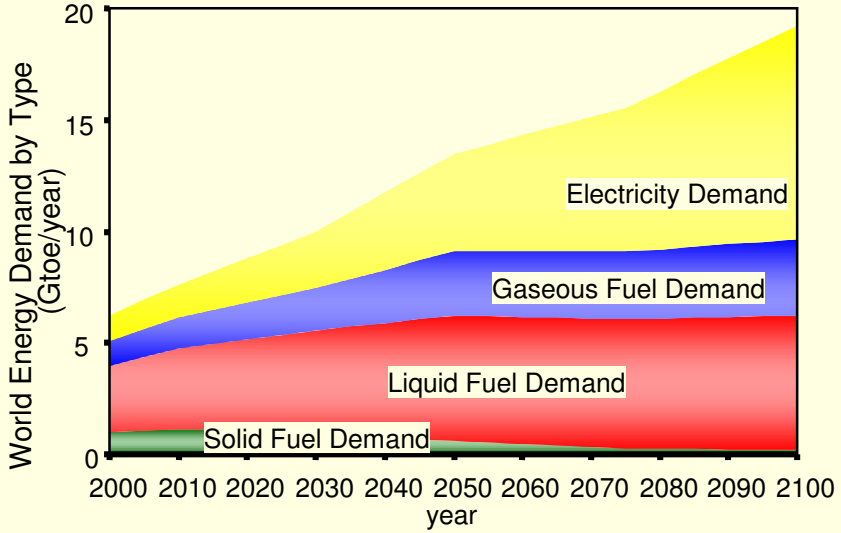
Tool to develop energy scenarios

- Global Energy Model
  - The purpose of the model is to obtain an insight into concrete normative images of our future energy system for long-term secure and sustainable development of human society.
  - The input data of the model are based on academic literature and governmental reports available.
  - The energy model can take account of various physical and economic conditions consistent with the above mentioned data.

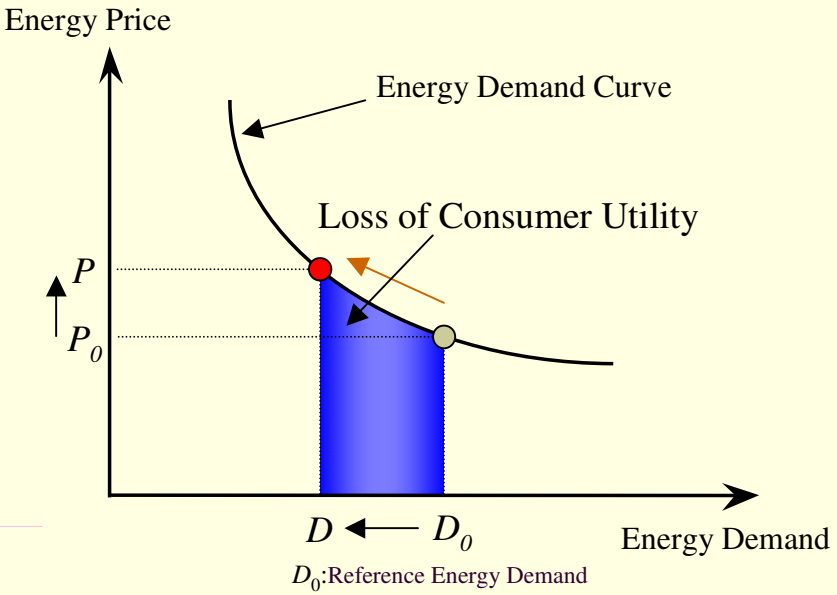
Energy System Configuration of the Model



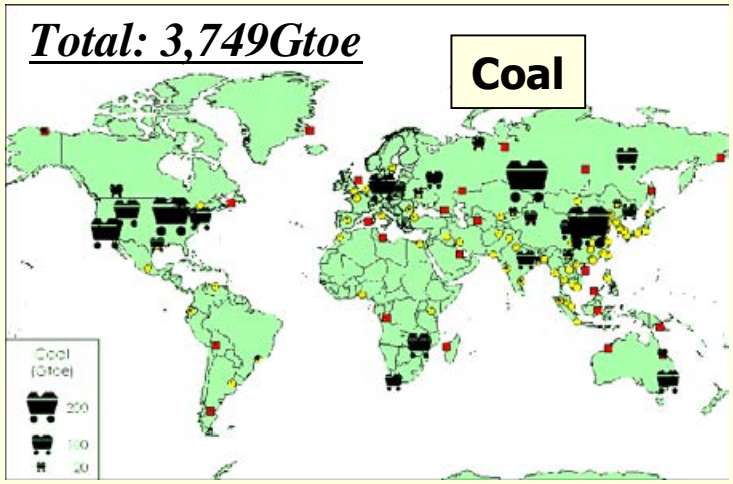
Reference Energy Demand Scenario and Energy Saving



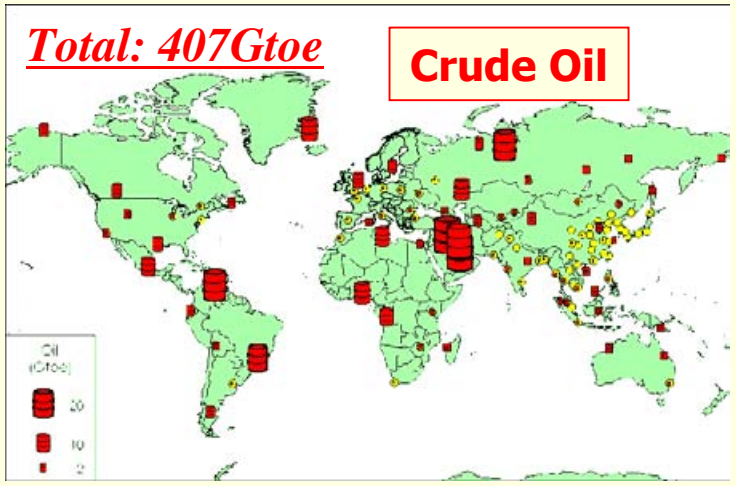
Reference Energy Demand Scenario by IPCC

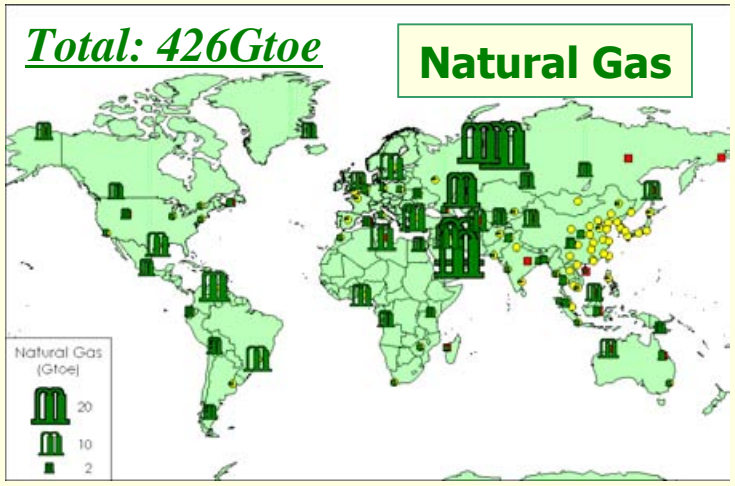


Fossil Fuel Resources



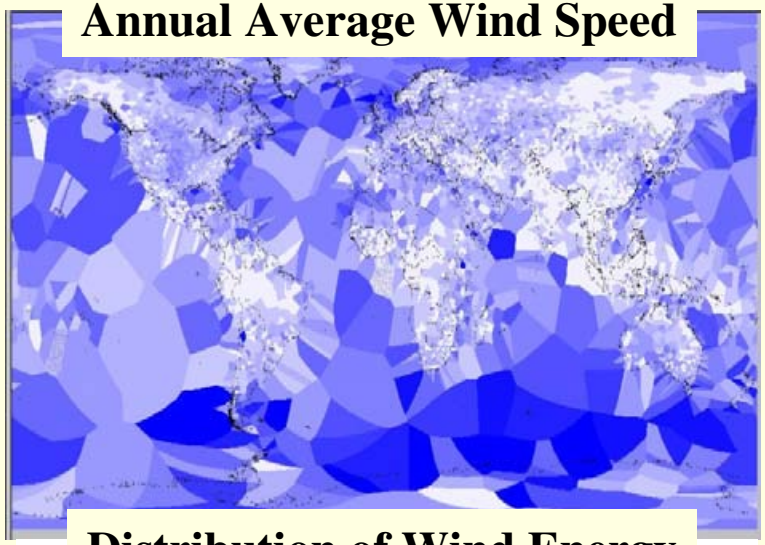
（Unit Gtoe：Giga tons of oil equivalent ）



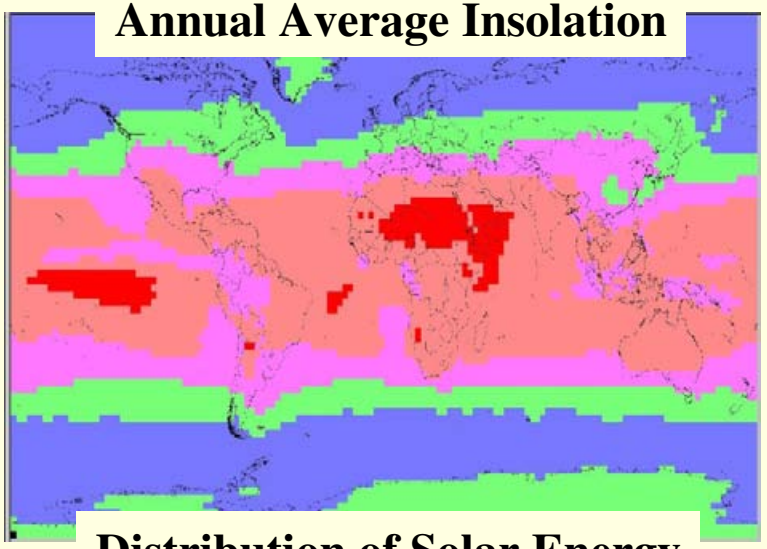


Renewable Energy Resources

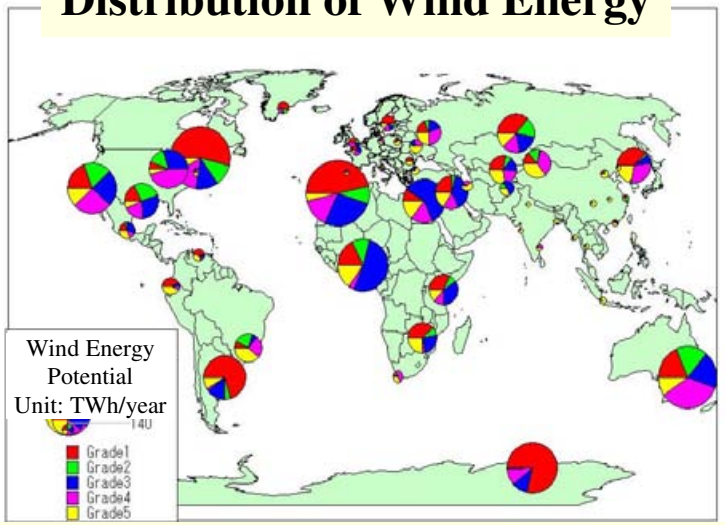
Annual Average Wind Speed



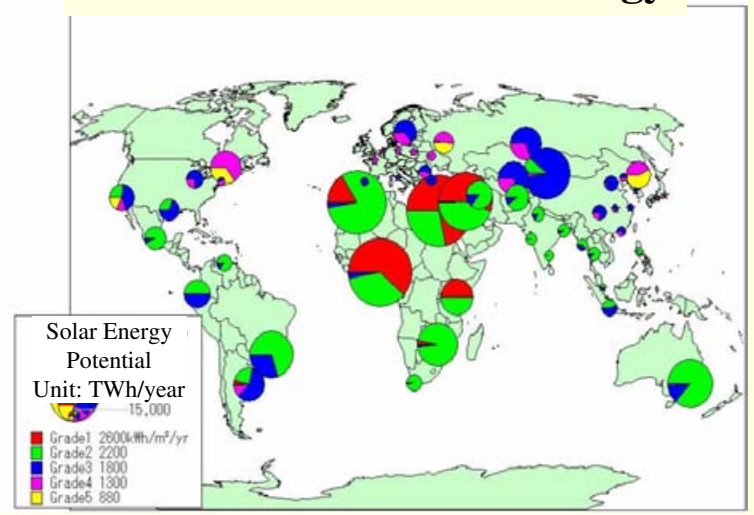
Annual Average Insolation



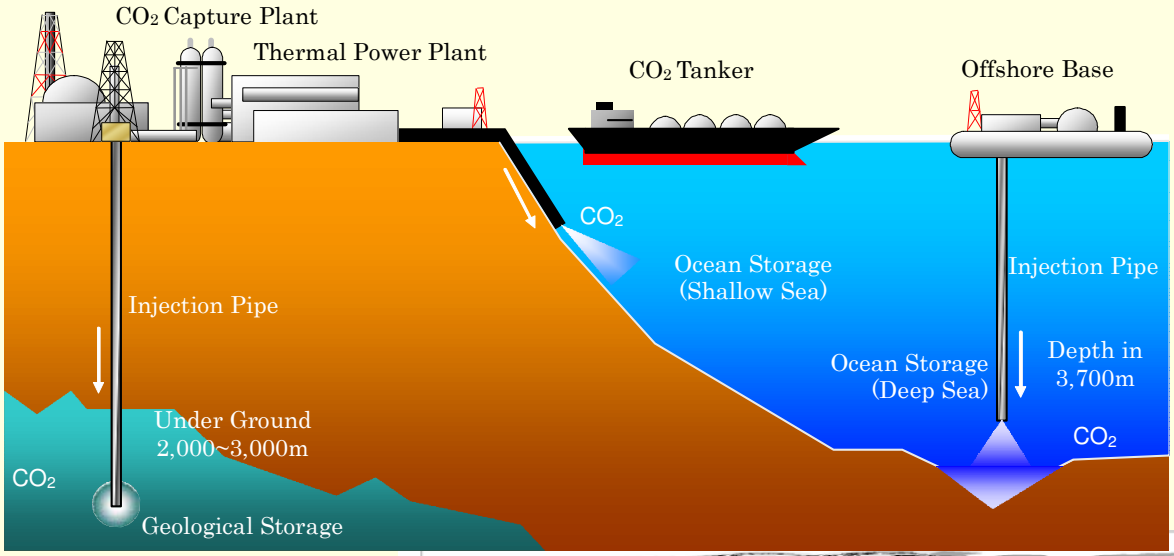
Distribution of Wind Energy

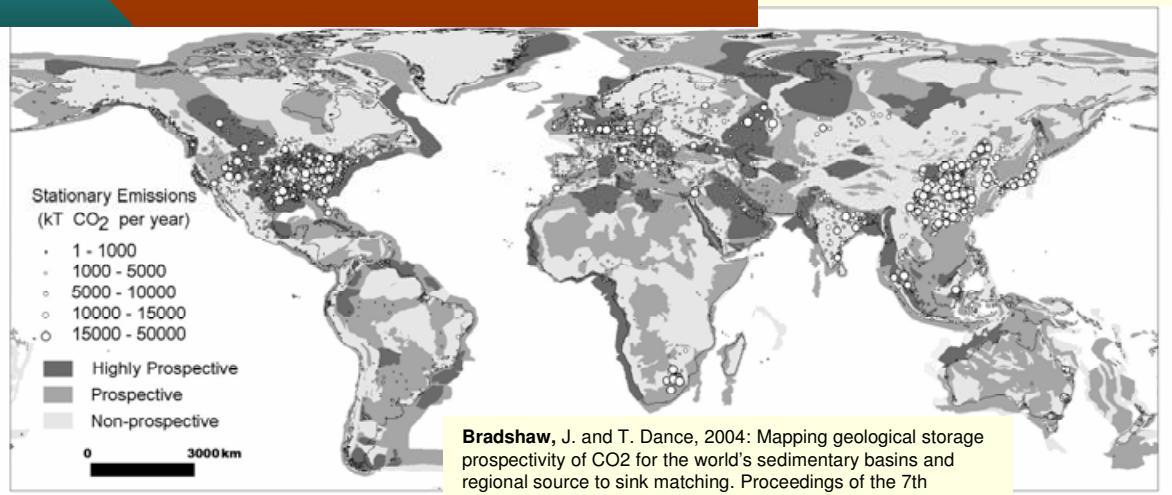


Distribution of Solar Energy



CO_2 Capture and Storage

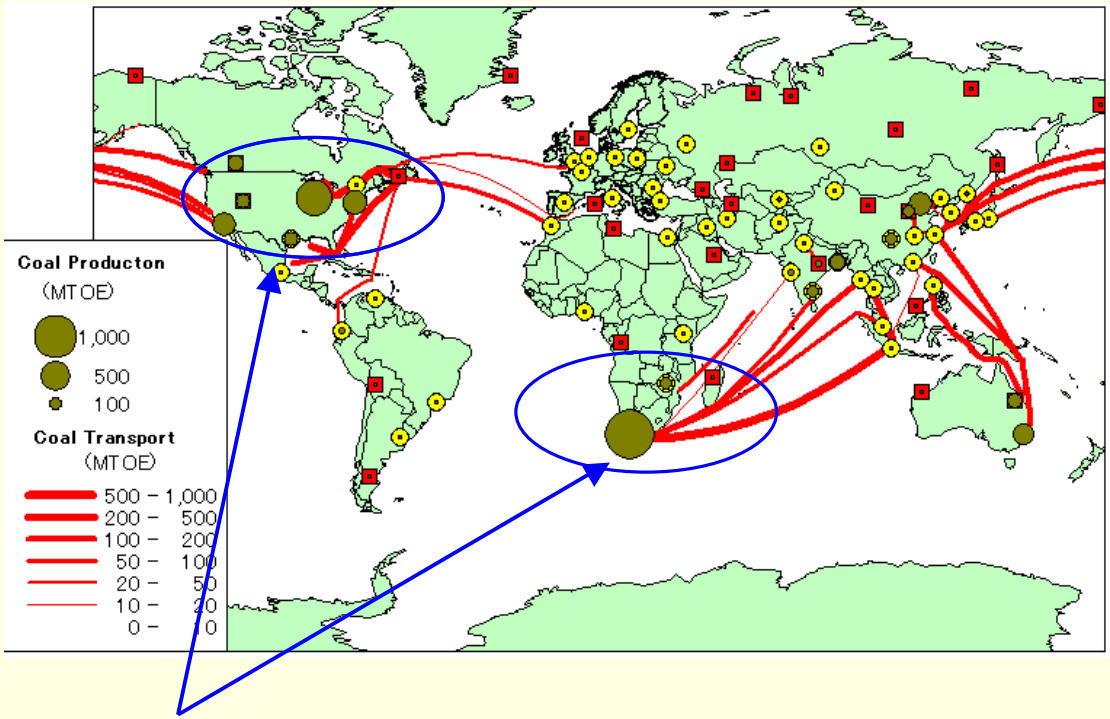




Bradshaw, J. and T. Dance, 2004: Mapping geological storage prospectivity of CO2 for the world's sedimentary basins and regional source to sink matching. Proceedings of the 7th International Conference on Greenhouse Gas Technologies

Results (1)
Coal Production and Transportation in 2050

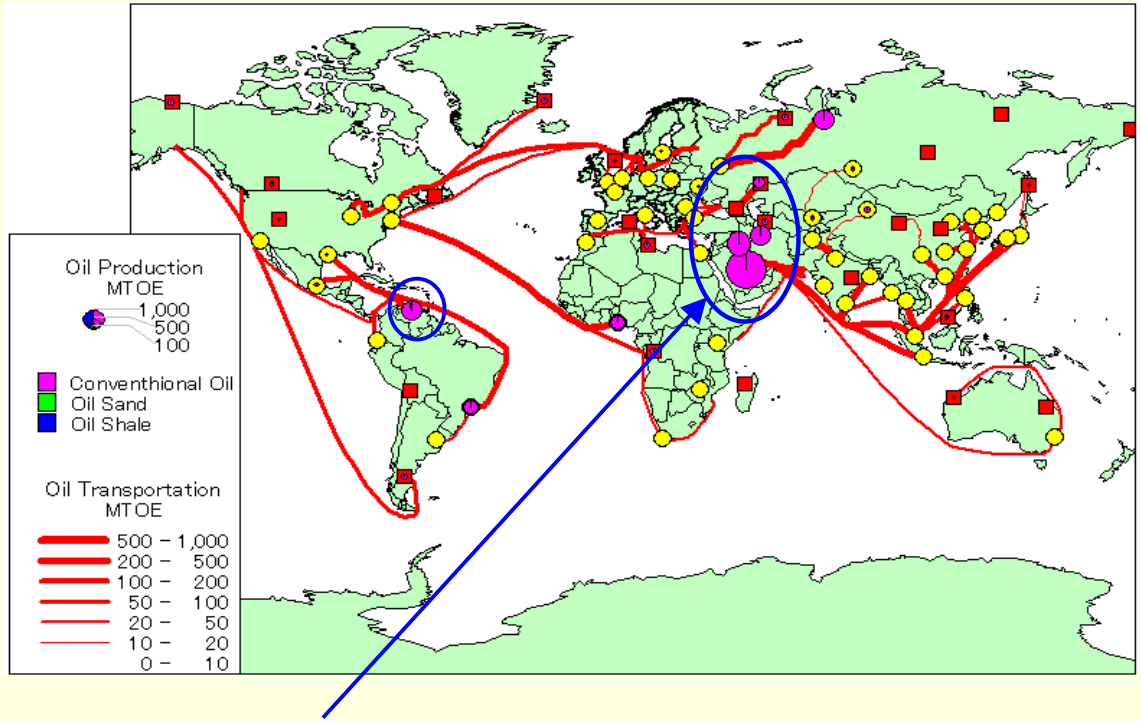
Reference Case in 2050



Coal productions are conducted intensively in specific regions, and mainly transported by sea.

Results (2)
Oil Production and Transportation in 2050

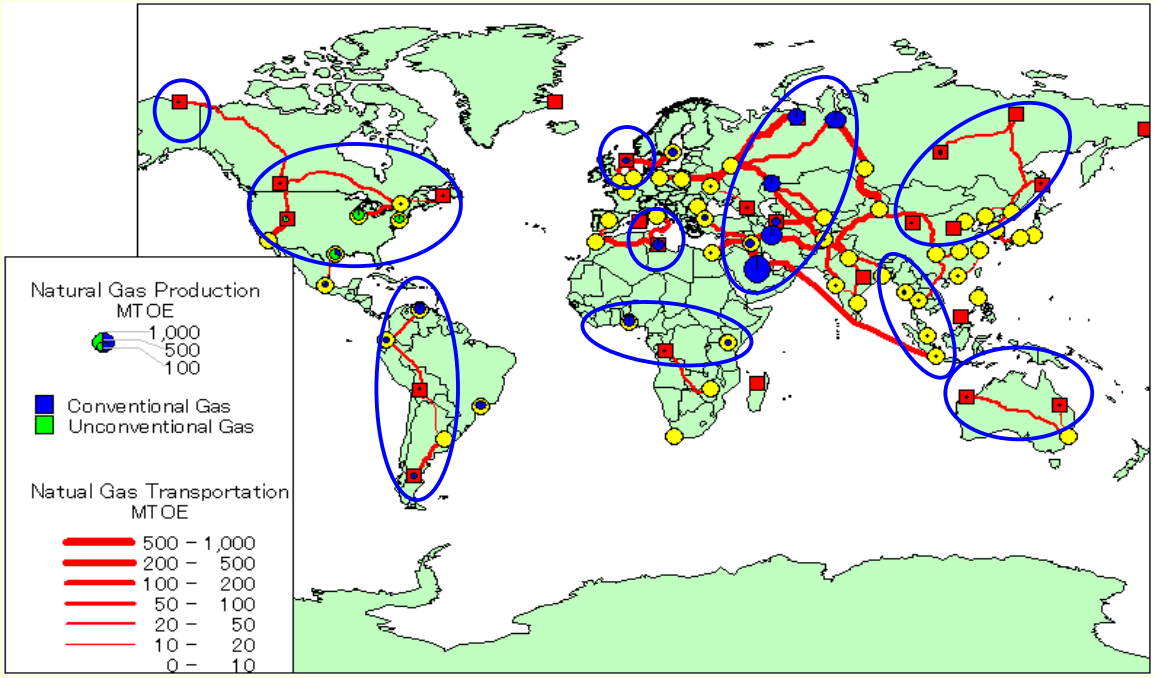
Reference Case in 2050



Oil is mainly produced in the Middle East,
and transported all over the world by tanker.

Results (3)
Gas Production and Transportation in 2050

Reference Case in 2050

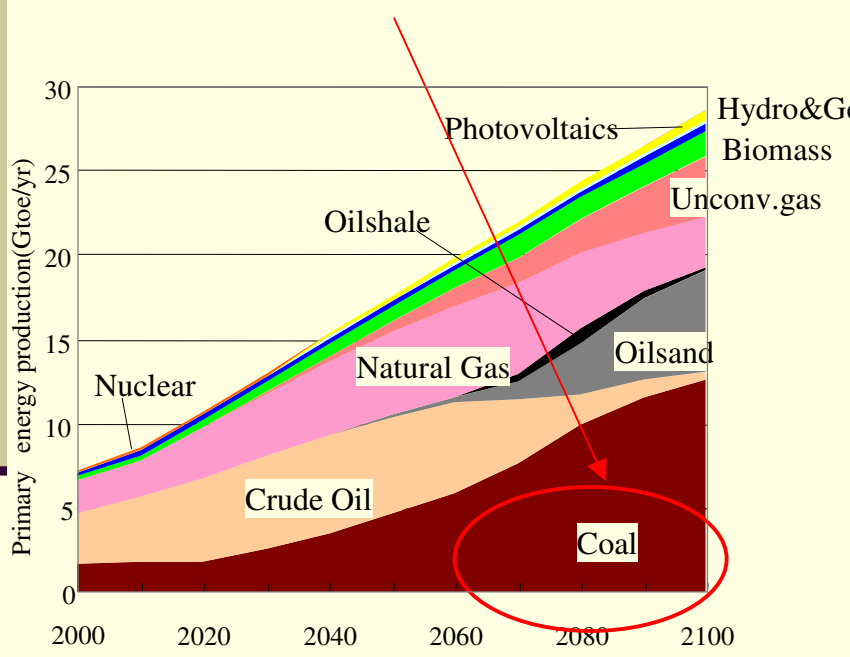


Natural gas productions are distributed in several regions, and transported mainly by pipeline.

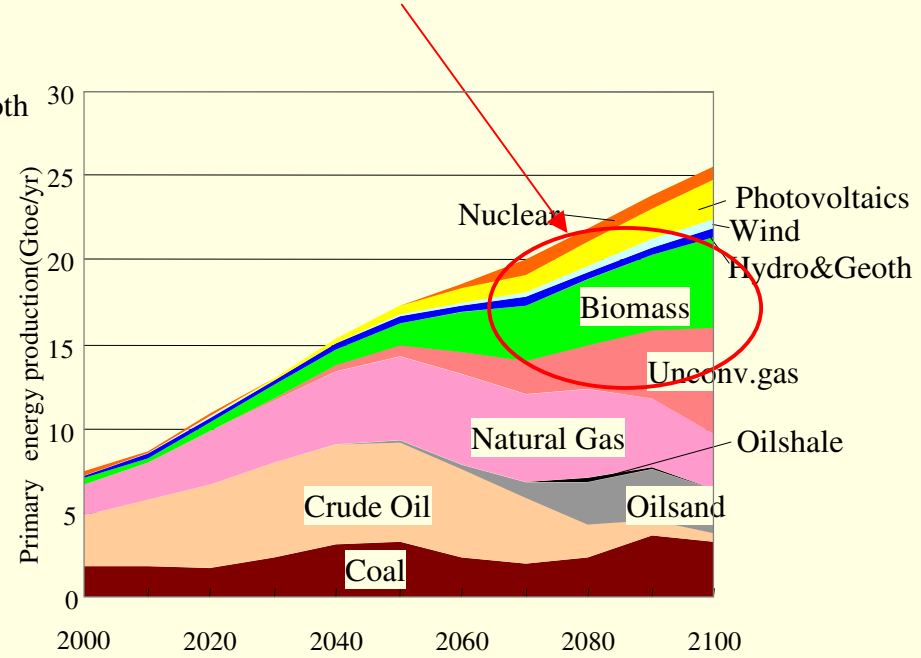
Results (4)
Primary Energy Production

Fossil fuels are dominant, and coal production increases in the latter half of 21st Century.

Non fossil energies (in particular Biomass) increases in the latter half of 21st Century.



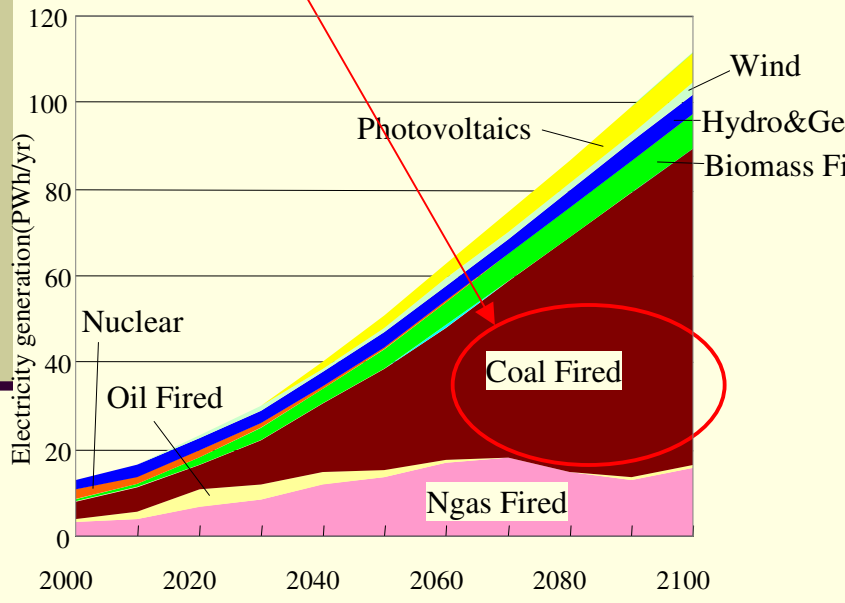
Reference Case



Controlled Case (550ppmv)

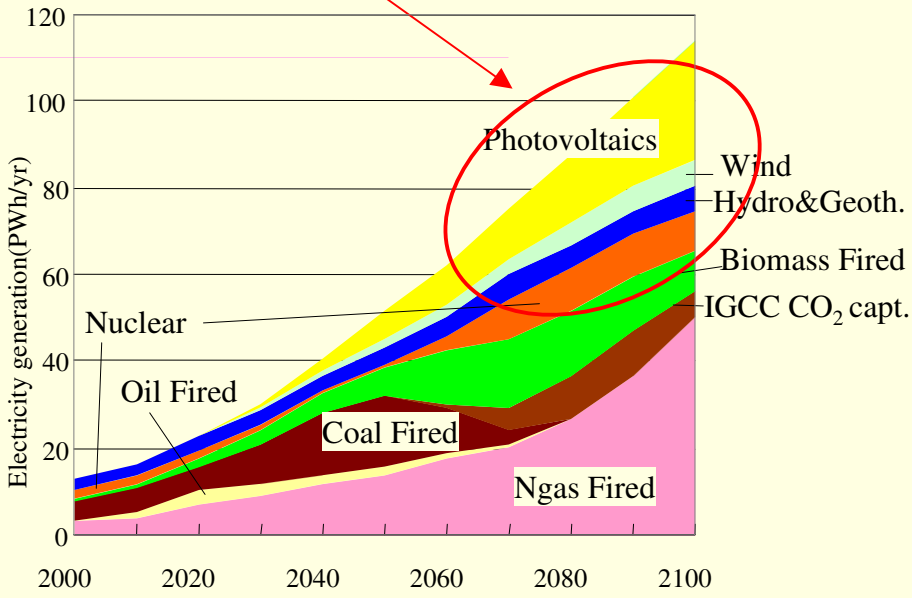
Results (5)
Electric Power Generation

Coal fired generation is dominant, because of abundant amount of resource.



Reference Case

Nuclear and Renewable generations increase in the latter half of 21st Century.



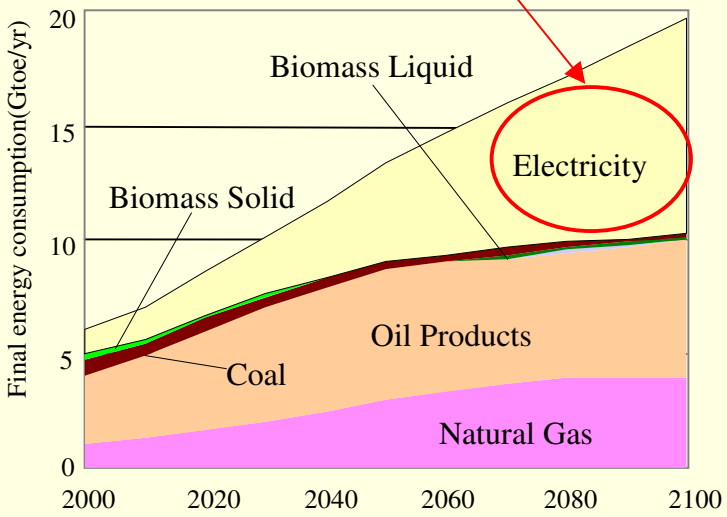
Controlled Case (550ppmv)

Results (6)
Final Energy Consumption

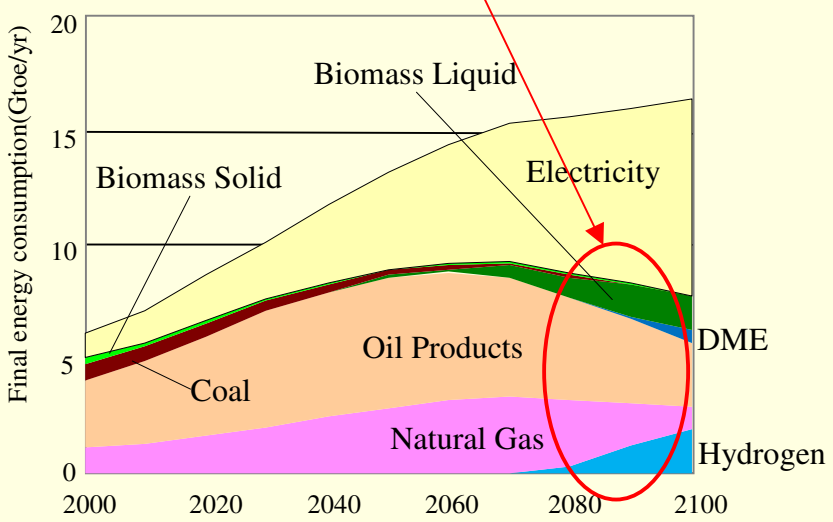
In Controlled Case, the gross energy consumption is reduced by energy conservation.

Electricity consumption continues to increase during the 21st Century.

Biomass derived liquid fuel and Hydrogen are used mainly in the latter half of 21st Century.

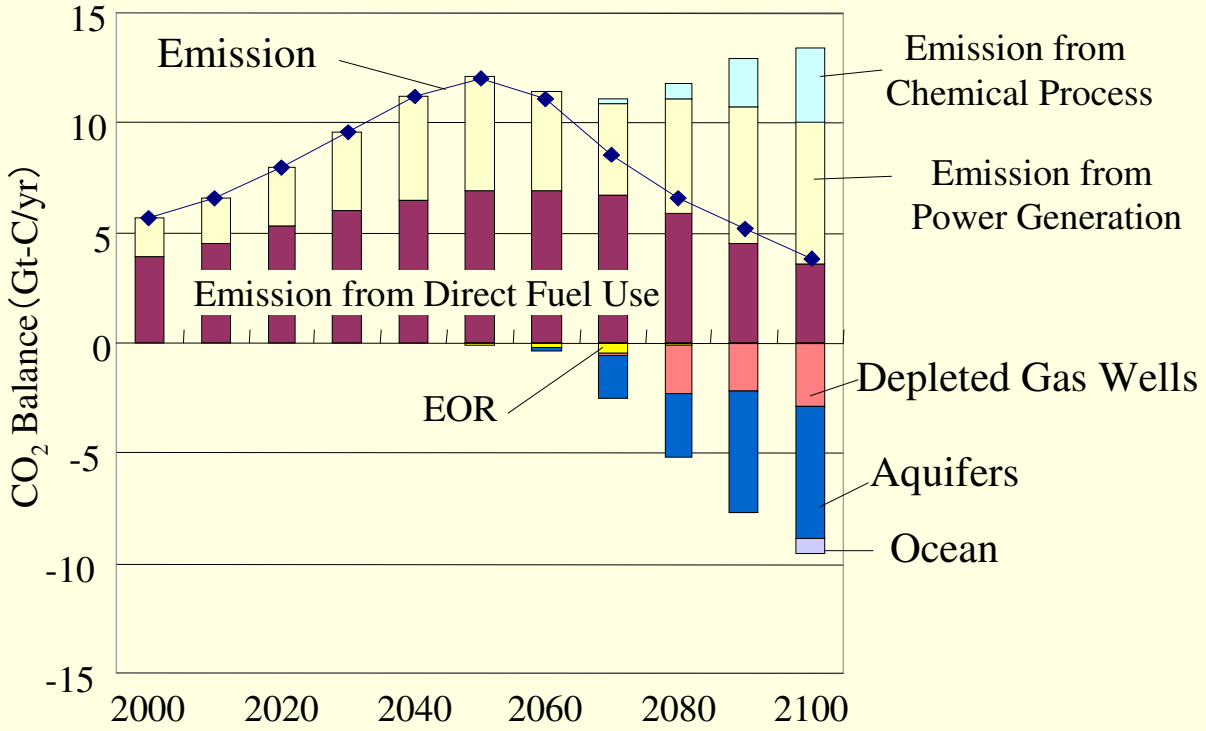


Reference Case



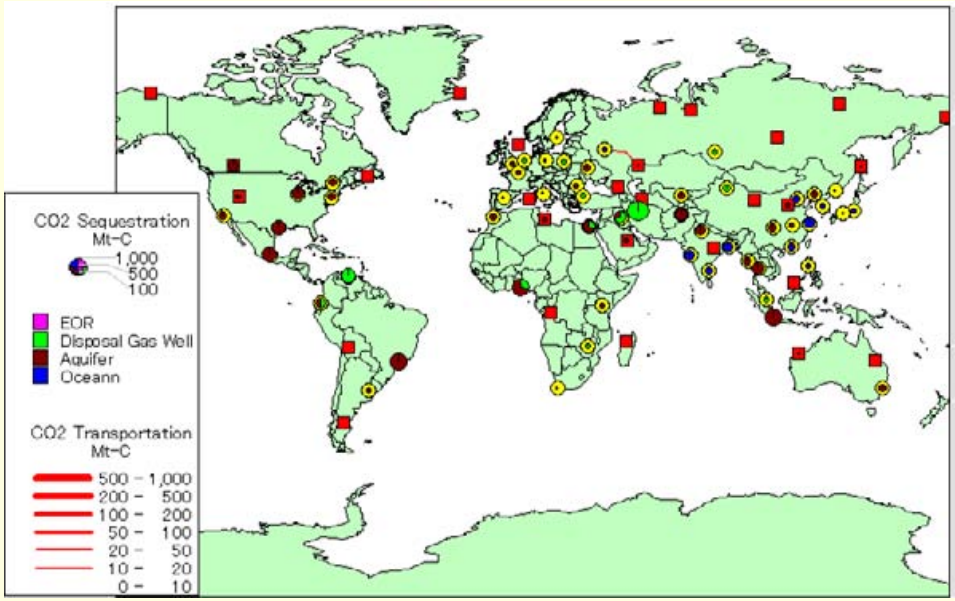
Controlled Case (550ppmv)

Results (7)
CO_2 Emission and Storage



Results (8)
CO_2 Capture and Storage

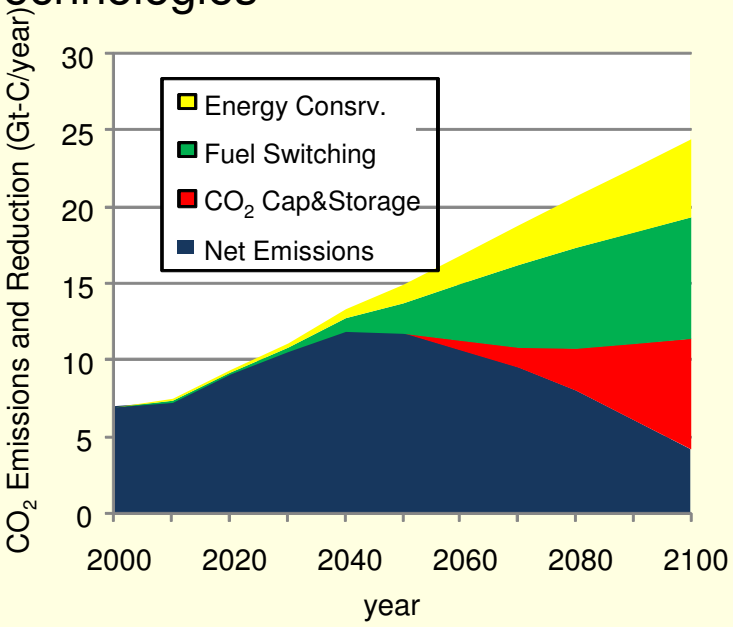
CCS technologies in 2100



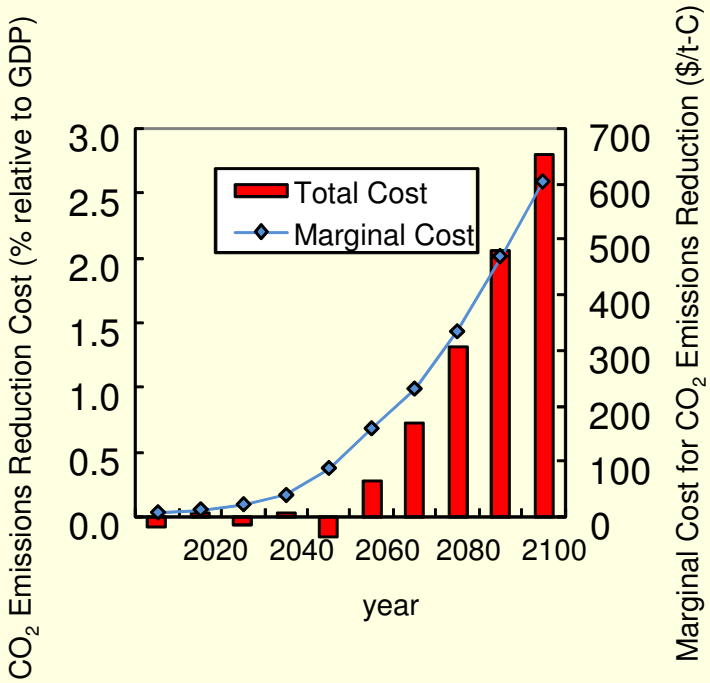
Aquifer storage and Ocean storage are conducted all over the world.

Results (9)
Technology Shares and Mitigation Cost

Contribution by Type of Technologies



Mitigation Costs



Concluding Remarks

- Mitigation of global warming is technically feasible.
- Oil and Natural Gas may remain major primary energy source over the 21st century. The production of coal may be affected significantly by the climate policy.
- The contribution of solar and wind energy is estimated to be rather small. This is because the limited shares of the renewable power in power systems are assumed.
- The contribution of nuclear may be limited, unless FBR is deployed.
- CO_2 capture and storage may play a big role in the second half of the 21st century in the CO_2 concentration controlled case.

- No specific technology can solve the problem.