APERC Annual Conference , 2014
Potential Energy Technology Game-Changers

Future Low-Carbon Energy Options for Food and Mobility

- the Hard Ones!

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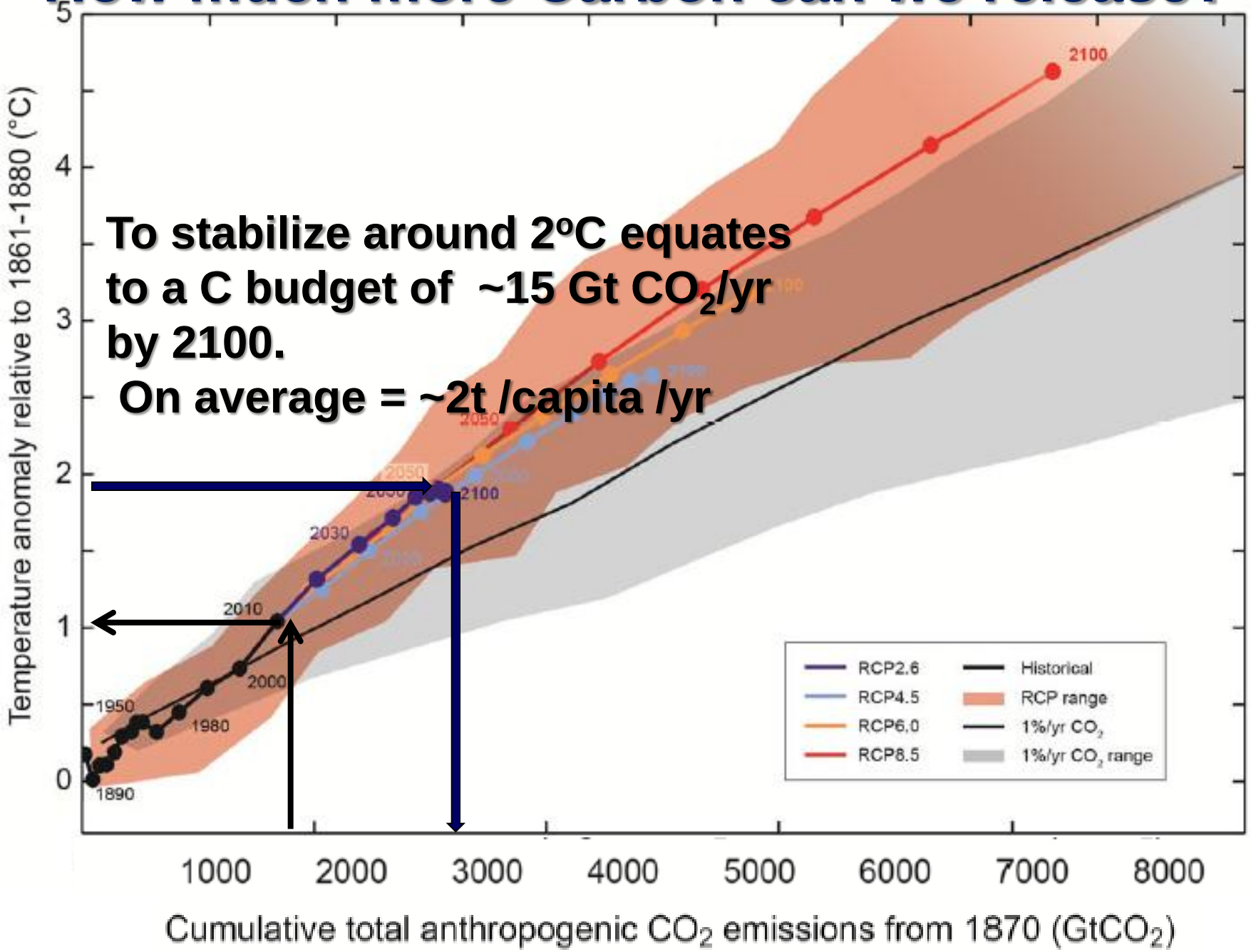
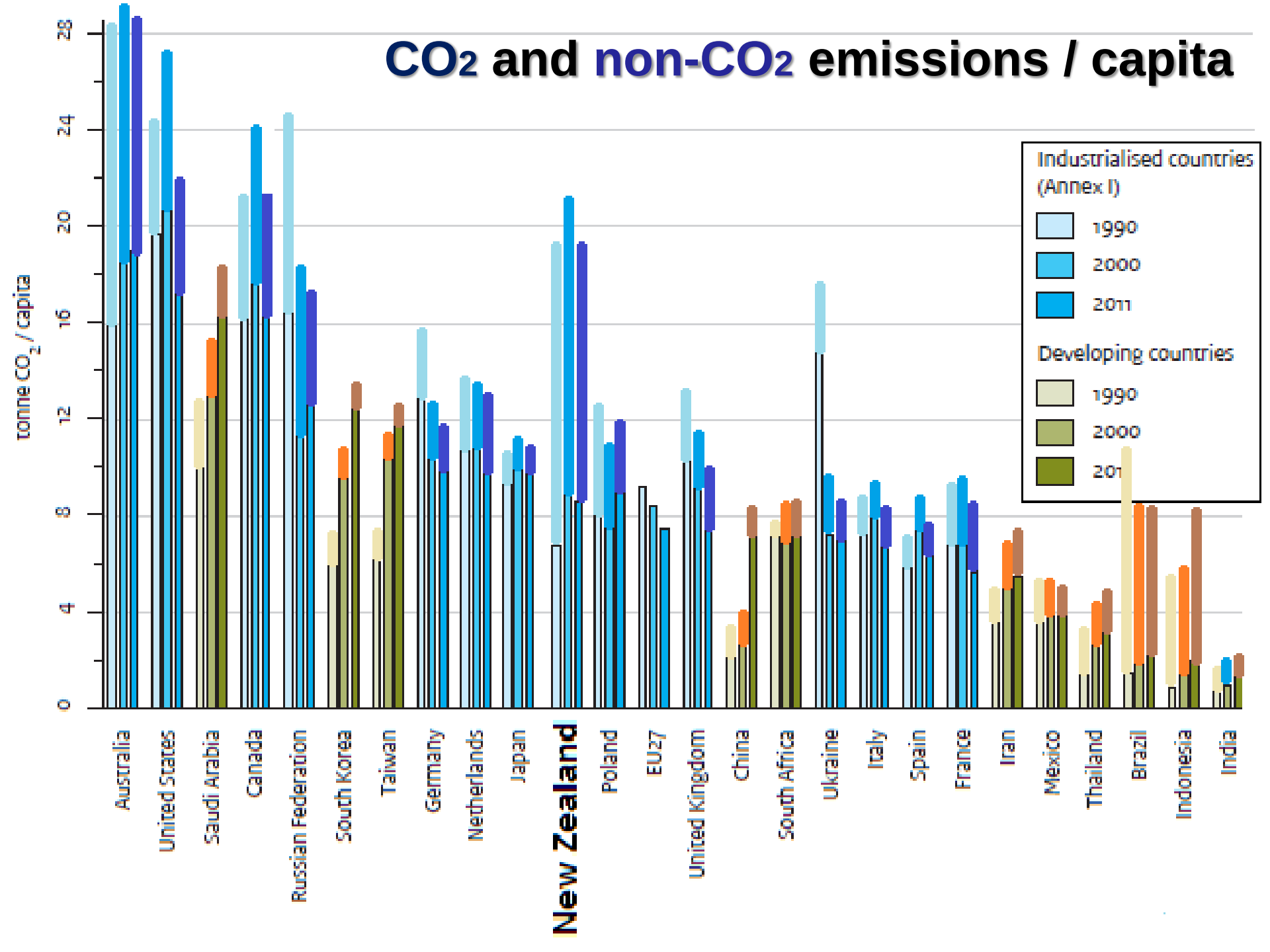
Aims

- Consider the rate of low-carbon energy technology advances.
- Outline energy demands for food supply and future opportunities.
- Consider some solutions for reducing transport-related GHG emissions - with emphasis on co-benefits.
- Recall that social sciences have a role to play since people are involved in the solutions.

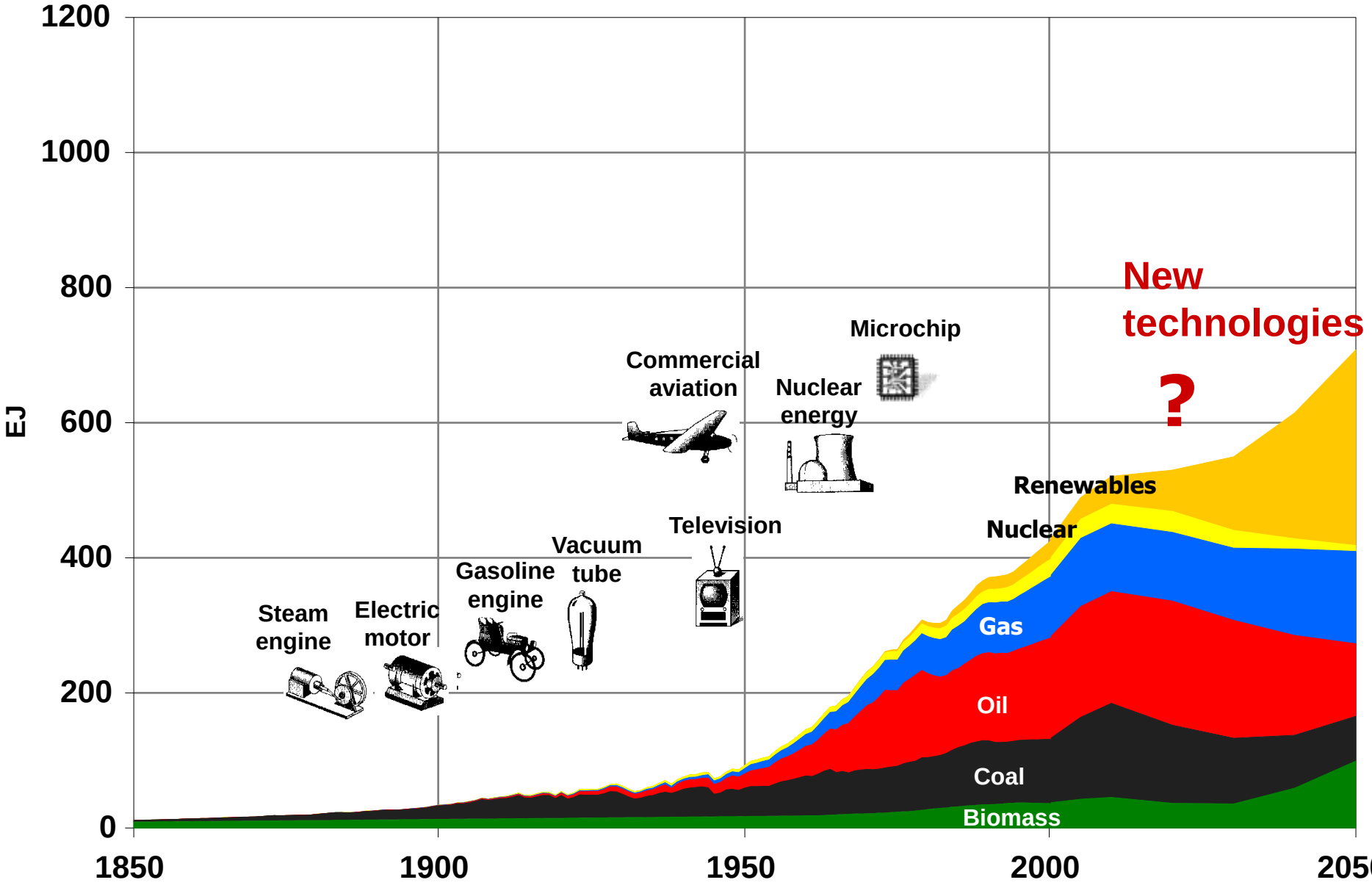
How much more Carbon can we release?



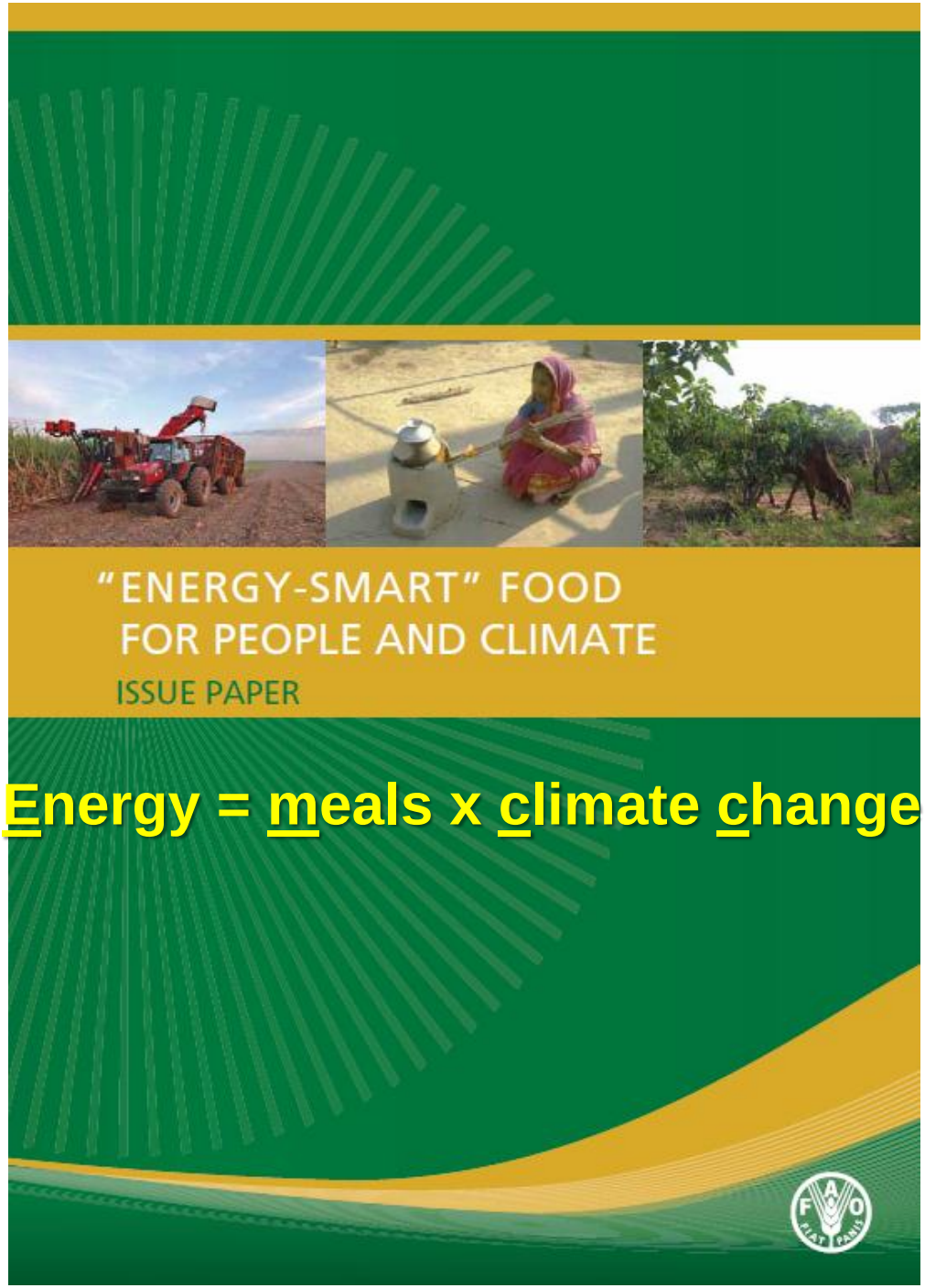
CO_2 and non-CO_2 emissions / capita



Global primary energy demand growth



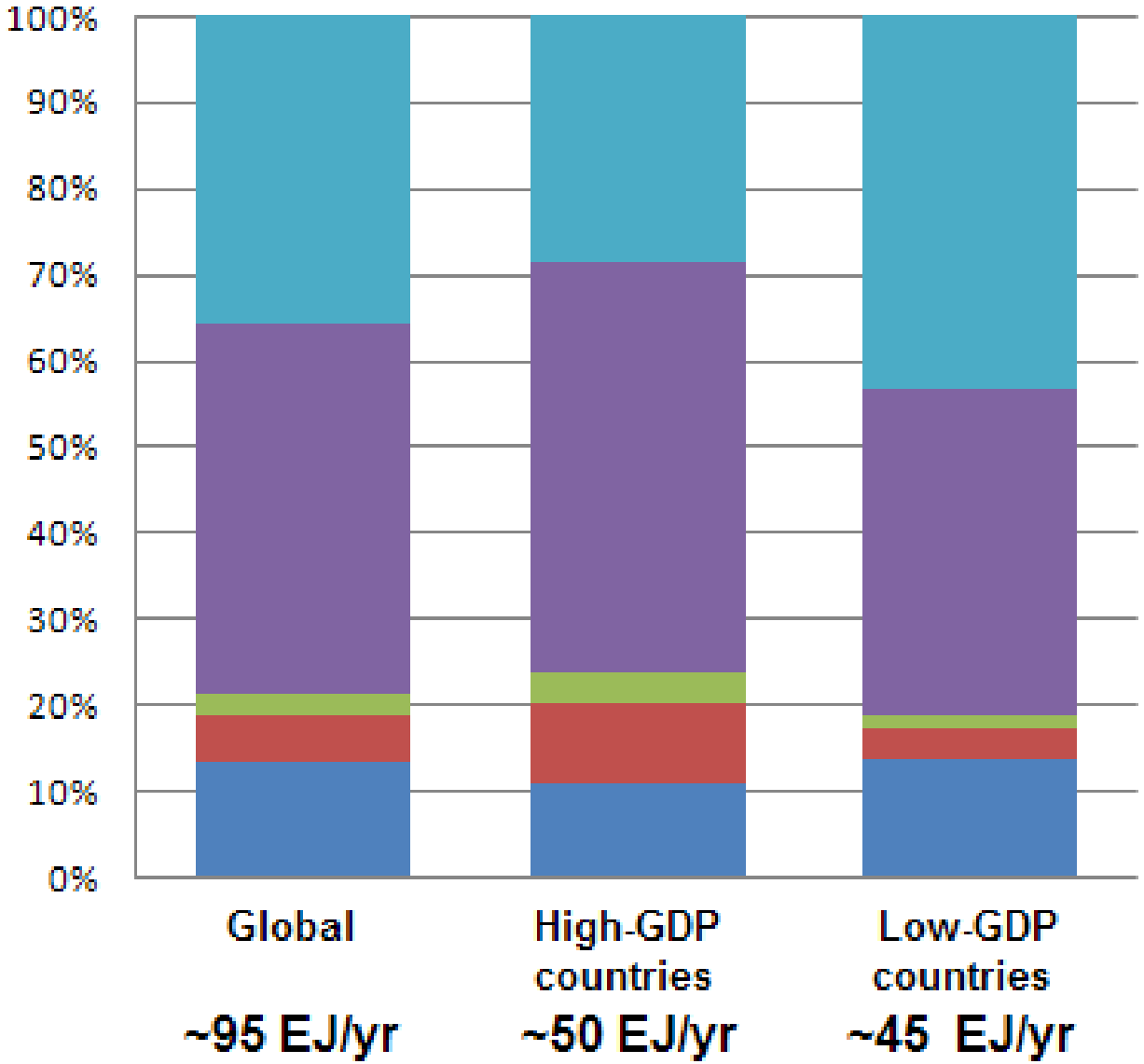
Global Energy Assessment 2012



Issue paper available at

http://www.fao.org/docrep/014/i2454e/i2454e00.pdf

Shares of energy in Agri-food supply chain



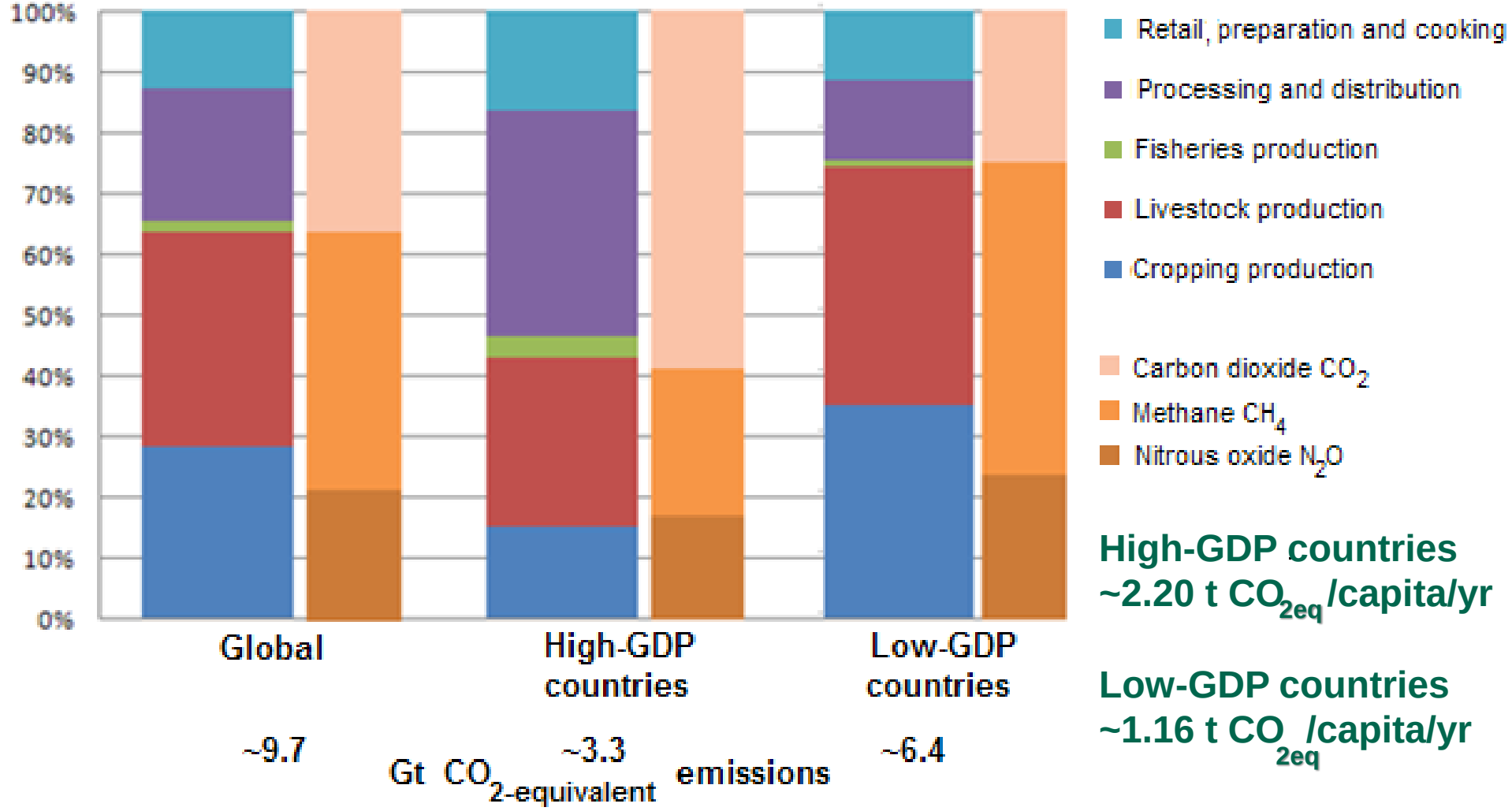
High-GDP countries ~ 35 GJ/capita/yr.

Low-GDP countries ~ 8 GJ/capita/yr.

Around 32% of the total global end-use energy demand of ~300 EJ/yr is used for providing food.

Shares of greenhouse gas emissions

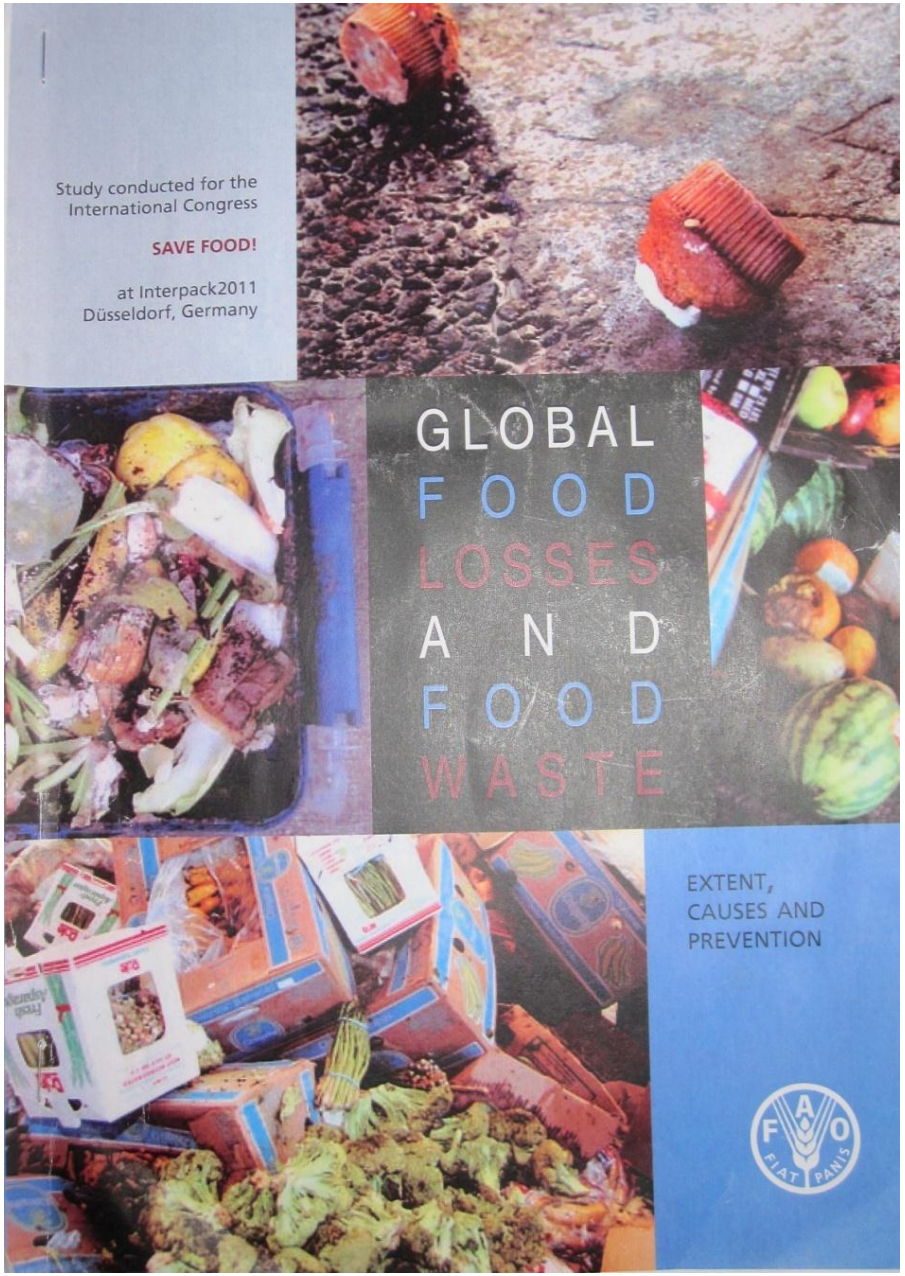
Around 22% of total global GHG emissions (~45 Gt $CO_{2\text{-equiv}}$ /yr) arise from the agri-food chain.



High-GDP countries
~2.20 t CO_{2eq}/capita/yr

Low-GDP countries
~1.16 t CO_{2eq}/capita/yr

Global food losses and waste



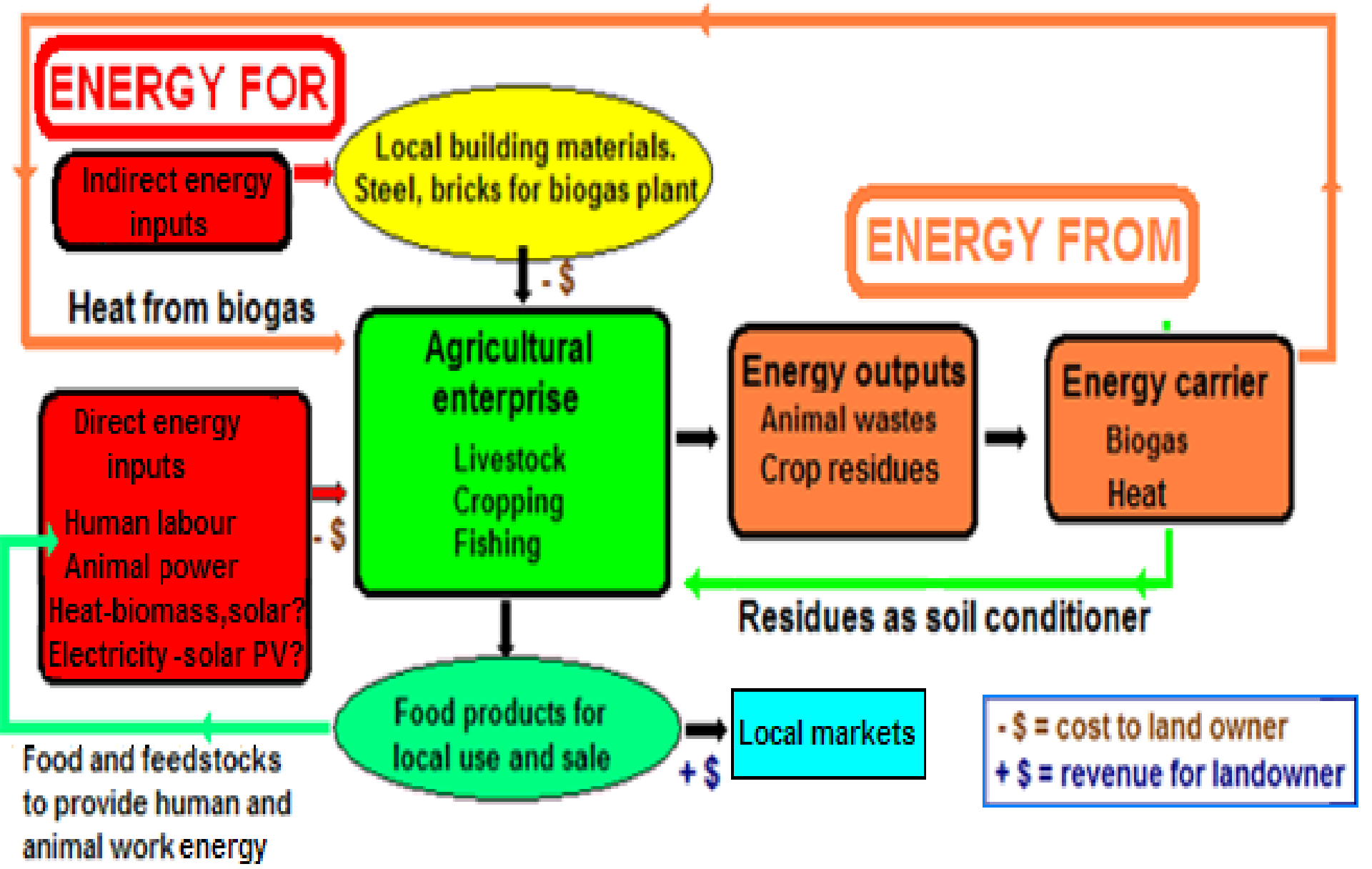
We fail to consume around one third of all food produced.

This wastes scarce land, water and energy resources.

If we reduced half of this waste, could we use more land for biomass production?

A *low input* agri-food /energy system

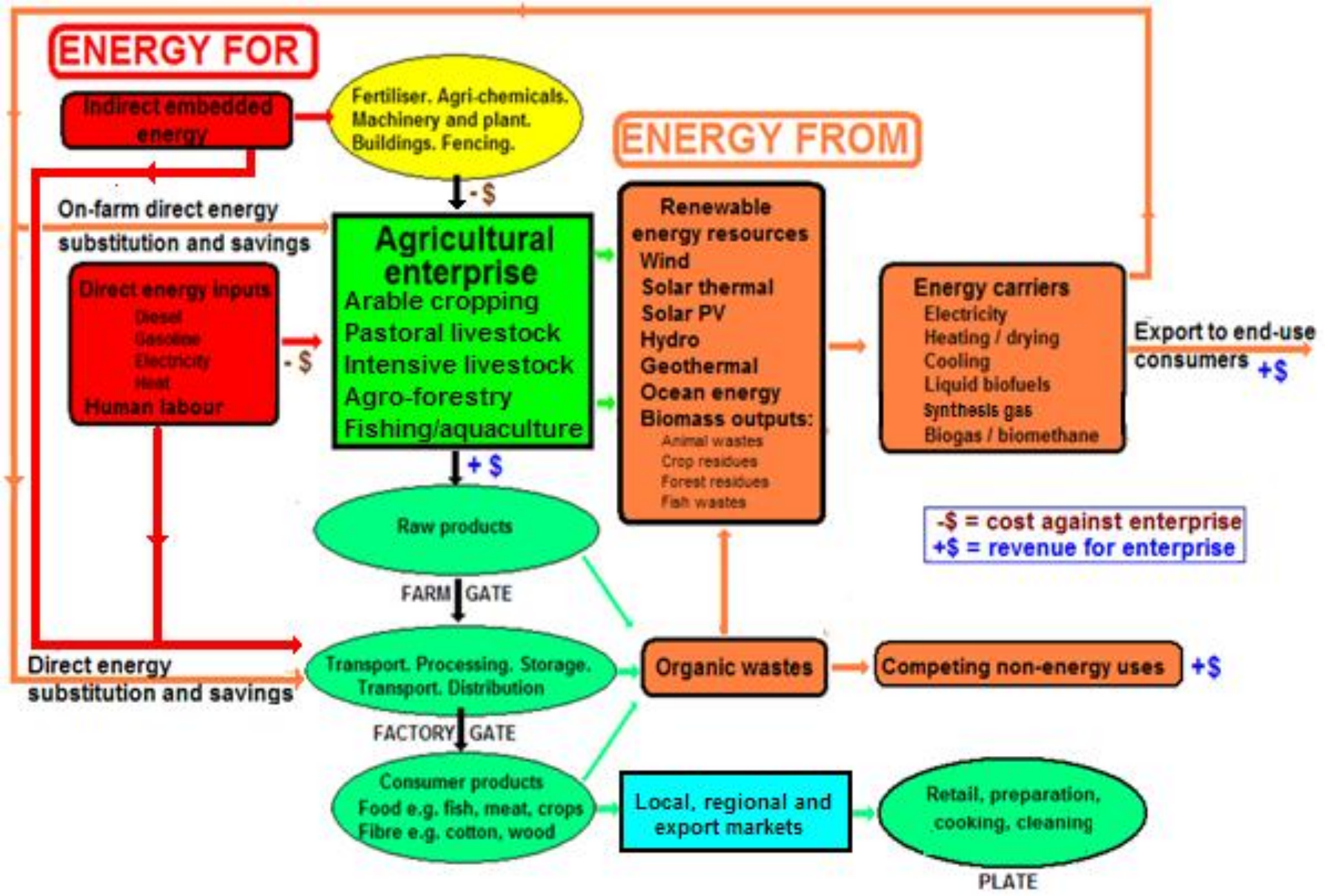
A *low input* agri-food /energy system



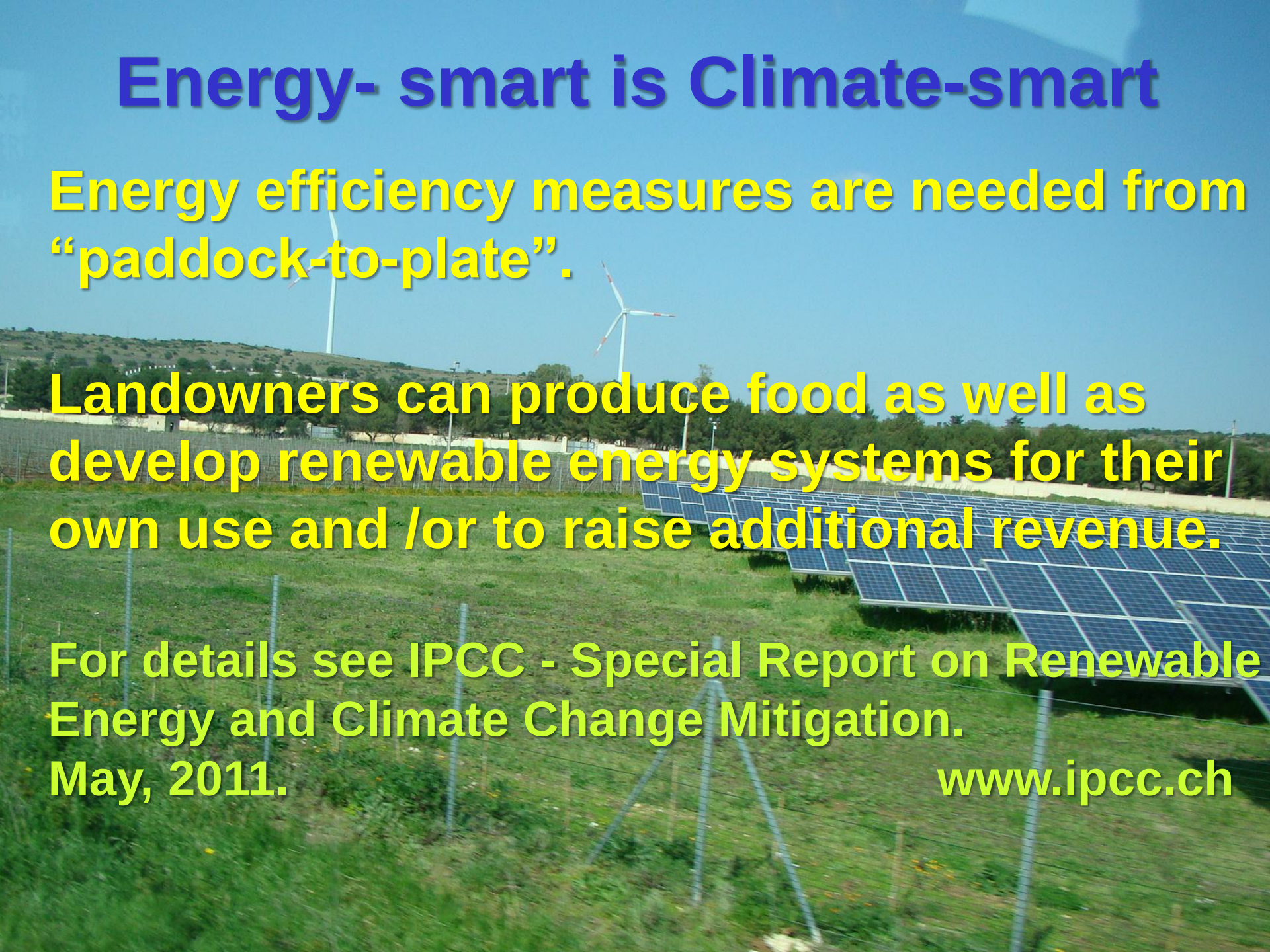
A *low input* agri-food /energy system

A *high input* agri-food / energy system

A *high input* agri-food /energy system



Energy- smart is Climate-smart

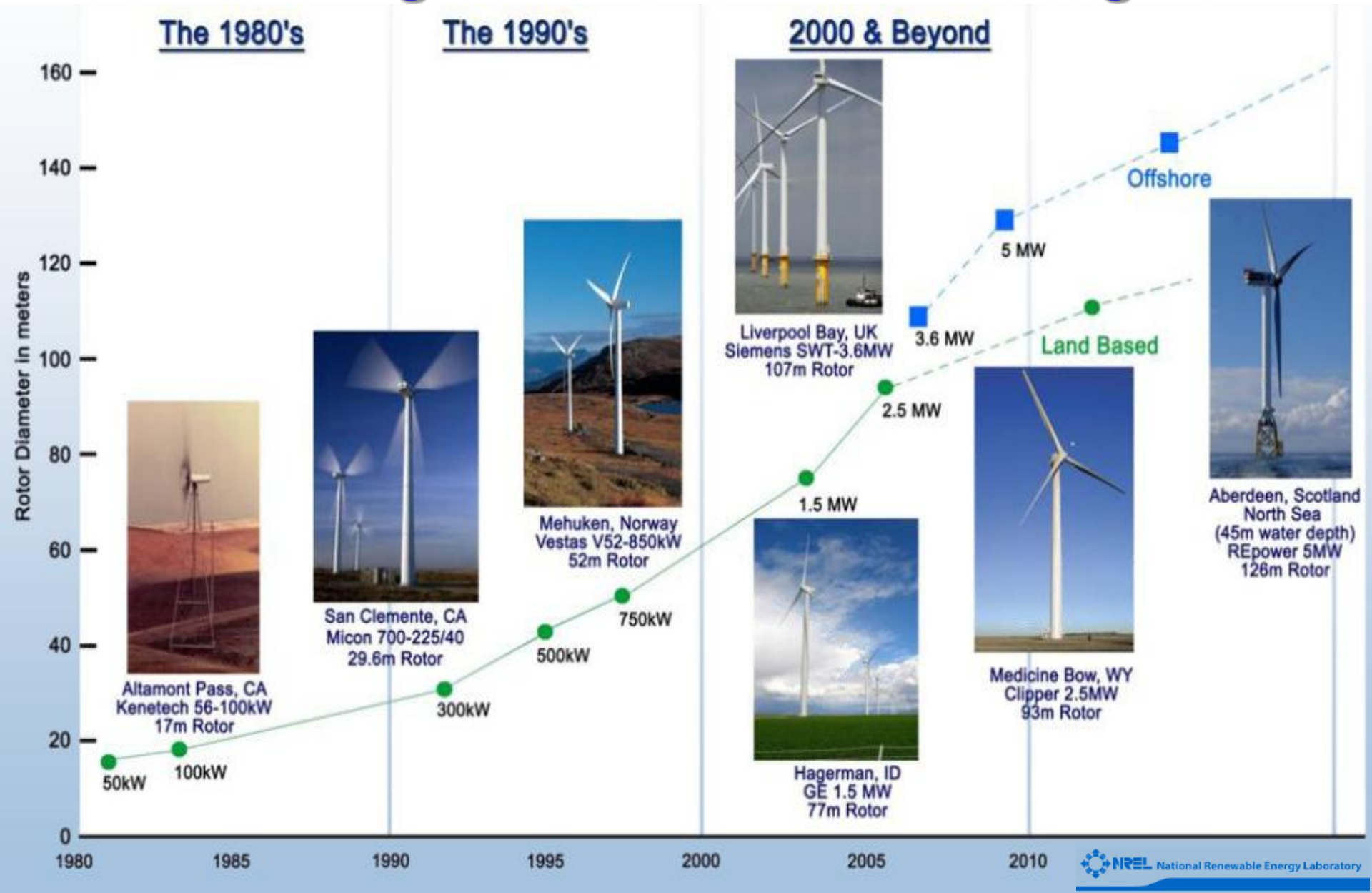


Energy efficiency measures are needed from "paddock-to-plate".

Landowners can produce food as well as develop renewable energy systems for their own use and /or to raise additional revenue.

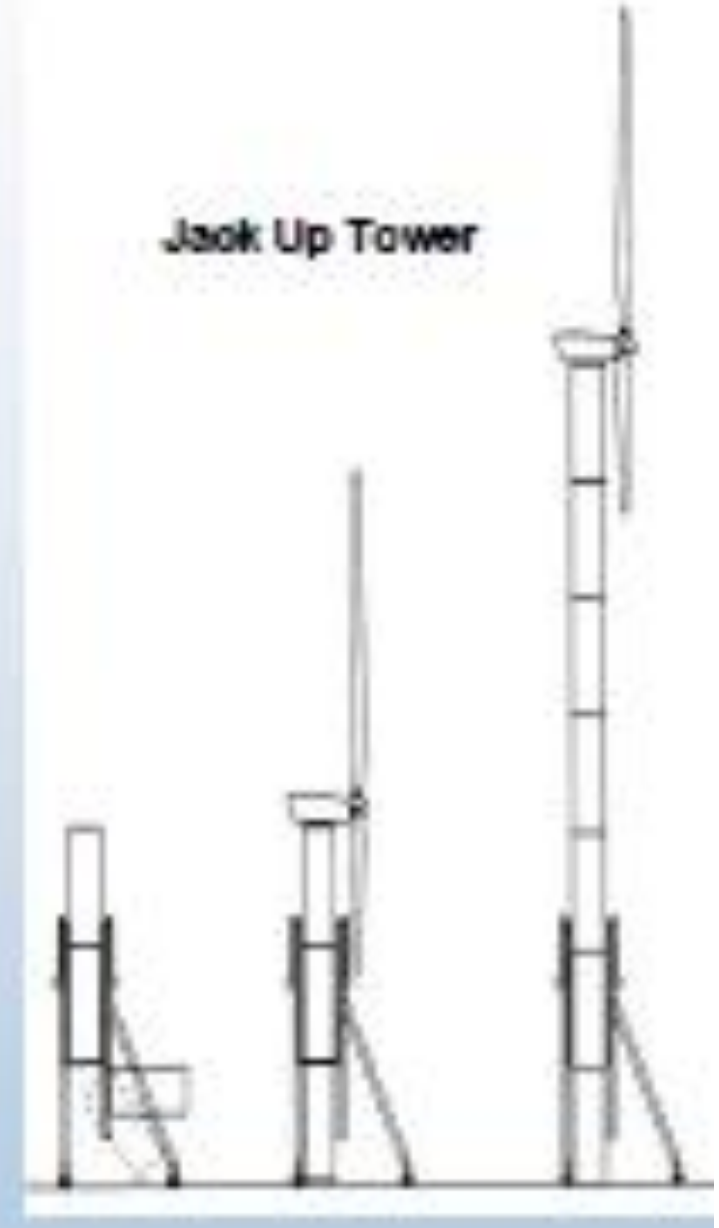
For details see IPCC - Special Report on Renewable Energy and Climate Change Mitigation.
May, 2011. **www.ipcc.ch**

Renewable energy technologies continue to evolve e.g. wind turbine technologies.

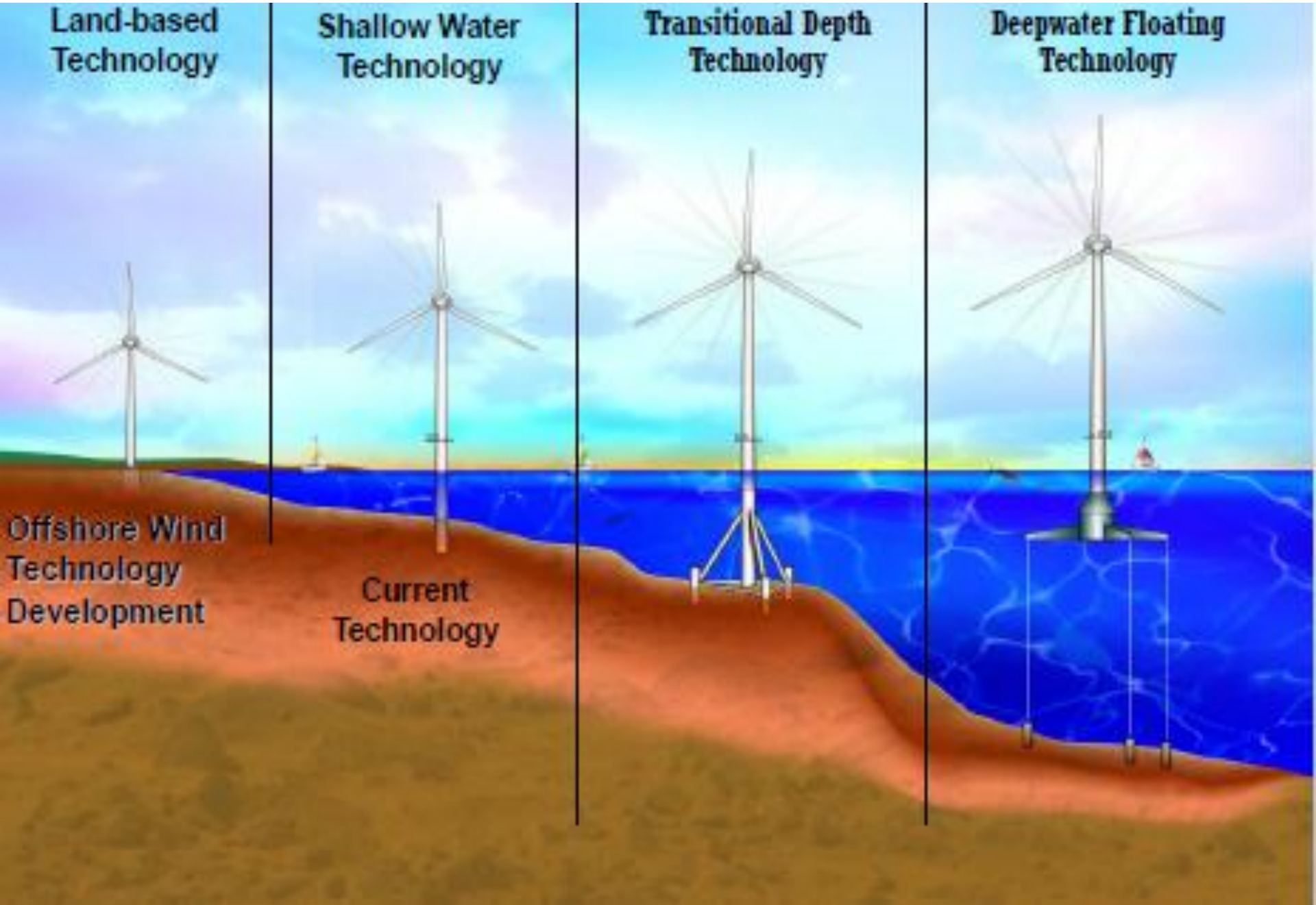


Telescoping Tower

Jack Up Tower



Future options for off-shore developments

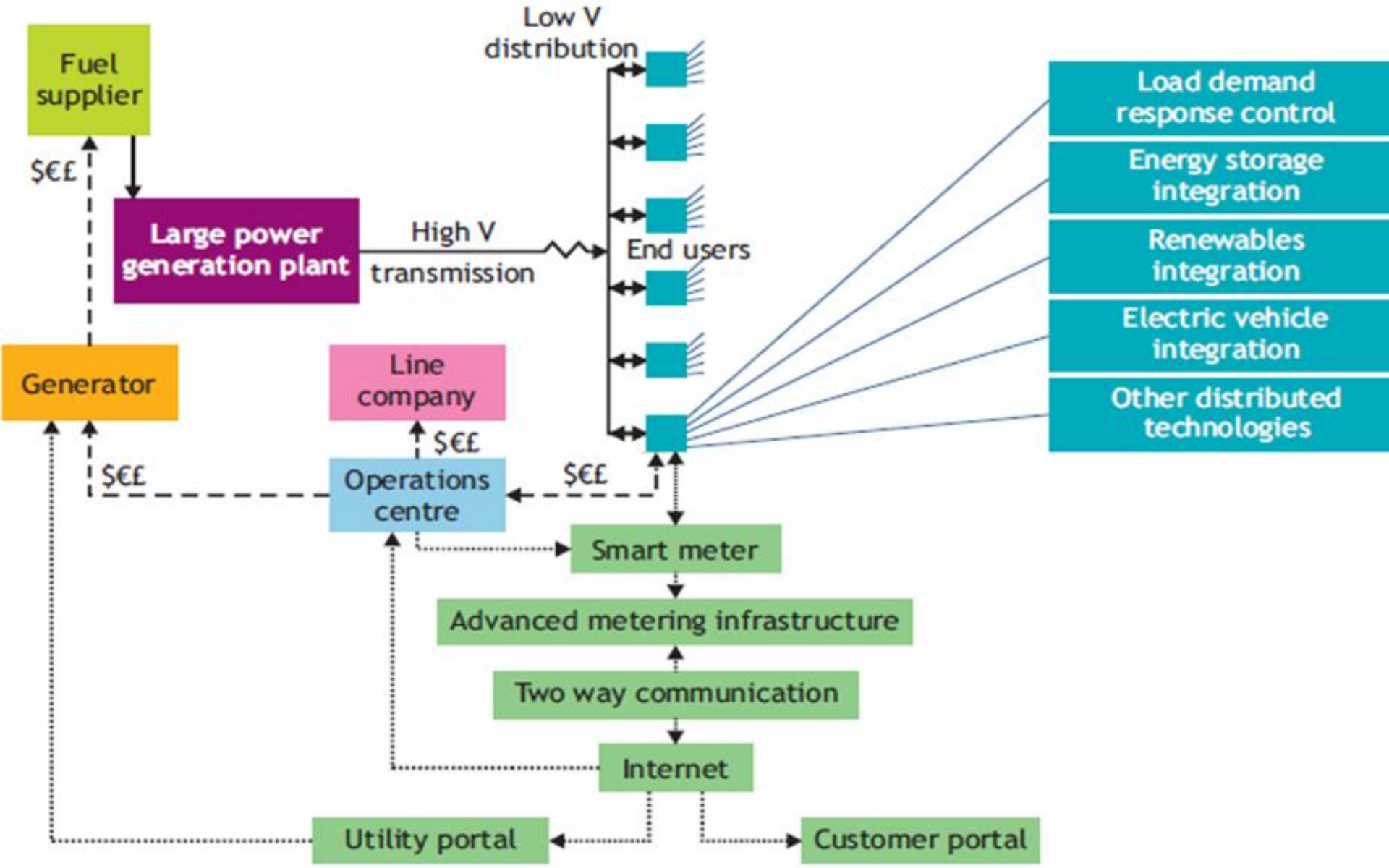


Smart-grids – a possible game changer?

Whispergen

Micro-CHP system

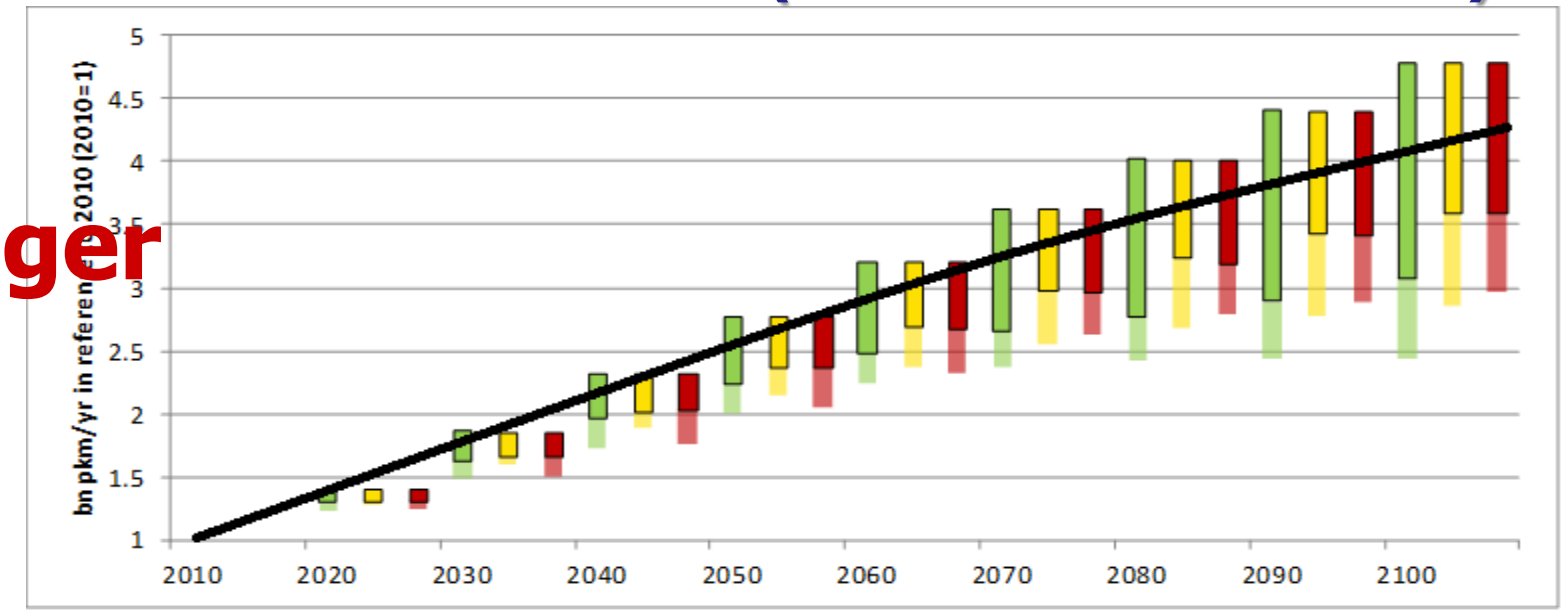
The digital energy revolution



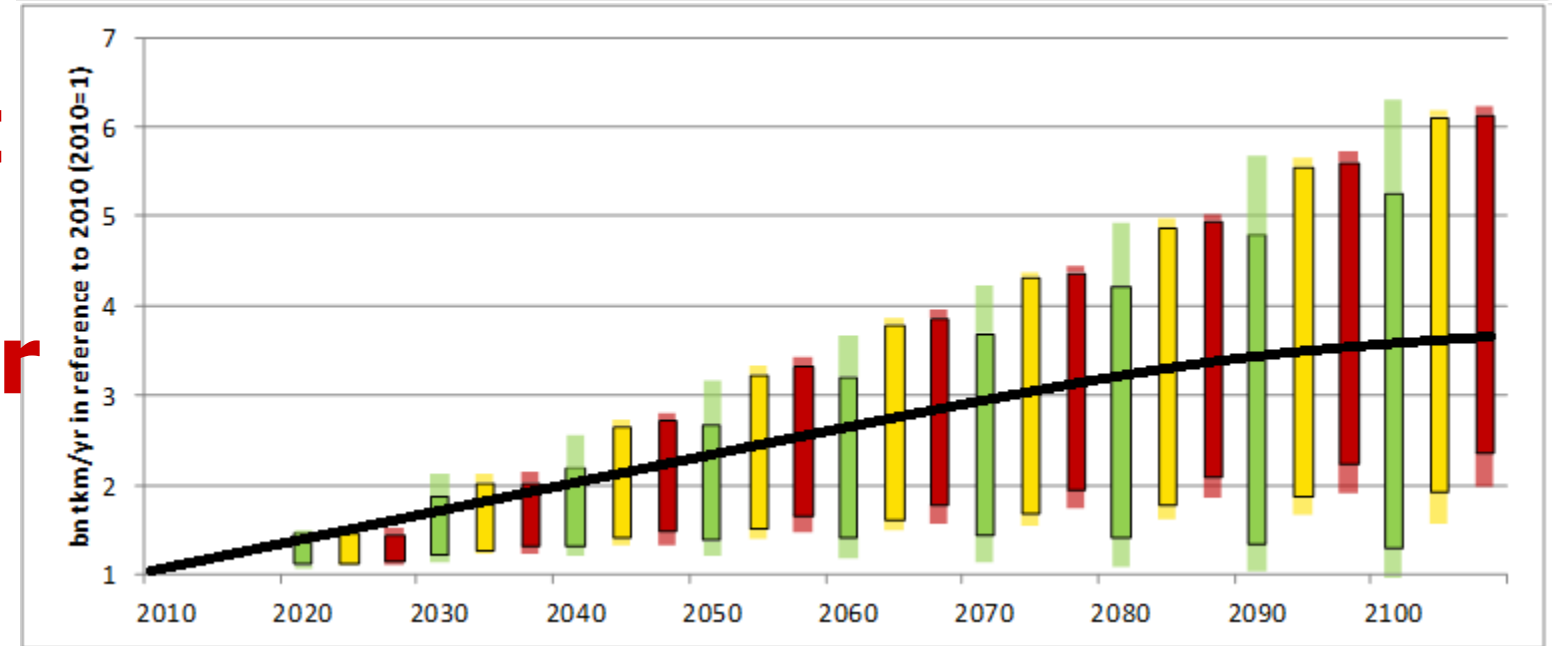
Transport – the other hard one!

BAU global transport demand projections compared with 2010 baseline (from 600 scenarios)

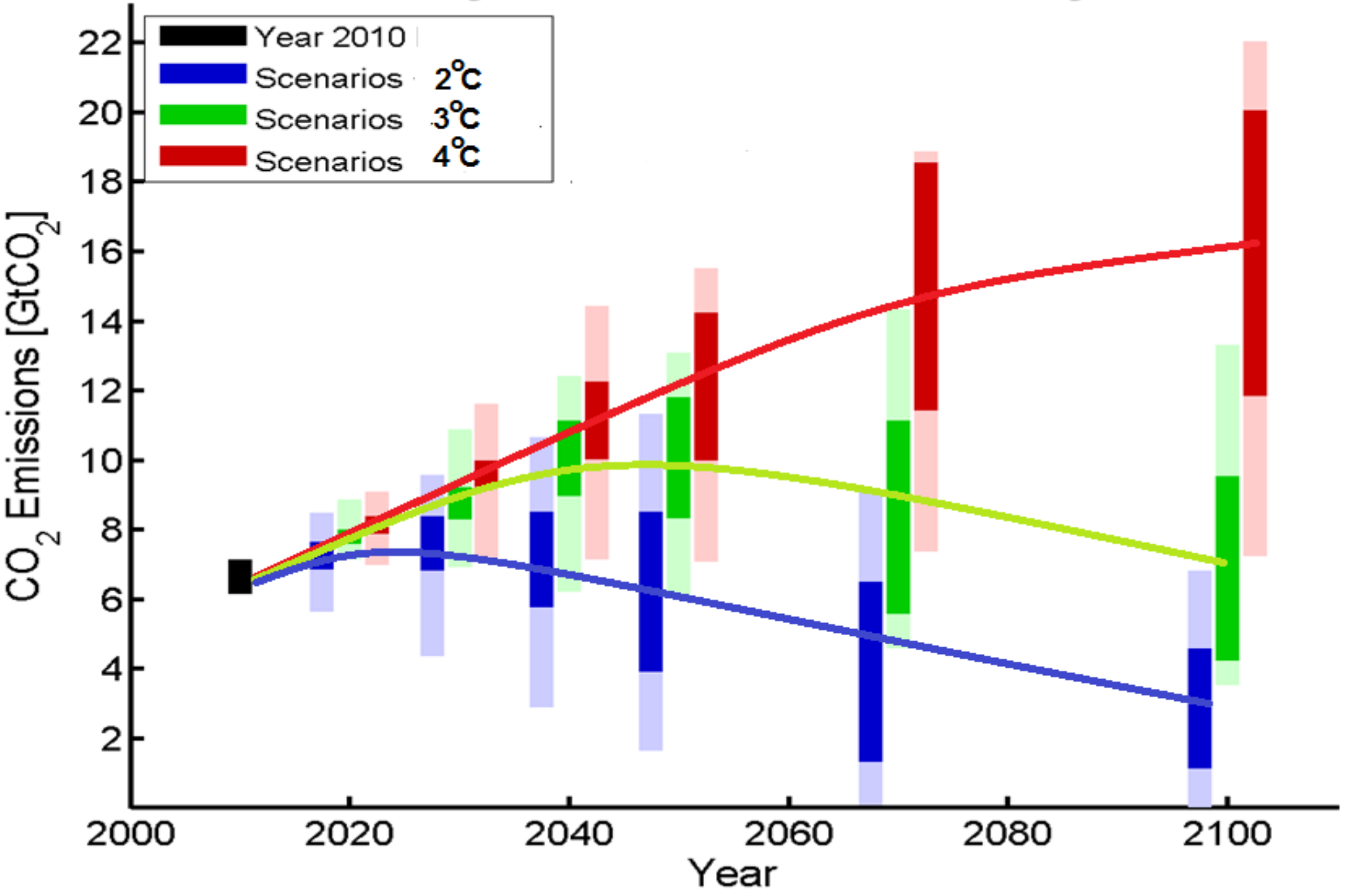
Billion passenger km /yr



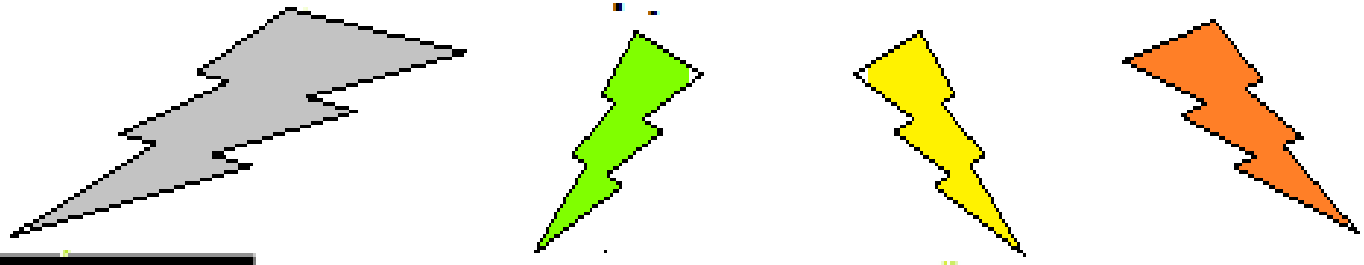
Freight billion t-km/yr



GHG reduction potential for all transport by reducing fuel carbon intensity and vehicle efficiency.



Global transport emissions ~22% CO_2



System - infrastructure. Modal choice	Fuel carbon intensity ($gCO_{2\text{-}eq}$/MJ)	Energy intensity (MJ / p km) (MJ / t km)	Activity (p km / yr) (t km / yr)
Urban form design. Roading / airports / railways / ports. Behavioural choice between modes: speed / comfort / cost / convenience.	Diesel Gasoline CNG LPG Biofuels Electricity Hydrogen	Light duty vehicles Heavy duty vehicles 2- and 3-wheelers Train /bus /aircraft Waterbourne craft Occupancy rate Cycling / walking	Number of journeys. Journey distance. Journey avoidance: - combining trips - internet shopping - video conferencing - tele-commuting.

$$\text{Total annual GHG emissions} = \sum_{\text{Modal shares}} \left(\sum_{\text{Fuels}} (\text{Fuel C intensity} * \text{Energy intensity} * \text{Activity}) \right)$$

From the suburbs, 250 people can travel to work or play in:

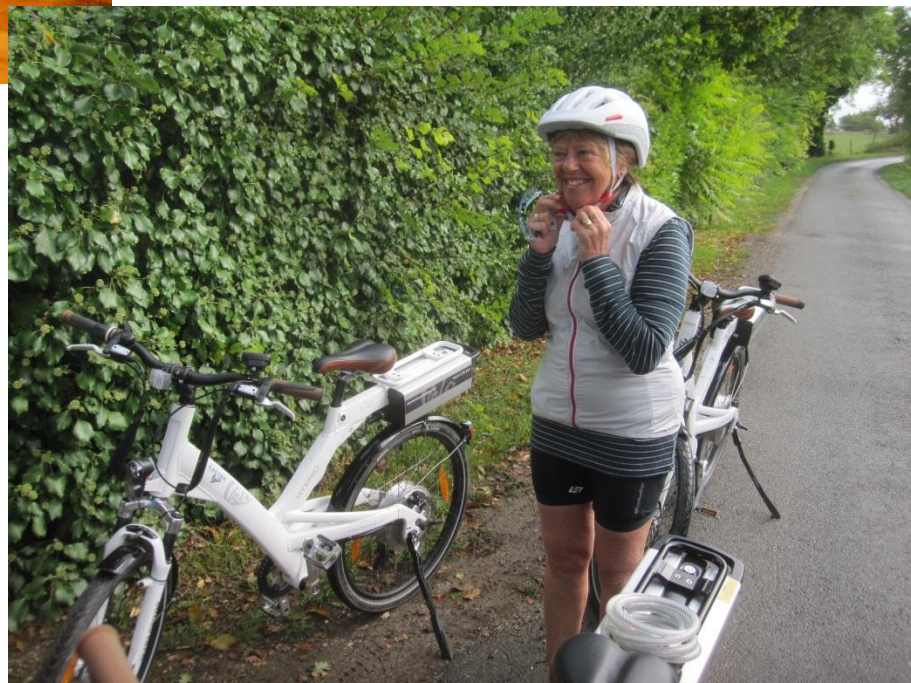
177 cars;

three buses;

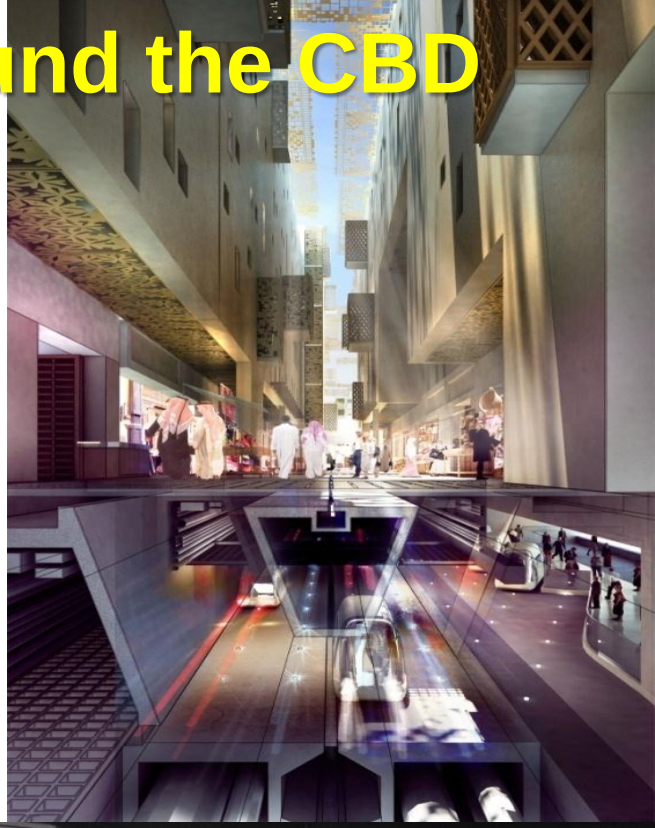
or one light rail unit.

Moving around the CBD

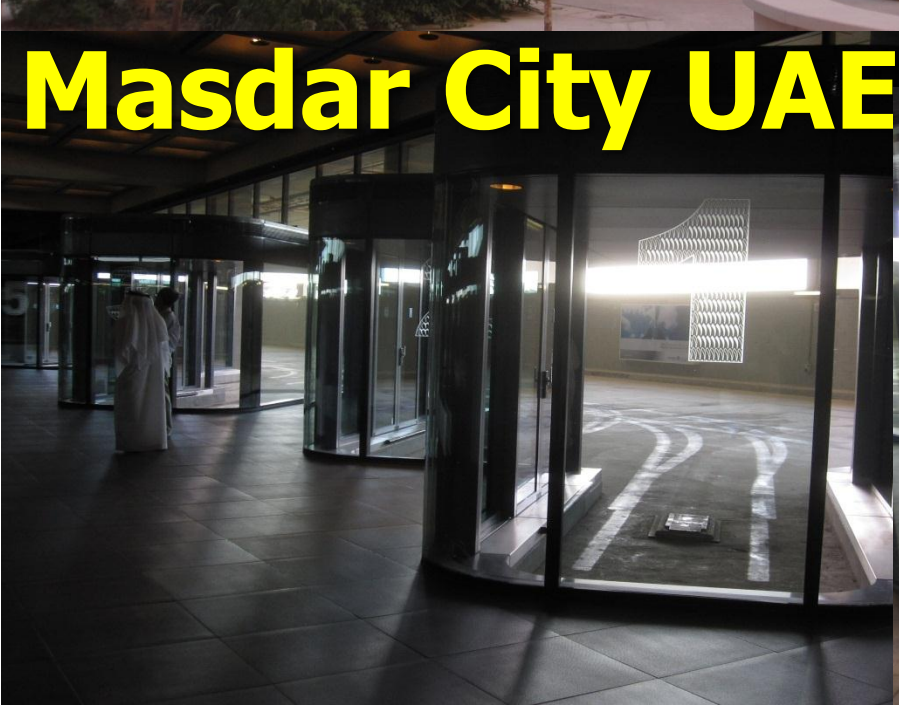
Moving around the CBD



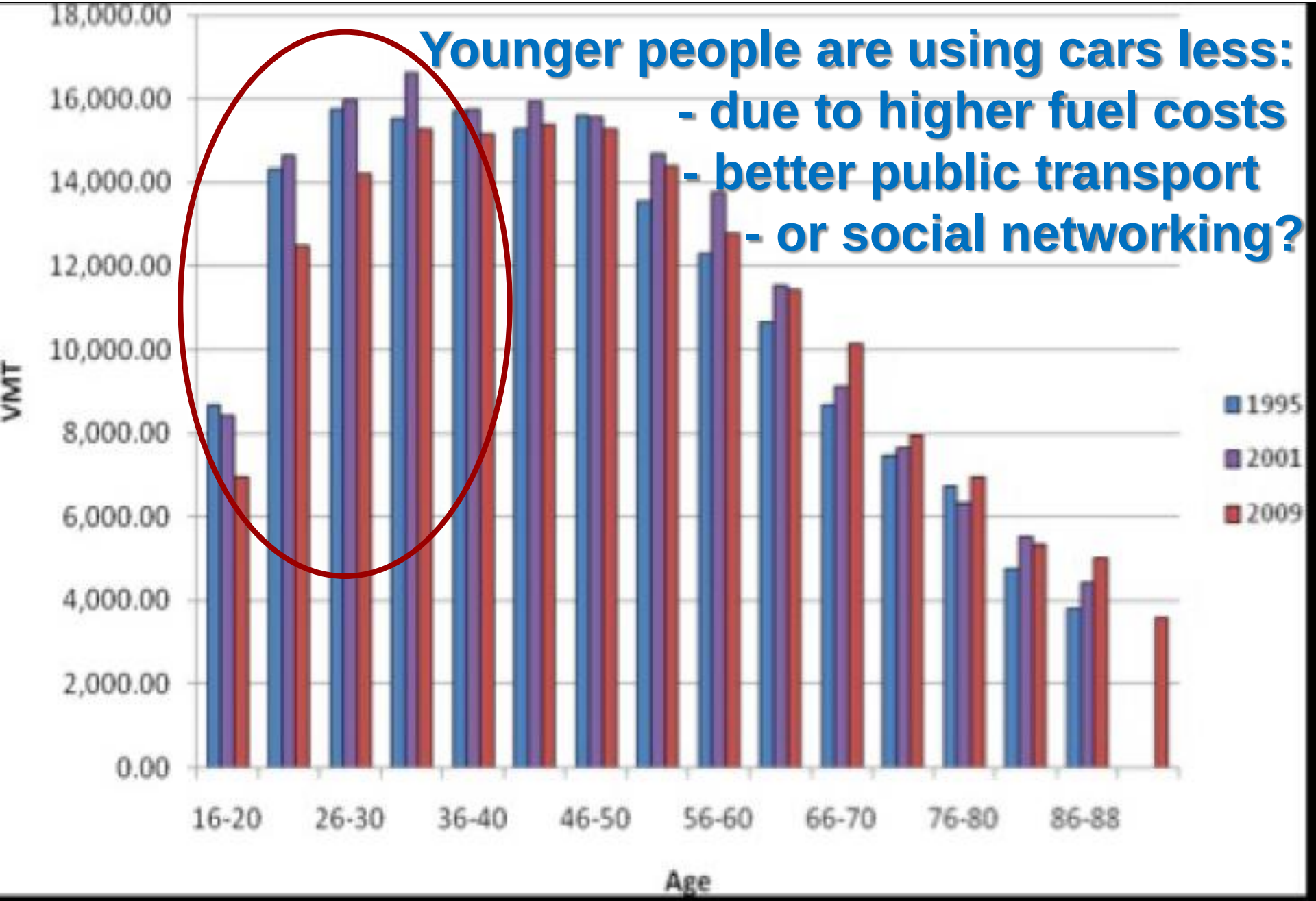
Moving around the CBD

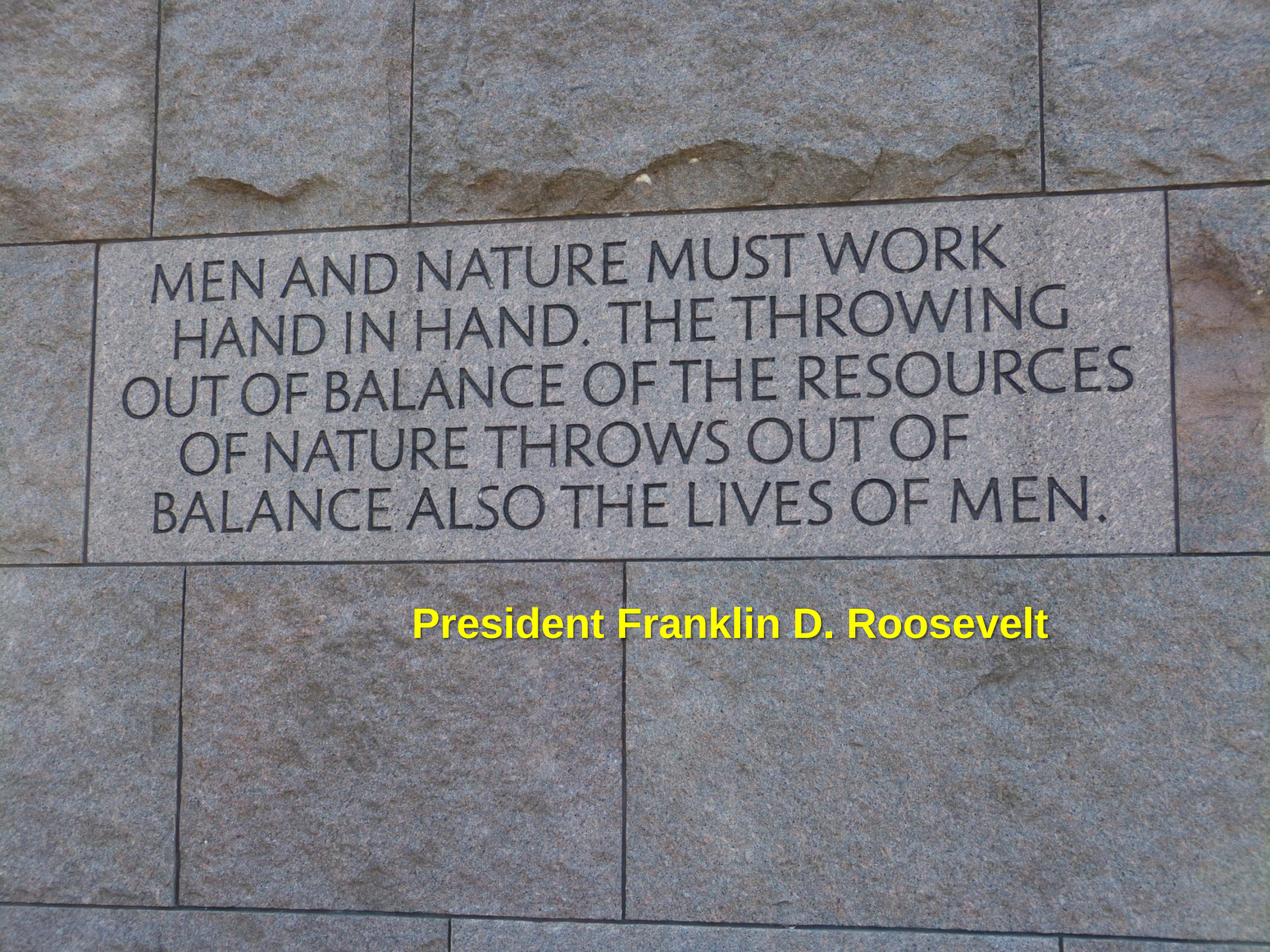


Masdar City UAE



Have we passed the age of “peak cars”?




MEN AND NATURE MUST WORK
HAND IN HAND. THE THROWING
OUT OF BALANCE OF THE RESOURCES
OF NATURE THROWS OUT OF
BALANCE ALSO THE LIVES OF MEN.
President Franklin D. Roosevelt