# Shell energy scenarios to 2050

## An era of revolutionary change

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Challenges in the Transition to a Low Carbon Economy
University of Warwick, 13 July 2009

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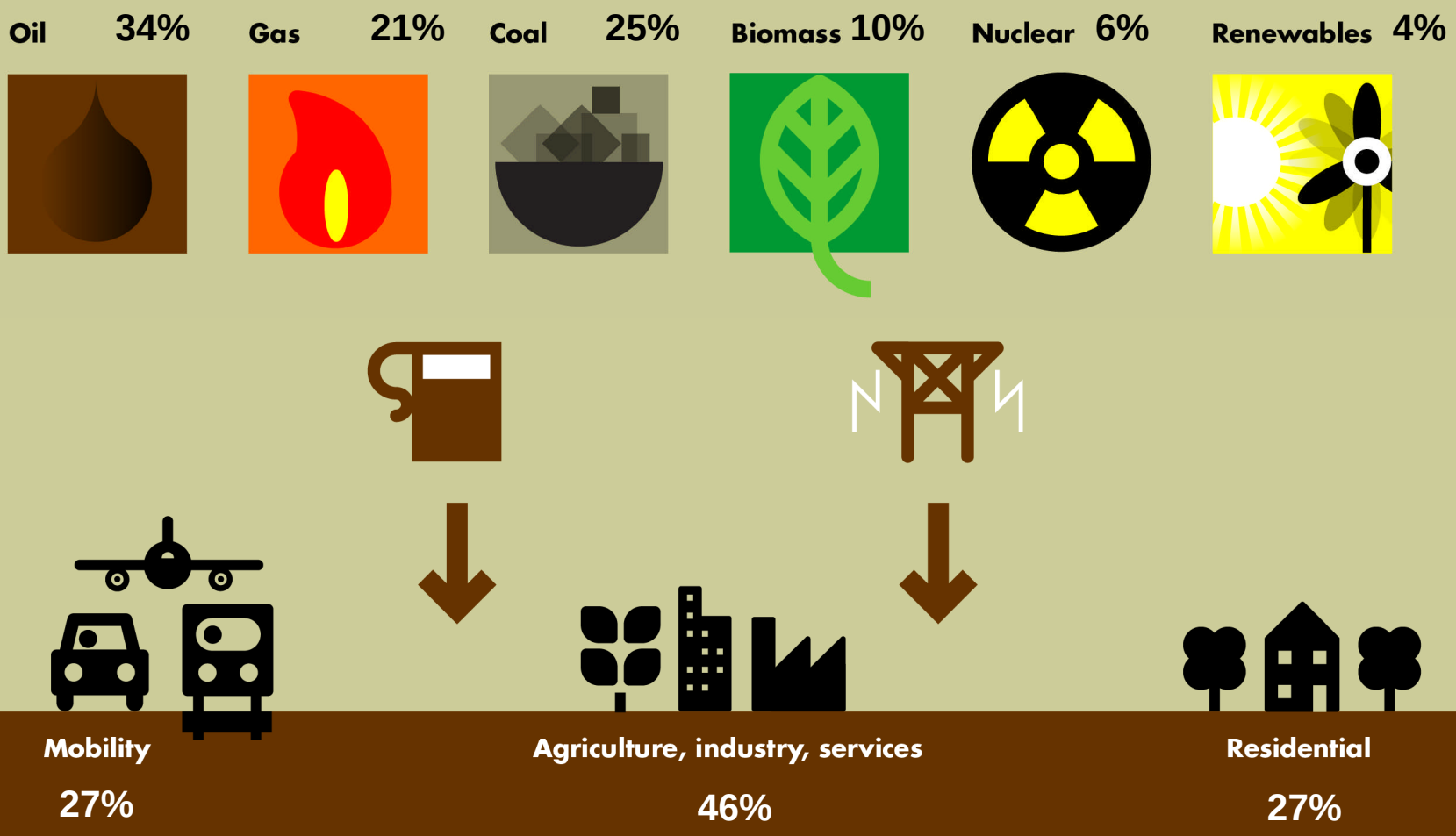
# The energy system today sets the context for the future




Source: Shell International BV; UN Population Division

**World population 6.6 bln; 50% in urban environment**

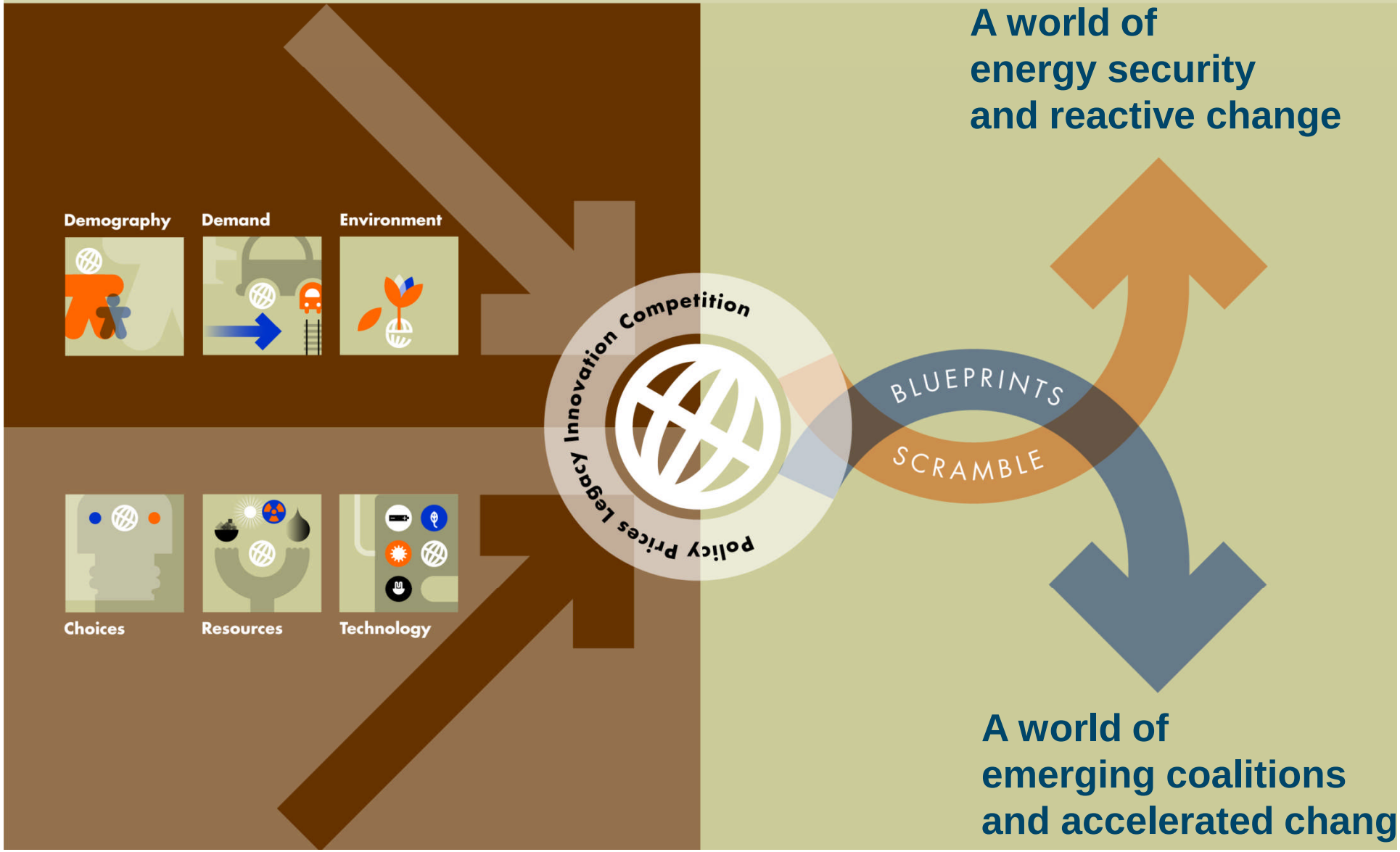
# Three Hard Truths

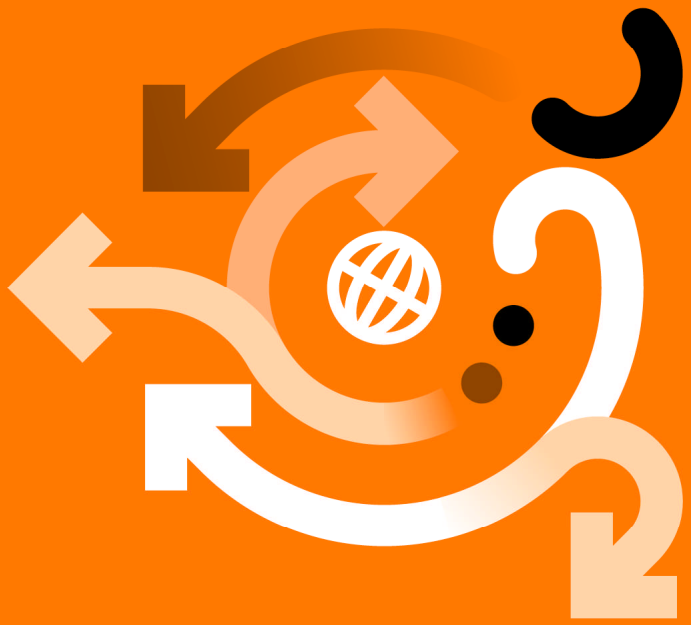
- **Surging energy demand**
- **Supply will struggle to keep pace**
- **Environmental stresses are increasing**

# Fundamental drivers to 2050

- World population will rise to 9 billion
- Five fold increase in real GDP
- Doubling of energy use
- Fossil fuels plateau in 2020s
- Need huge renewables growth
- Hard truths are inevitable

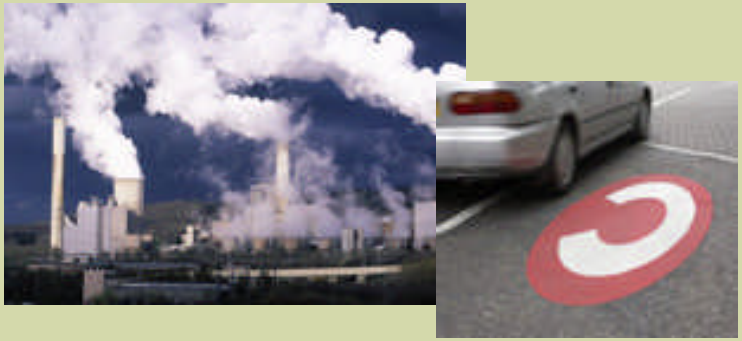
# Shell energy scenarios help us to imagine alternative futures





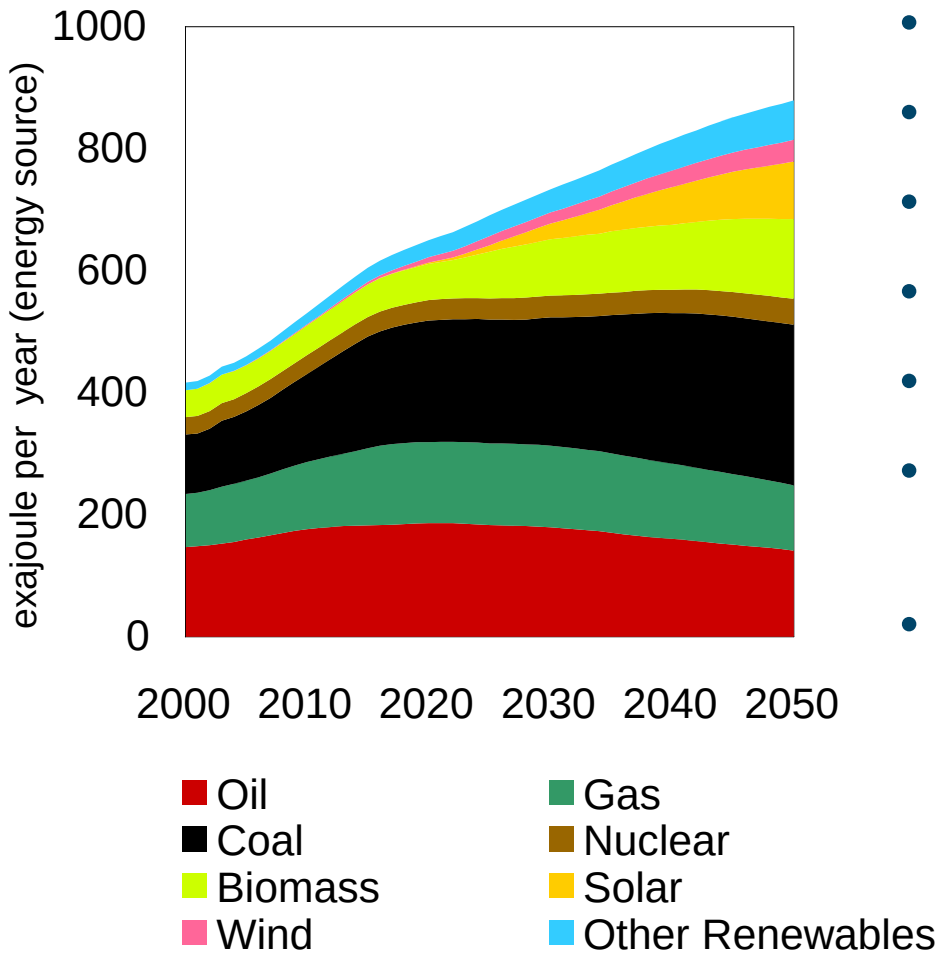
SCRAMBLE

# **Scramble** - Security of supply and fear of losing economic growth



# What this means for energy

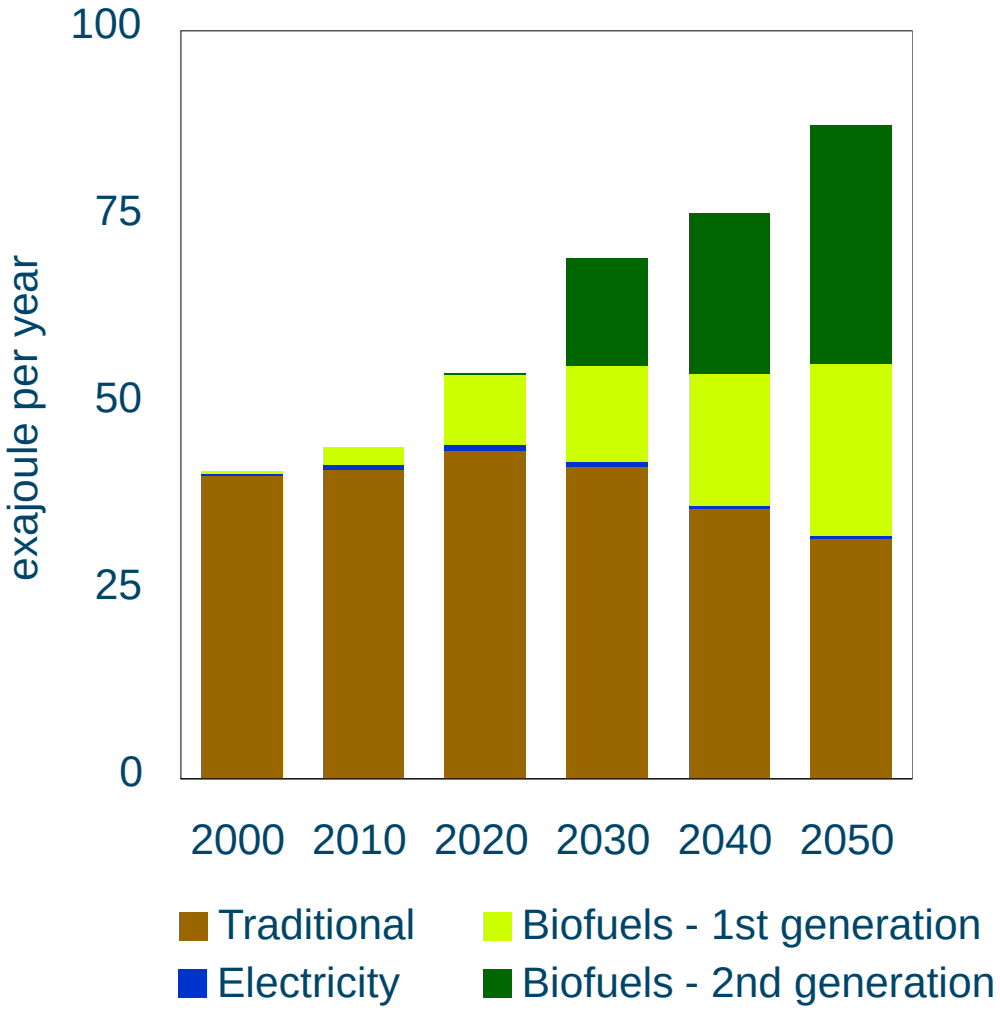
**Total primary energy supply/demand**




- Focus on existing infrastructure
- Sequential responses to hard truths
- Flight to coal, then biofuels
- Volatile energy prices
- Renewables forced in by mandates
- Eventual governments turn to efficiency measures
- Knee-jerk reactions to climate events
  - But no effective carbon pricing
  - Focus on adaptation

Source: Shell International BV and Energy Balances of OECD and Non-OECD Countries©OECD/IEA 2006

# Scramble - Biomass diversifies liquid fuel mix



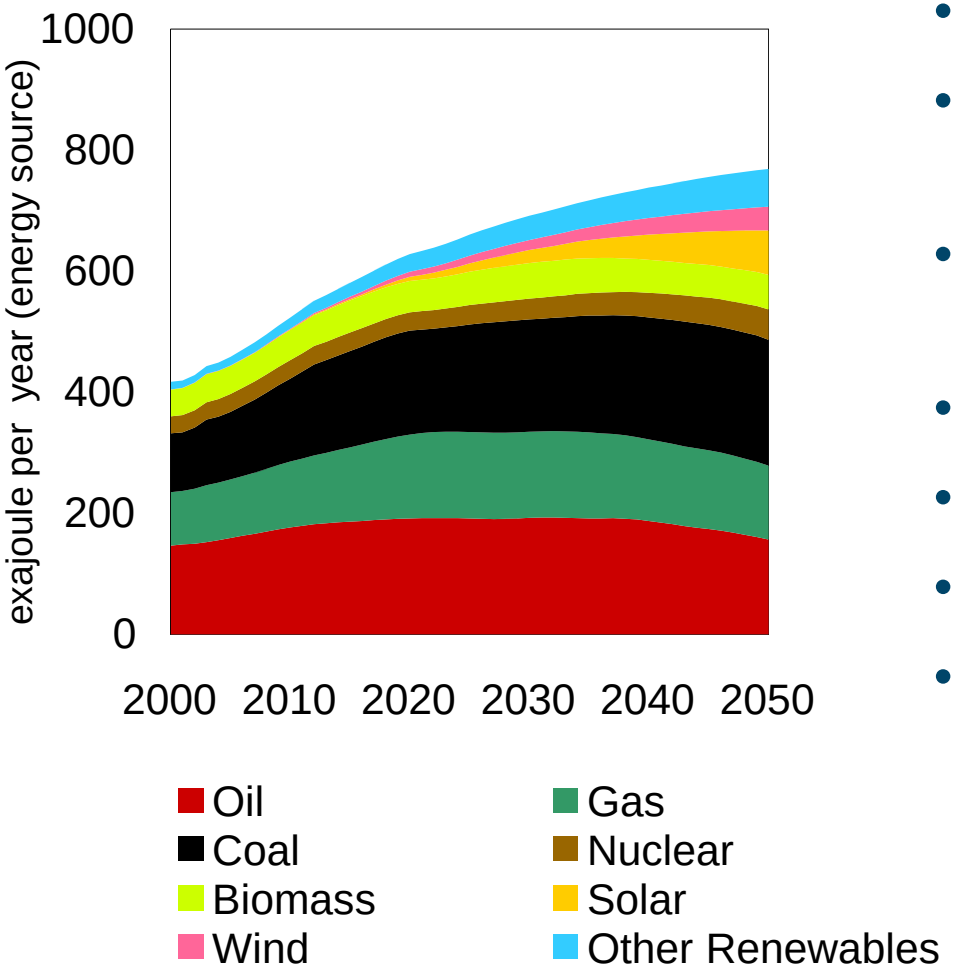

Source: Shell International BV and Energy Balances of OECD and Non-OECD Countries©OECD/IEA 2006

# BLUEPRINTS

# **Blueprints - e**nergy security and sustainability


# What this means for energy

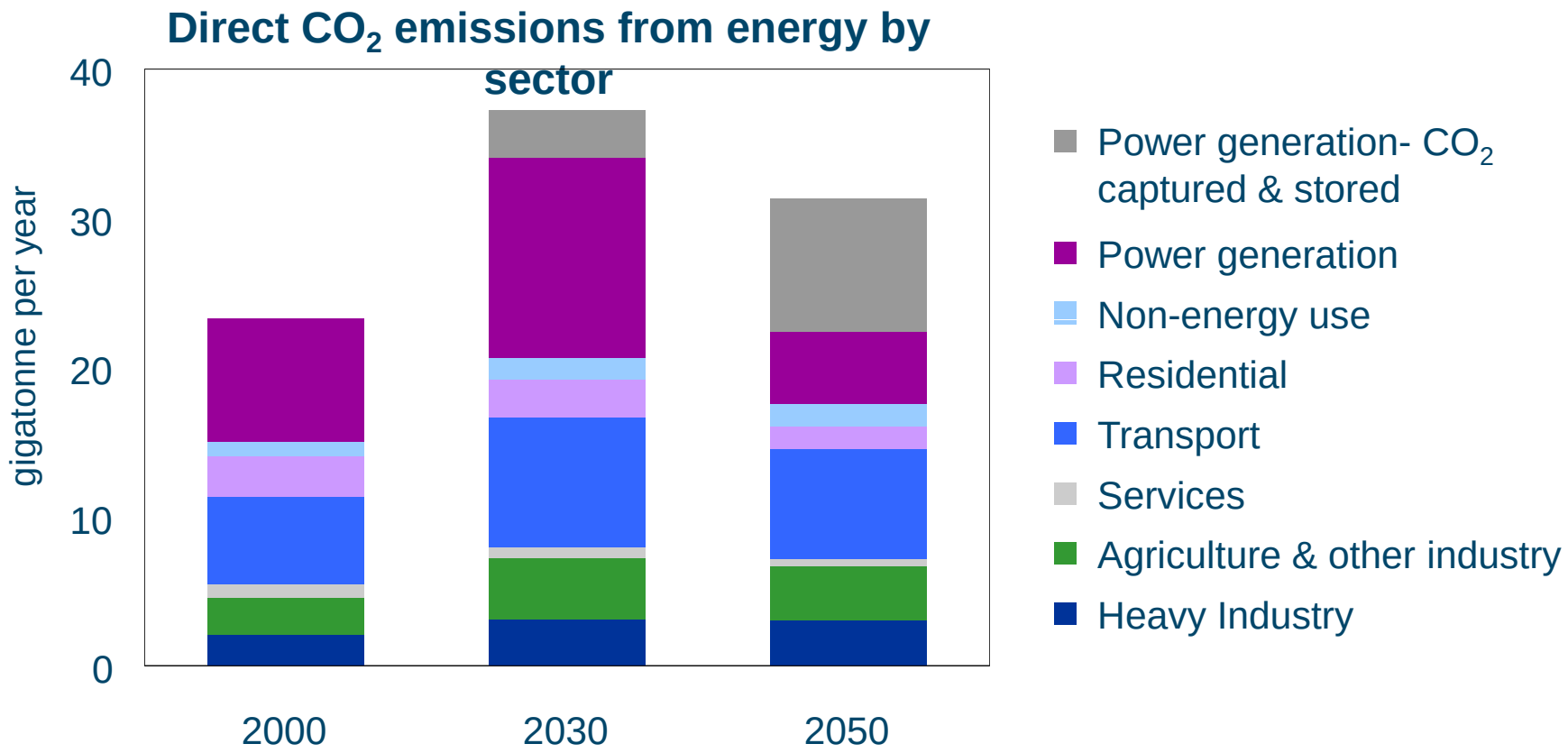
**Total primary energy supply/demand**




- 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

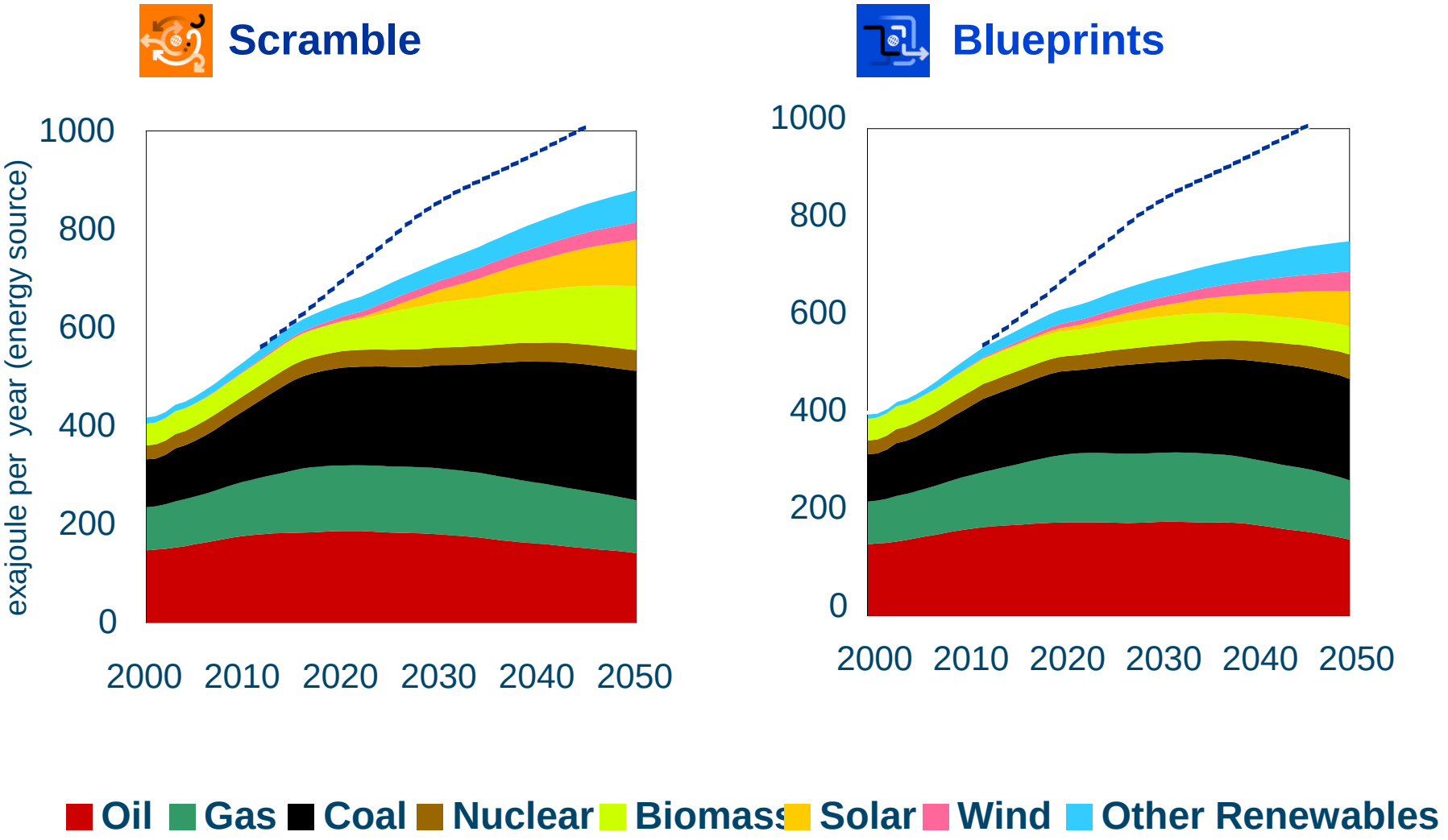
Source: Shell International BV and Energy Balances of OECD and Non-OECD Countries©OECD/IEA 2006

# Blueprints – $CO_2$ capture and storage abates ~30% of total emissions by 2050




Source: Shell International BV and Energy Balances of OECD and Non-OECD Countries©OECD/IEA 2006

# Comparing the scenarios' energy mix

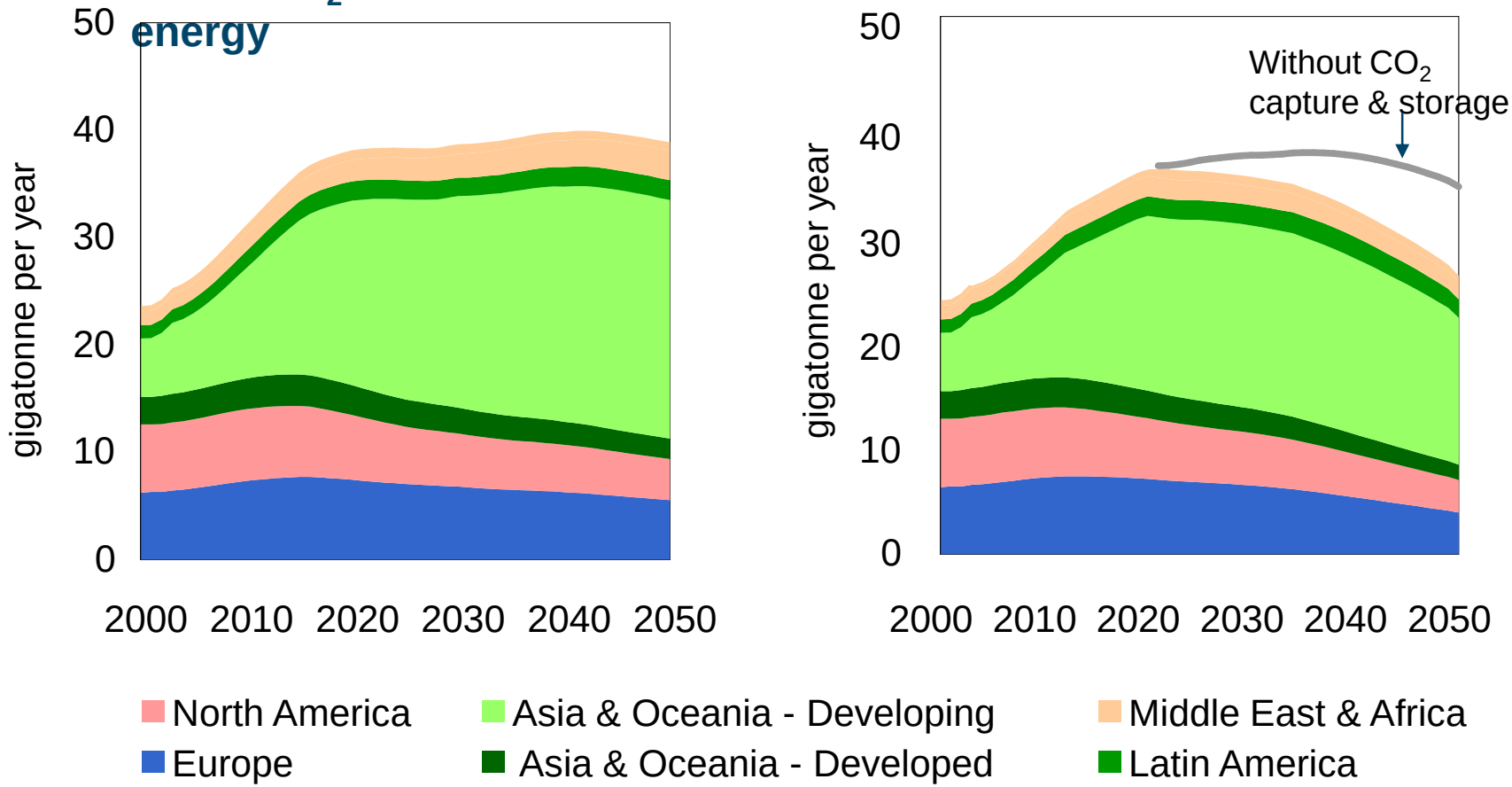



Source: Shell International BV and Energy Balances of OECD and Non-OECD Countries©OECD/IEA 2006

# Implications for direct $CO_2$ emissions from energy

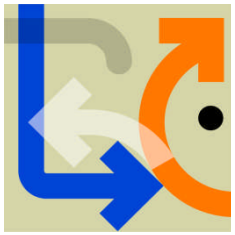
**Scramble** - Late reactions

**Blueprints** - Early actions




Source: Shell International BV and Energy Balances of OECD and Non-OECD Countries©OECD/IEA 2006

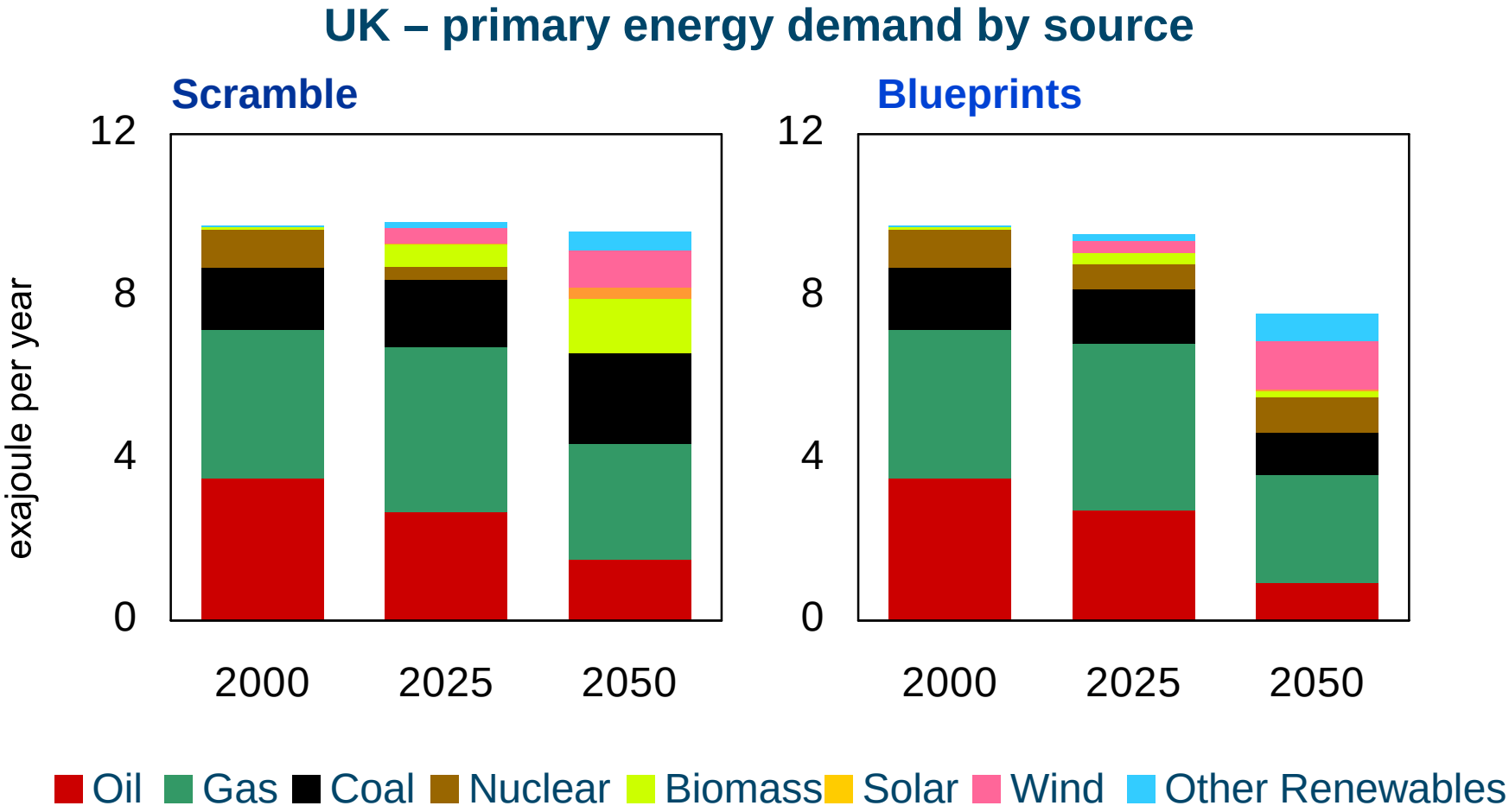
# What have we learned?



- 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

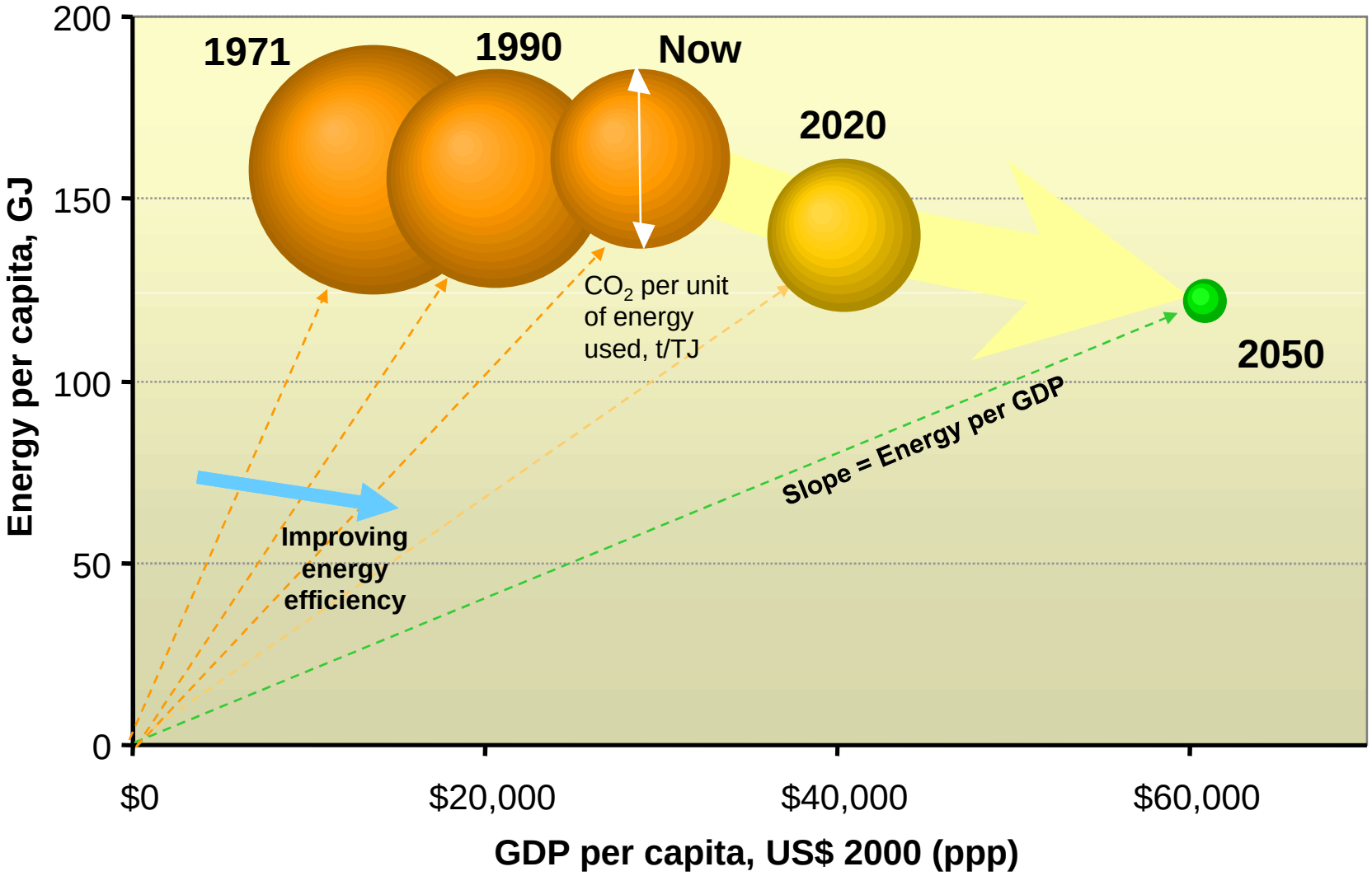
# UK scenarios have lower demand than business as usual, Blueprints ~ 33% less




Source: Shell International BV and Energy Balances of OECD and Non-OECD Countries©OECD/IEA 2006

# Pathways to 2050 for the UK (illustrative)

Sharp declines needed in both energy/GDP and $CO_2$/ energy



# Things to do over the next 4000 days

- Five large-scale (1 GW) coal fired power stations with carbon dioxide capture and storage
- Maintain nuclear and add one net power station
- Build 20 “London Array” scale wind farms
- Swap most of the vehicle fleet for high efficiency (like the Toyota Prius) models
- 10% of vehicle fuel from bio-alternatives
- Half-million “electric” cars on the road
- Reduce total residential energy use by 10%

# What is Shell doing?

- Increasing our own efficiency
- Helping our customers use less energy and emit less $CO_2$
  - Shell Fuel Economy Formula
  - Save more than fuel campaign
- R&D into efficient technologies and cross-industry collaboration
  - Shell Global Solutions energy management programmes
  - Shell Eco-marathon
- Establishing capability in Carbon Capture and Storage
- Aggressively developing low $CO_2$ sources of energy
- Working with governments for more effective $CO_2$ regulation

# Shell advocates $CO_2$ regulation

We ask governments to lead in regulating:

- Cap and trade $CO_2$ market
- Incentives for $CO_2$ Capture and Storage
- Targets for renewables sources of electric power
- Transport sector measures
- Building and appliances efficiency standards