

The World needs more Energy and less CO₂

How can scenarios help policy makers and industry
to meet this dual challenge ?

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energy



SECURITY



CARBON

RESOURCES

TECHNOLOGY

ENERGY

The background features a complex arrangement of overlapping geometric shapes in shades of yellow, orange, and grey. A large, stylized grey 'V' shape is prominent in the upper right. A circular graphic with a globe-like pattern is centered behind the main text. Various text elements are scattered throughout: 'SECURITY' is written vertically in orange on the left; 'CARBON' is written horizontally in orange above the main text; 'RESOURCES' is written horizontally in grey to the left; 'TECHNOLOGY' is written vertically in grey to the right; and 'ENERGY' is written horizontally in white at the bottom. The main text is in a bold, dark blue font.

The World needs
more Energy
And less CO₂

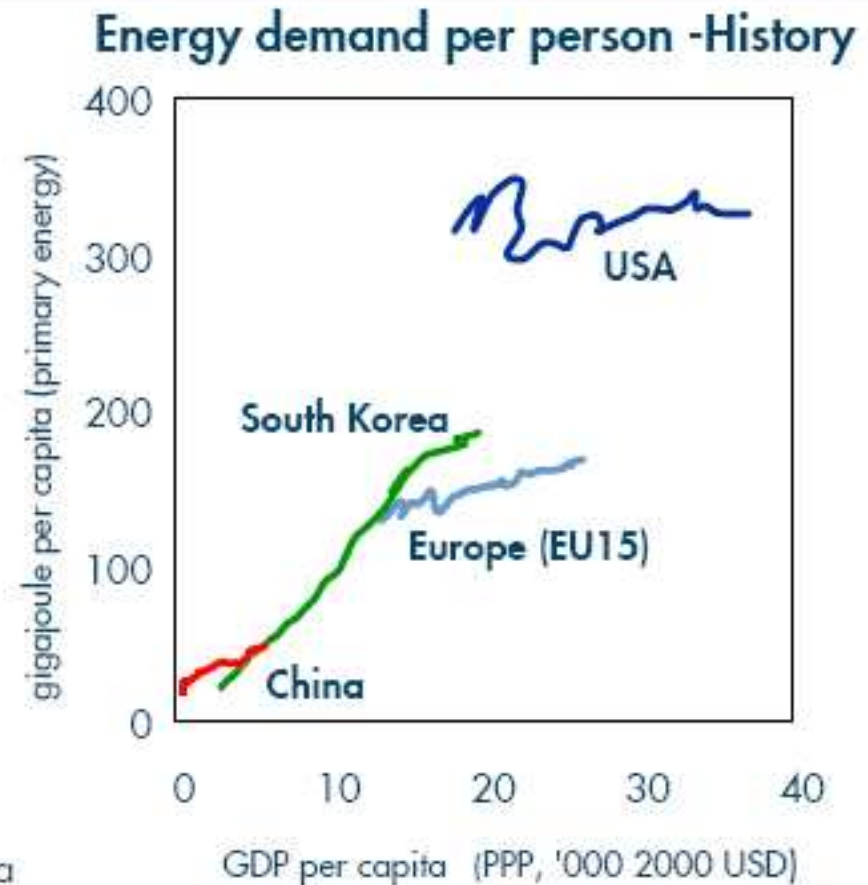
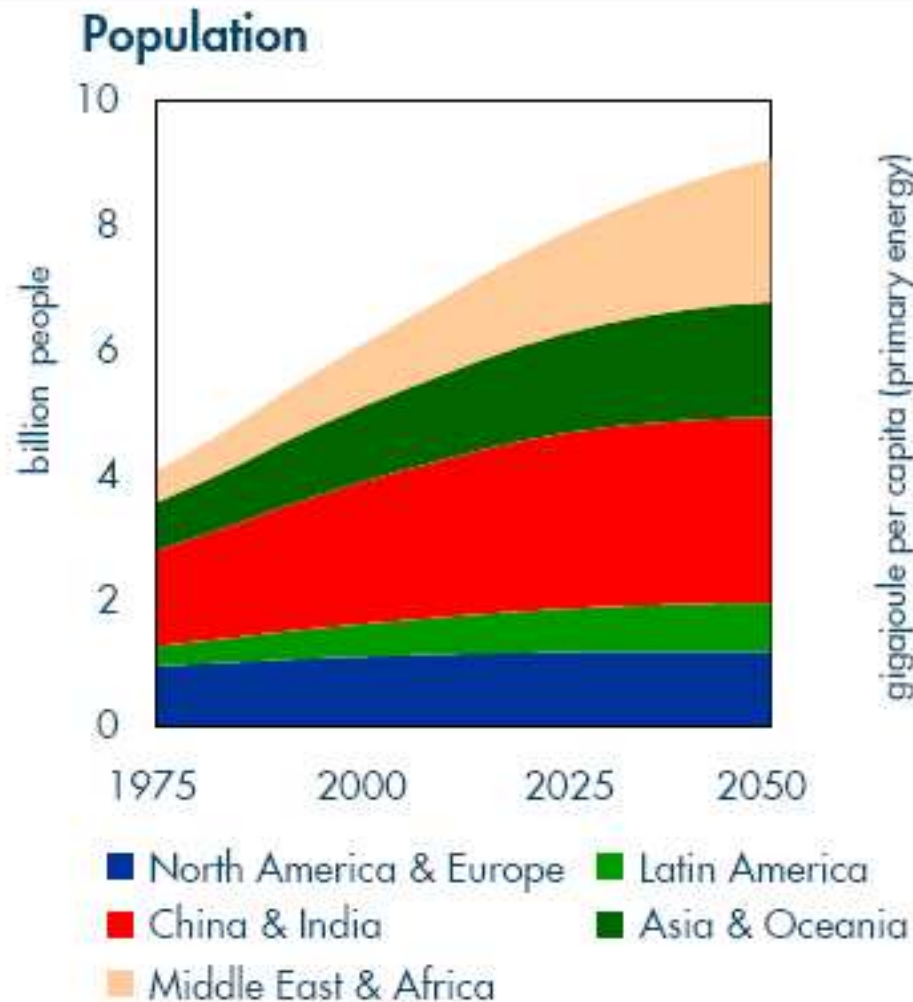
ENERGY

A People-Centred Map of the World



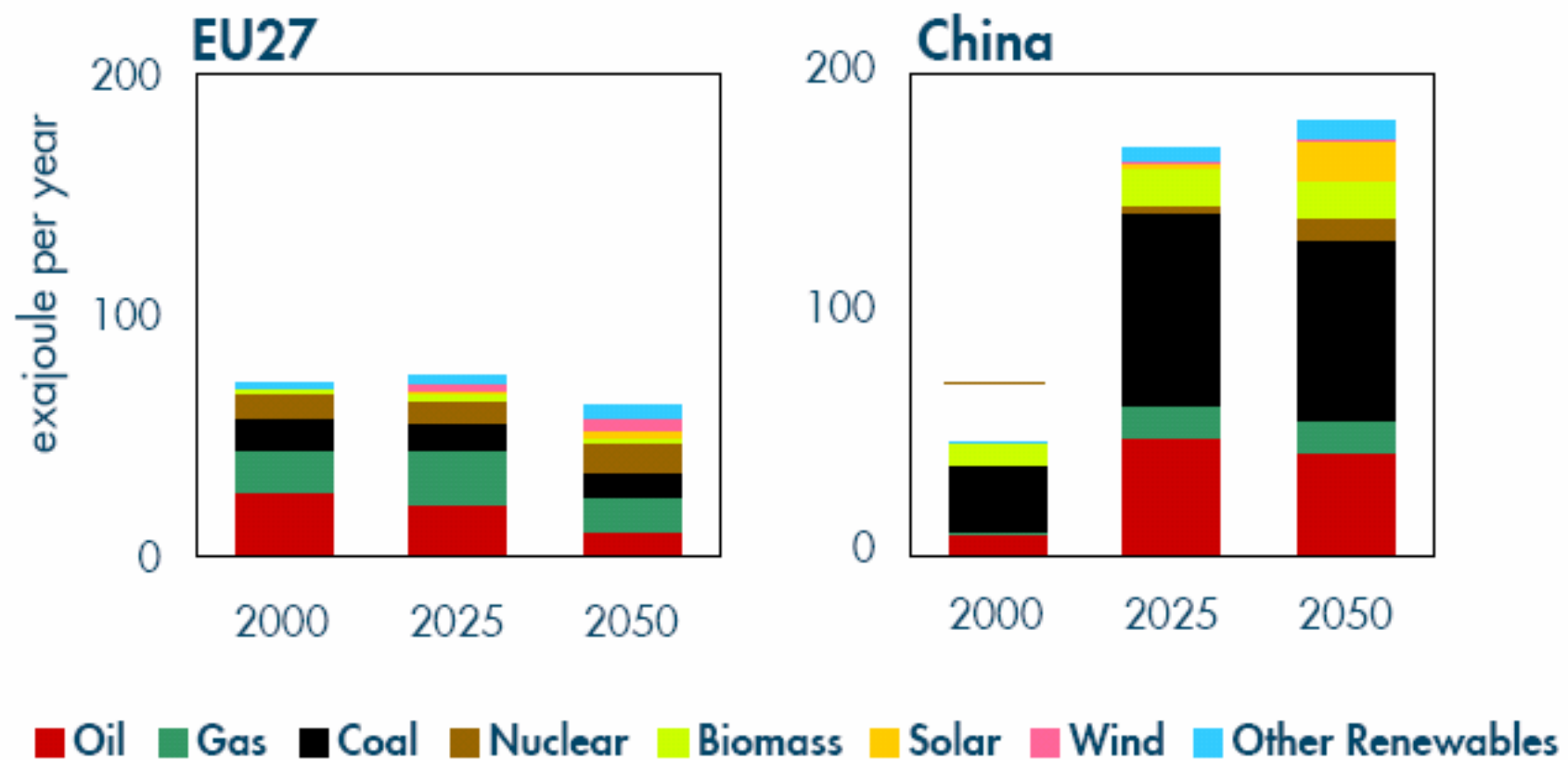
Year 2000; Source Mark Newman, University of Michigan

Growth in population and prosperity are key drivers of energy demand



Energy transitions are inevitable

Total primary energy demand (scenario example)

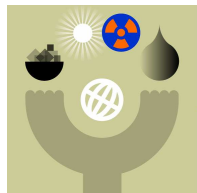


TINA : Three Hard Truths...

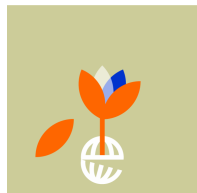
signal turbulent times ahead



- Global energy demand is accelerating

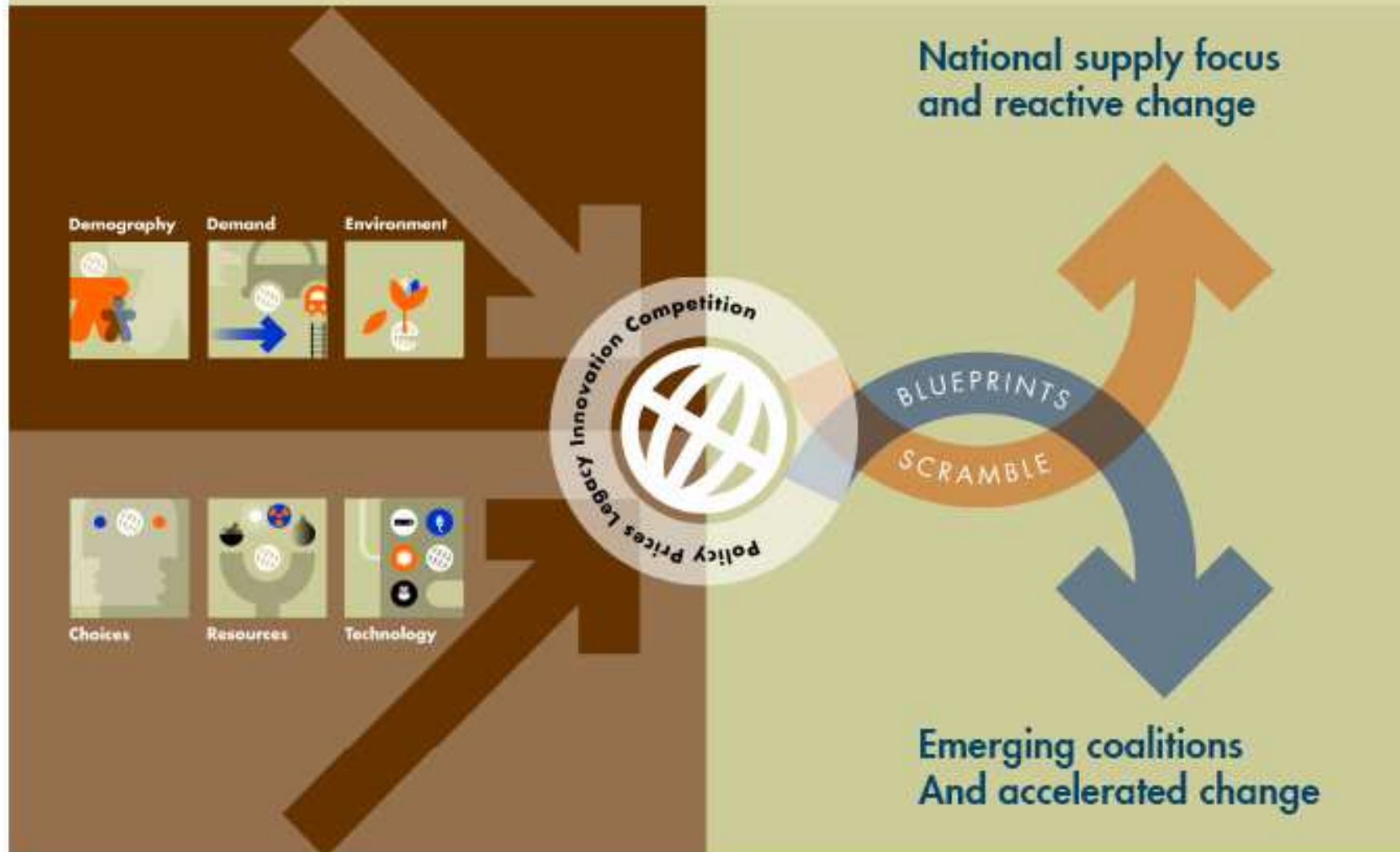


- Easy oil & gas supply will struggle to keep pace



- Flight into coal causes climate stresses & makes dealing with CO₂ imperative

Shell energy scenarios



Scramble - Security of supply and fear of losing economic growth

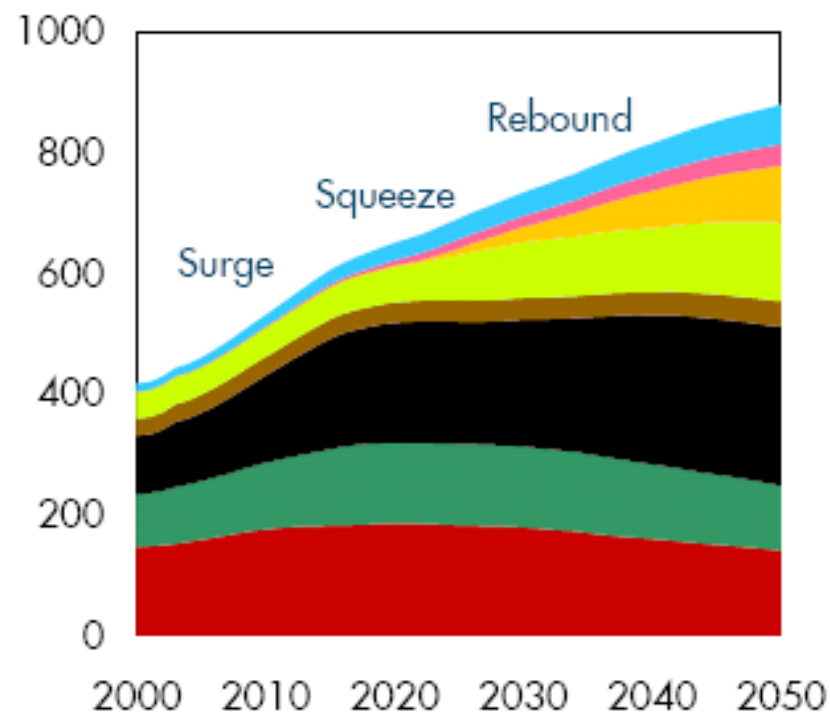


Scramble

What this means for energy



Total primary energy (EJ per year)



- Focus on existing infrastructure
- Sequential responses to hard truths
- Volatile energy prices
- Knee-jerk reactions to concerns
 - No effective carbon pricing
 - Adaptation
- Flight to coal, then biofuels
- Renewables forced in by mandates
- Patchwork of national standards

Events outpace Actions

■ Oil ■ Gas ■ Coal ■ Nuclear ■ Biomass ■ Solar ■ Wind ■ Other Renewables

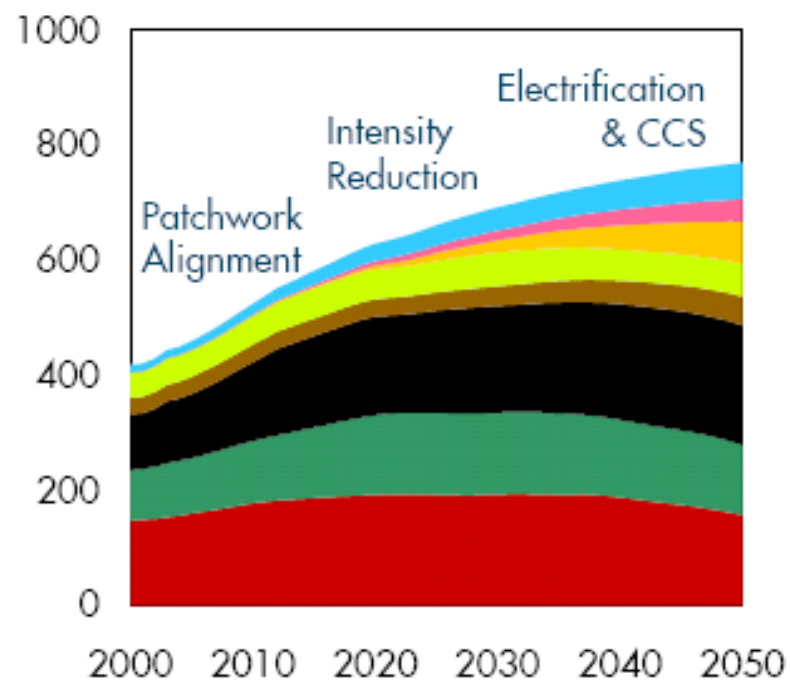
Blueprints – Energy security and sustainability



Blueprints What this means for energy



Total primary energy (EJ per year)

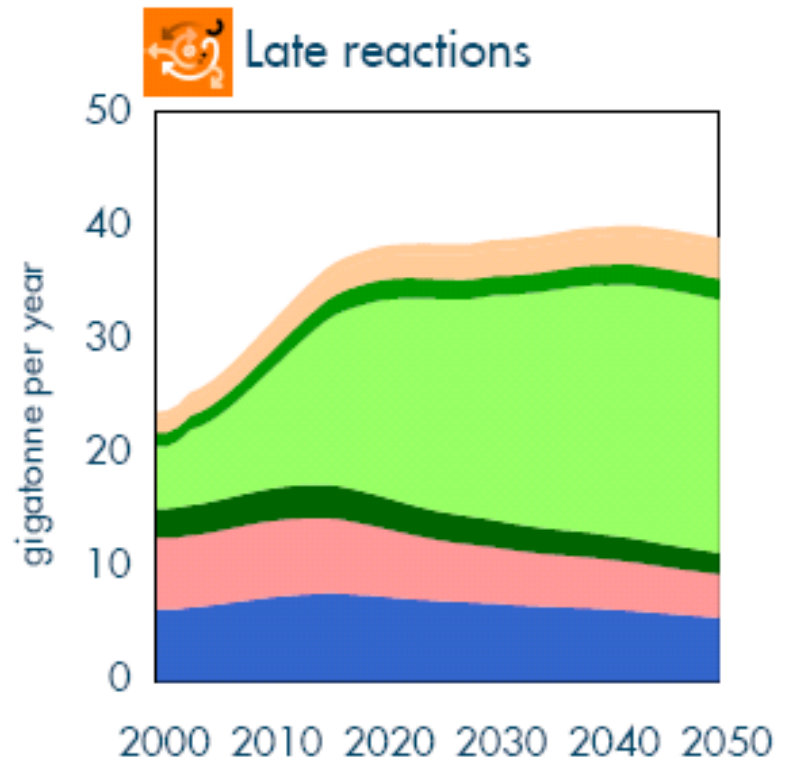


- Broader anticipation of challenges
- Critical mass of parallel responses to hard truths
- Effective carbon pricing established early
- Aggressive efficiency standards
- Growth shifts to electrification
- New infrastructure develops
- CCS emerges after 2020

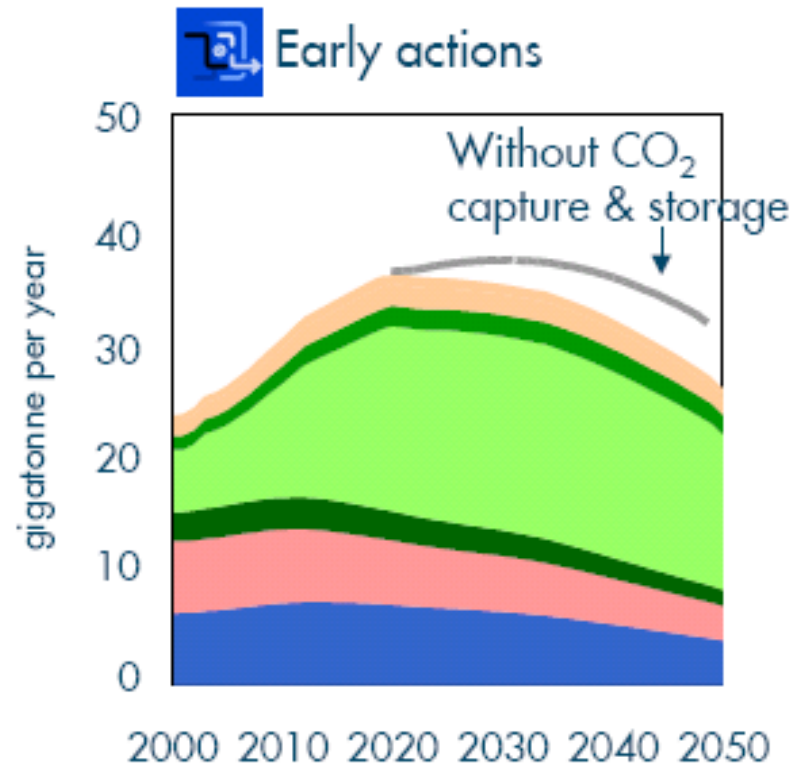
Actions outpace Events

■ Oil ■ Gas ■ Coal ■ Nuclear ■ Biomass ■ Solar ■ Wind ■ Other Renewables

Implications for direct CO₂ emissions from energy



- Europe
- Asia & Oceania - Developed
- Latin America



- North America
- Asia & Oceania - Developing
- Middle East & Africa

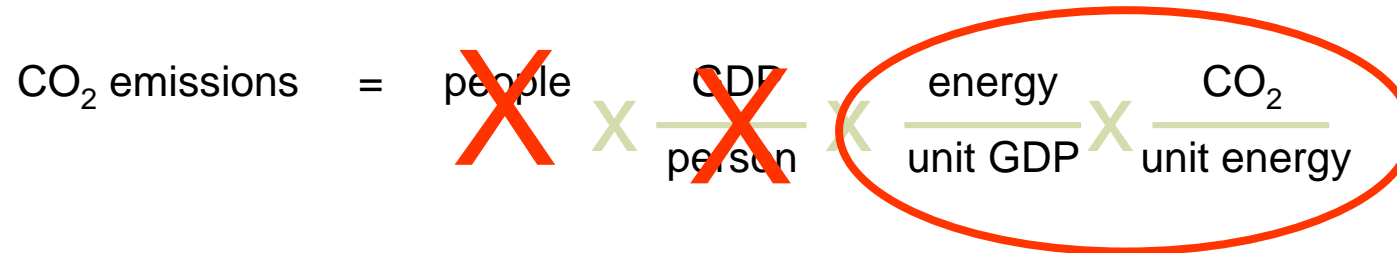
In summary – what we have learned



- The three hard truths are **very** hard
- Transition is both inevitable and necessary
- Technology plays a major role, but no silver bullets
- Political and regulatory choices are pivotal
- The next 5 years are critical

Tackling all three hard truths TOGETHER is essential for a sustainable future

4 Factors determine CO2 Emissions

$$\text{CO}_2 \text{ emissions} = \text{people} \times \frac{\text{GDP}}{\text{person}} \times \frac{\text{energy}}{\text{unit GDP}} \times \frac{\text{CO}_2}{\text{unit energy}}$$


Only four factors govern the outcome, being:

- Population Number of people
- Standard of Living GDP per person
- Energy Intensity Energy per unit of GDP (efficiency of the economy)
- Carbon Intensity CO2 per unit of energy (reflects the energy source)

Options for change – enabling technologies

Emission reduction (CO₂ / unit energy)



A further shift to natural gas



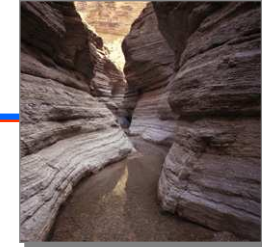
Nuclear power



Renewables



Bio-products



Carbon capture and storage

Energy conservation and efficiency (energy / unit GDP)



Mass transportation



Road transport



Buildings



Low energy appliances



Doing things differently

TANIA: There Are No Ideal Answers...

So work on several solutions

- Make Energy Efficiency top priority today

AND

- Develop sustainable low CO2 alternatives

AND

- Enable CCS, to be prepared for the “Flight into Coal” without the CO2 downside

AND

- Fill EU Talent Pipeline for Innovation



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