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Why Muddling Through Wont Do

The need for systemic approaches to delivering energy and climate security

Nick Mabey, E3G

January 2010

Outline

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- Introduction
- Systems Challenges in Day to Day Government
- Examples from E3G's Work
  - Power Sector Decarbonisation
  - Low Carbon Innovation
  - Climate Security
  - Natural Resources and Corruption
- Some critical systems issues in the climate and energy debate?
- Implementing systems thinking in real decision making

Background

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- Non-profit, public interest European organisation with a global scope
- Founded in 2005 with mission to "accelerate the transition to sustainable development"
- Carries out coalition building, advice and institutional design working across energy, environment, security, diplomatic and economic sectors

My Background (abridged)

- UK Prime Ministers Strategy Unit: Energy, Climate Change, Security Policy
- FCO Environment Policy Department
- Climate and energy research at London Business School and MIT

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The Reality of Decision Making?

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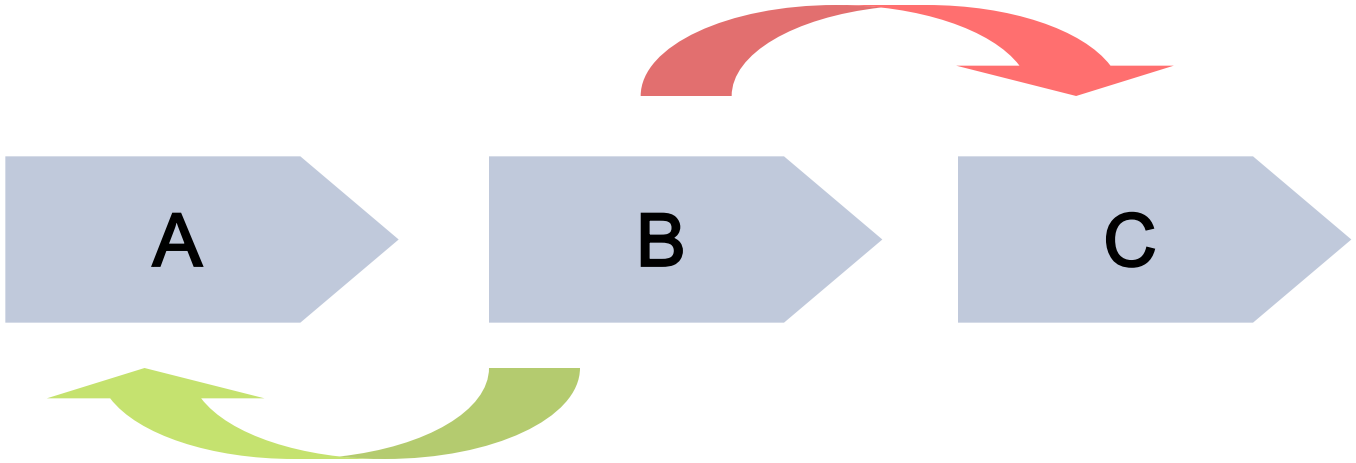
'There is nothing a government hates more than to be well-informed; for it makes the process of arriving at decisions much more complicated and difficult'

John Maynard Keynes

What is Systems Thinking?



- Systems show non-intuitive behaviour
- Systems are prone to boom and bust cycles
- Systems "control" must include all elements

At a trivial level everything is a system. But when are system characteristics material for policy making?

Systems thinking works best in the knowable domain; complexity requires different tools

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Complex Cause and effect only coherent in retrospect and do not repeat	**Knowable** Cause and effect separated in space and time
Chaos No cause and effect relationships perceivable	**Known** Cause and effect relationships are clear, repeat and can be predicted

Systems Thinking in Day to Day Government

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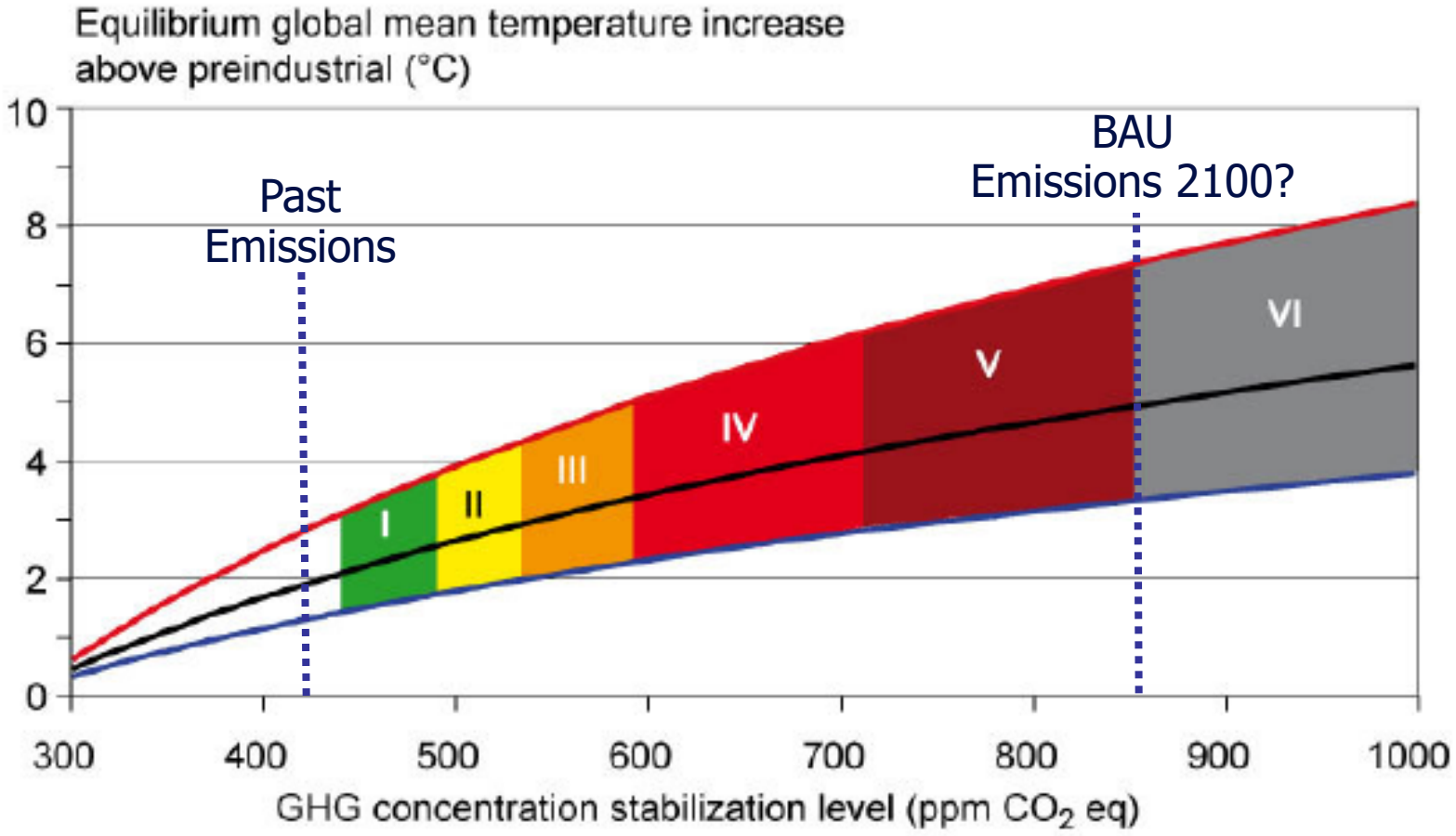
Governments' interest in systems thinking is to deliver:

- **better decisions**;
- map **unintended consequences** of actions;
- counter tendencies to **silo/departmental thinking**
- communicate assumptions to **stakeholders**

Speed of policy cycle and complexity of issues means that a broad understanding of systems concepts is often as useful as full models

Past GHG emissions will result in 1.6C warming. Business as Usual will result in a rise of up to 6.5C by 2100



Source: IPCC, 2007

Impact estimates are increasing

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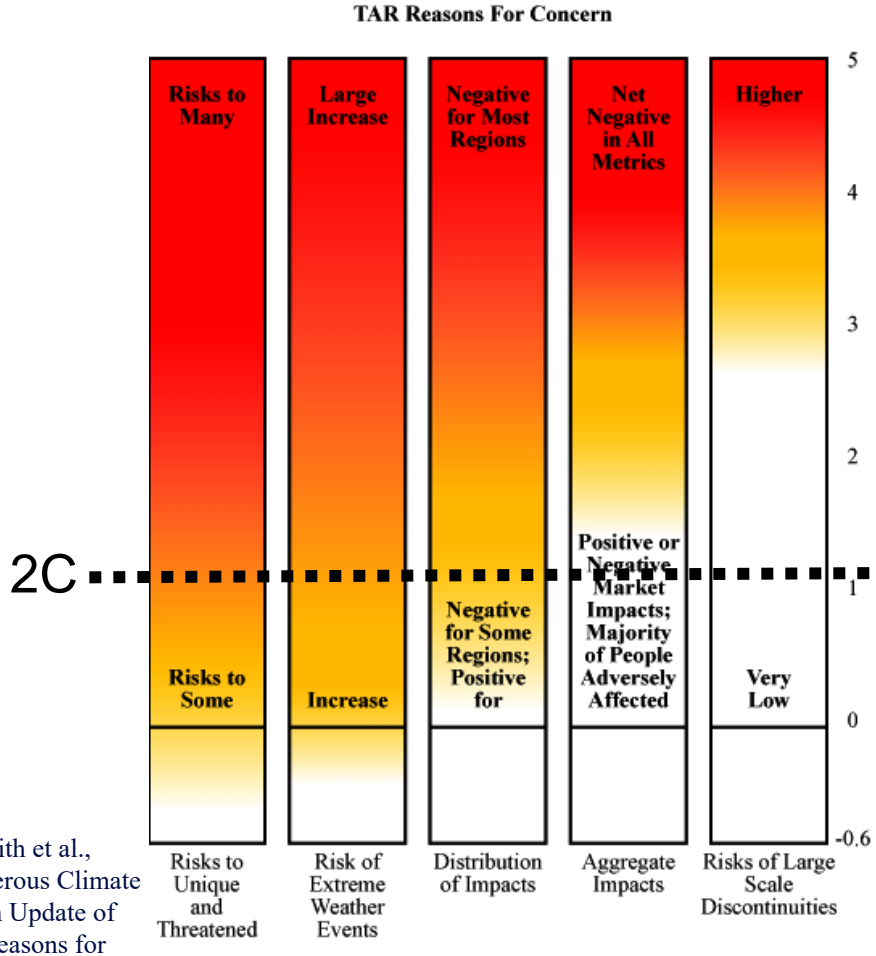

Source: Smith et al., 2007 Dangerous Climate Change: An Update of the IPCC Reasons for Concern

There are surprises out there!

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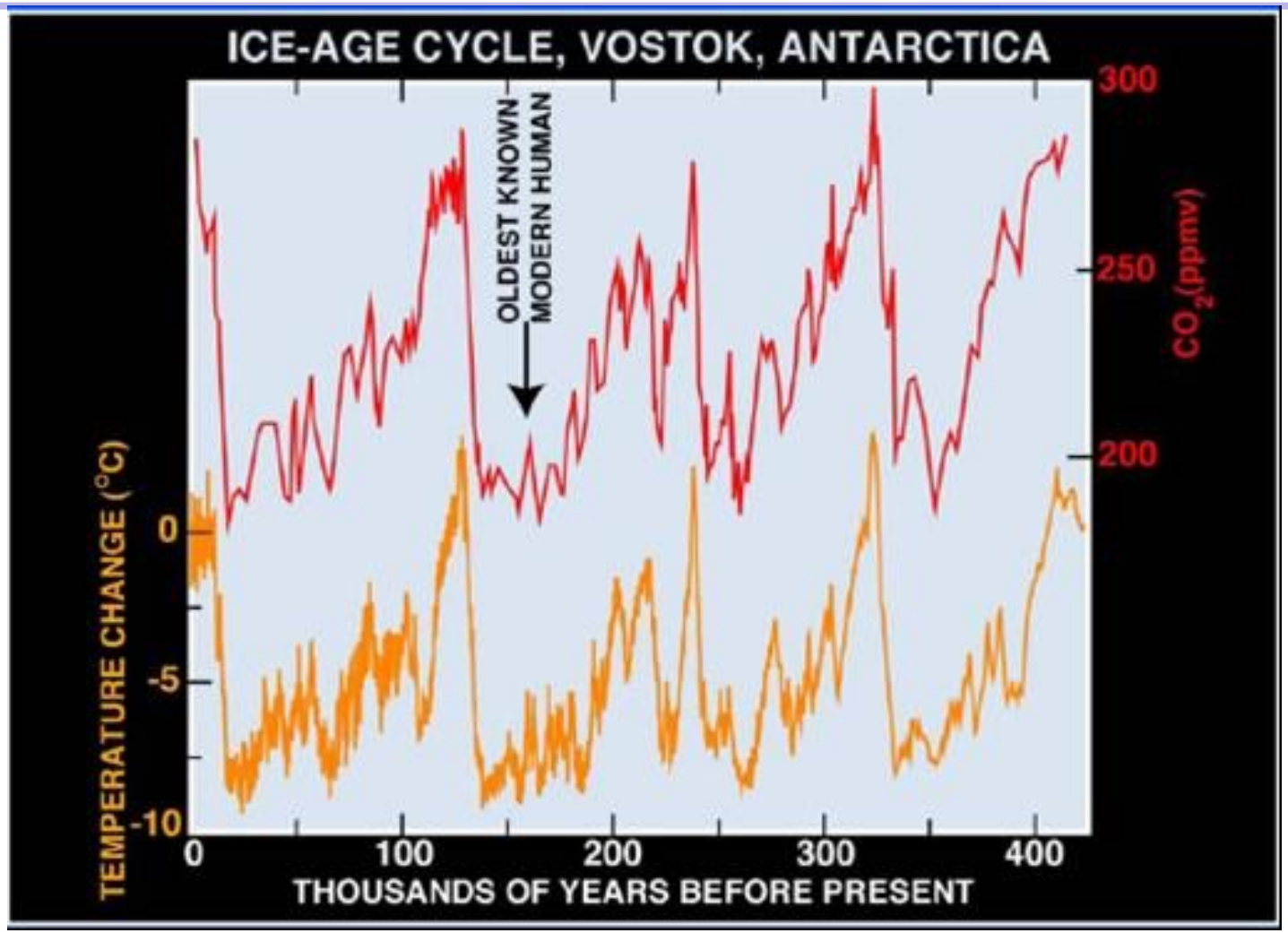

Source: Hansen (2005)

Preserving Climate Security: Avoiding Climate Tipping Points

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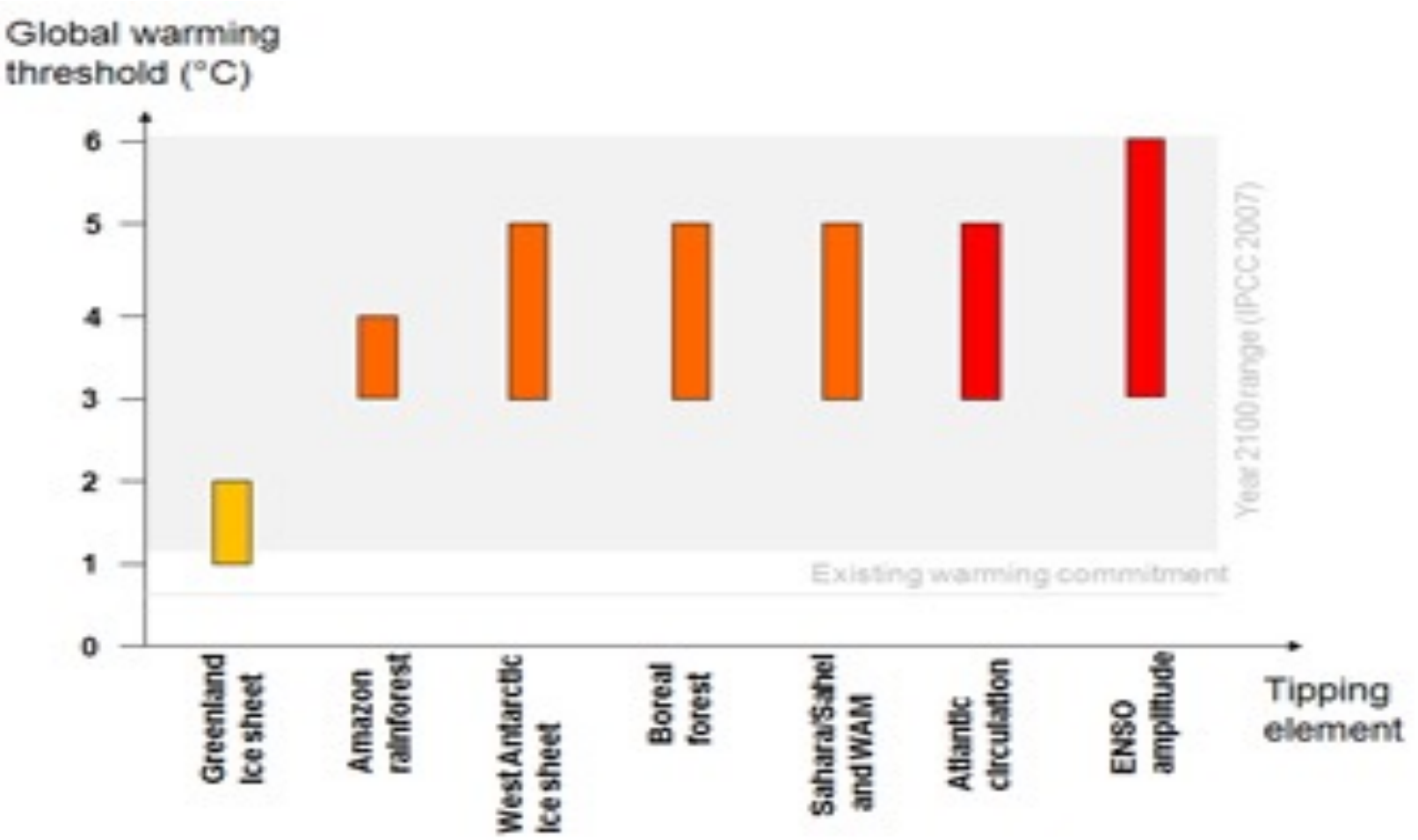
IPCC analysis does not yet include many of the most extreme impacts of climate change

- High impact scenarios: Atlantic conveyor slowdown; increased storm activity; monsoon variation;
- Cost of social instability and conflict
- Irreversible impacts (all accelerating): glacial melting; icesheet melting rates; ocean acidification
- Runaway climate change: Amazon forest dieback; tundra melt; release of methane hydrates;

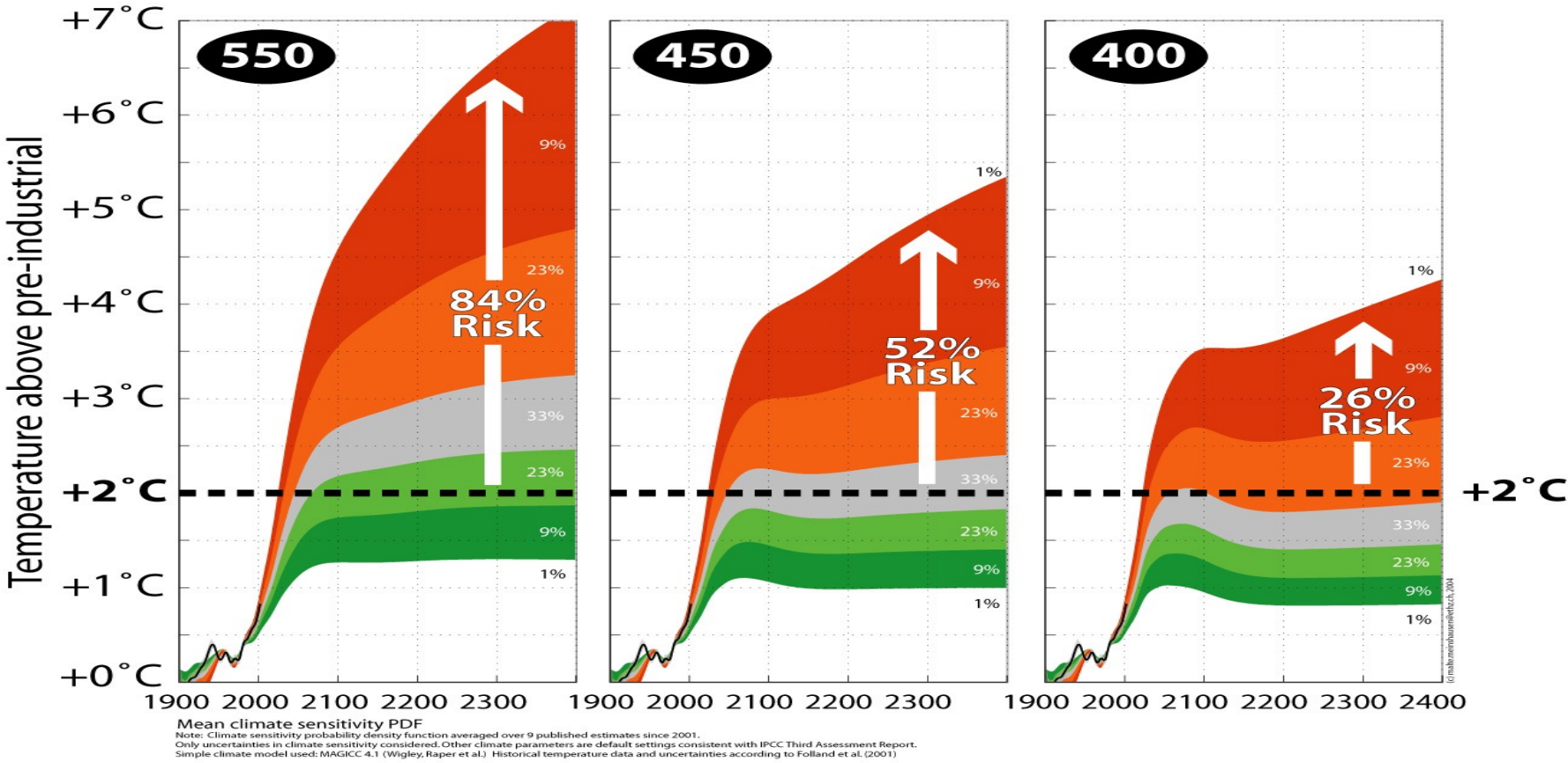
Real issue is how we avoid passing these tipping points

Current Threshold Estimates



Source: Lenton (2009) http://researchpages.net/ESMG/people/tim-lenton/tipping-points/

Achieving a 2°C world will require rapid action to stabilize climate emissions



Source: Meinshausen, M. (2005) *On the Risk of Overshoot – 2 degrees*

Our current strategy?

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- Weak consensus on aiming for 2C global limit
- In practice interpreted as 450ppm equiv - which gives a 50:50% chance of exceeding 2C
- Can emit 300-500 billion tonnes CO2 equiv more; 4-6 trillion tonnes in existing fossil fuel reserves
- Global peak in GHG emissions by 2015-2020; eliminate deforestation by 2030
- Zero carbon energy sector in OECD plus China by 2050

Effective mitigation will require significant action in all major sectors

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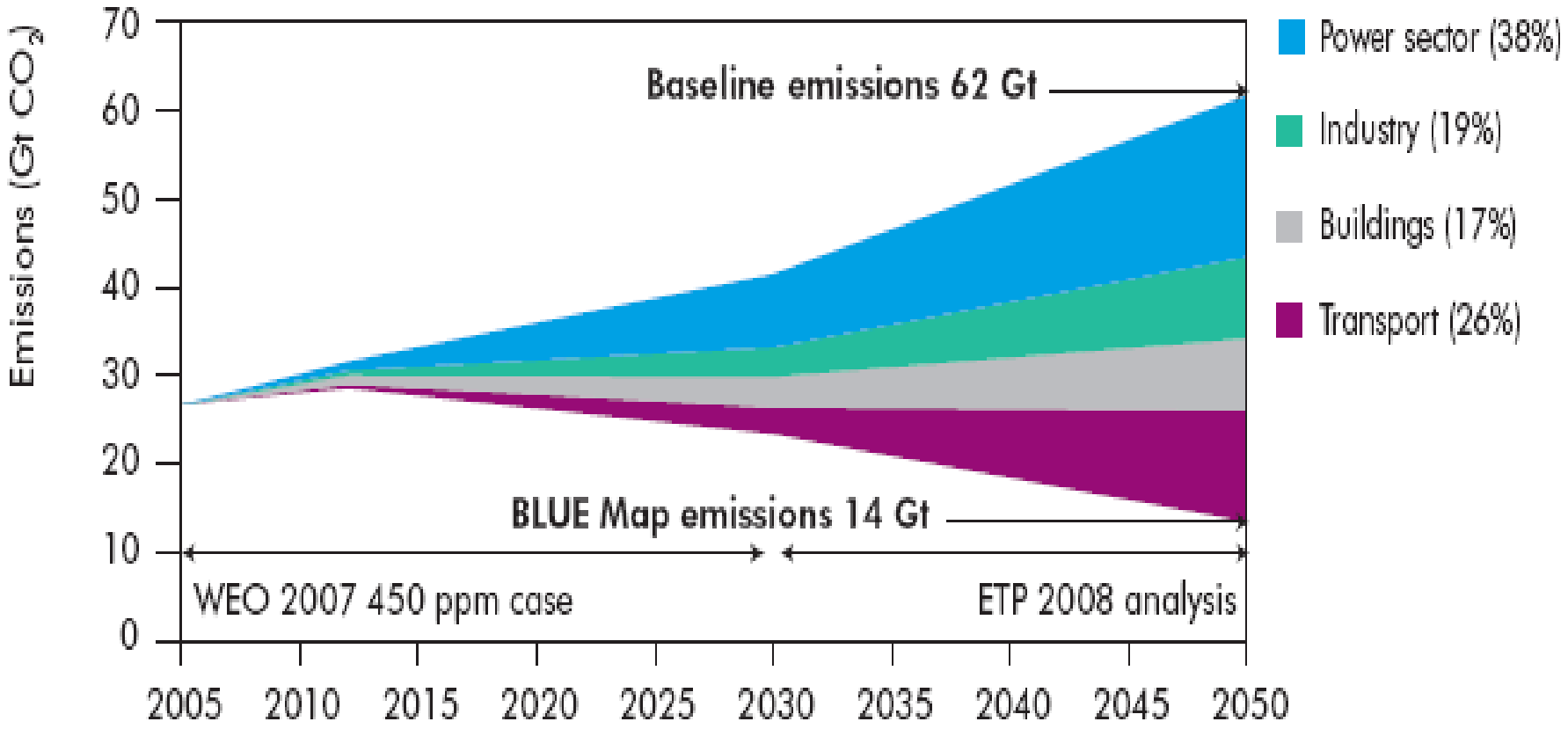
IEA Emission Scenarios



Source: IEA, ETP, 2008

Climate Change is perhaps the Ultimate Systemic Challenge

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- Long term threat which mediates itself through complex climate and economic/social systems
- Risk of threshold and non-linear impacts makes safe levels hard to define; "driving near a cliff in the dark"
- Responses requires next generation of global investment in energy and land use to change
- Rapid innovation needed in technologies, markets, business models, institutions and lifestyles

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Examples from current policy processes

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1. **Power Sector Decarbonisation**: delivering long term system wide change while maintaining energy security and cost constraints under conditions of endemic and wide ranging uncertainty

2. **Low Carbon Innovation**: incentivising delivery of a wide portfolio of technologies inside a fixed timeframe by market-based actors

3. **Climate Security**: defining priority actions to reduce risk of climate change driven conflicts and increase resilience

4. **Natural Resources and Corruption**: delivering systemic incentives to improve the management of natural resources

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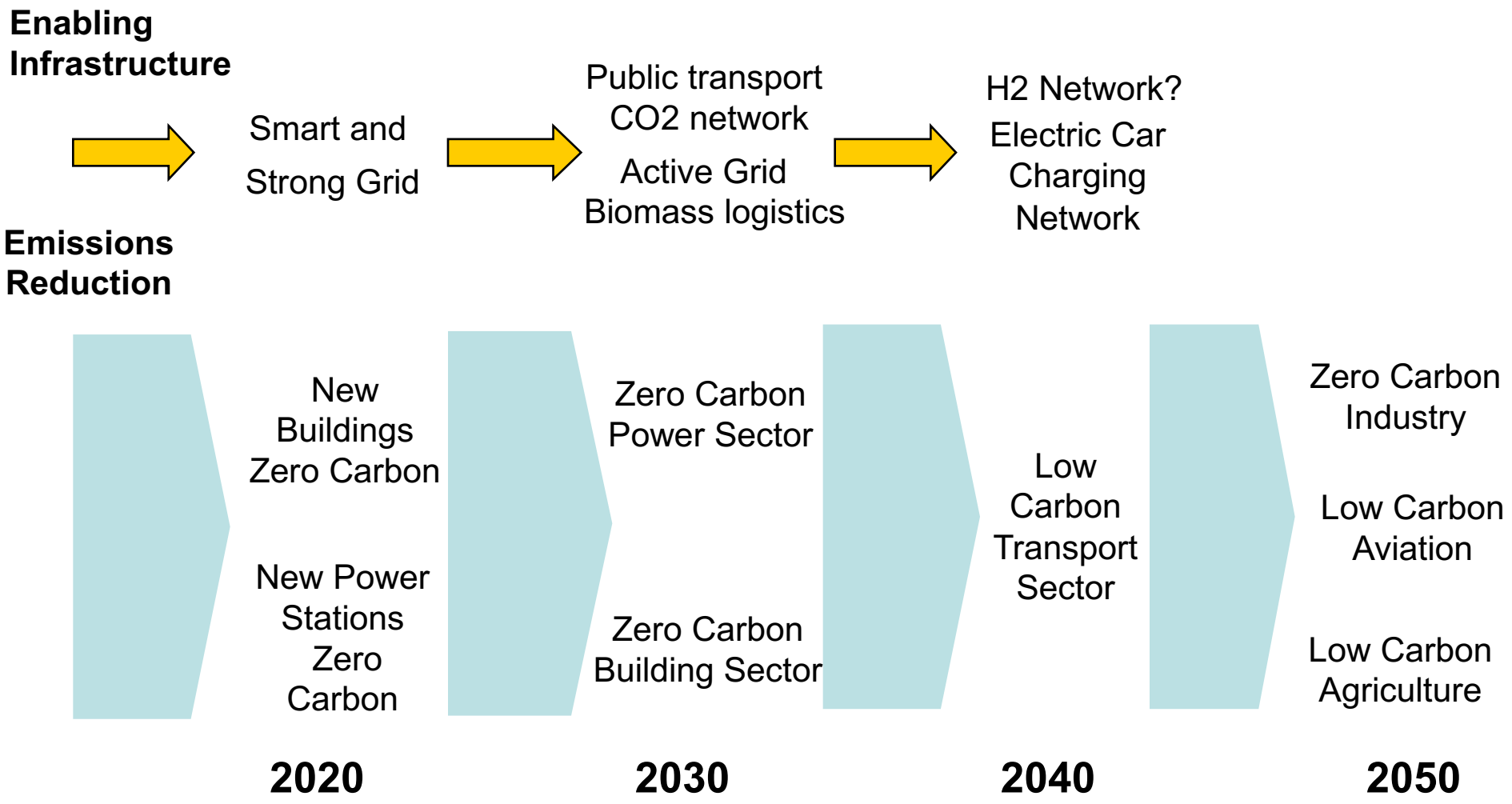
Low Carbon Economy Routemap for EU?



All current 450ppm scenarios depend on delivering high levels of energy efficiency

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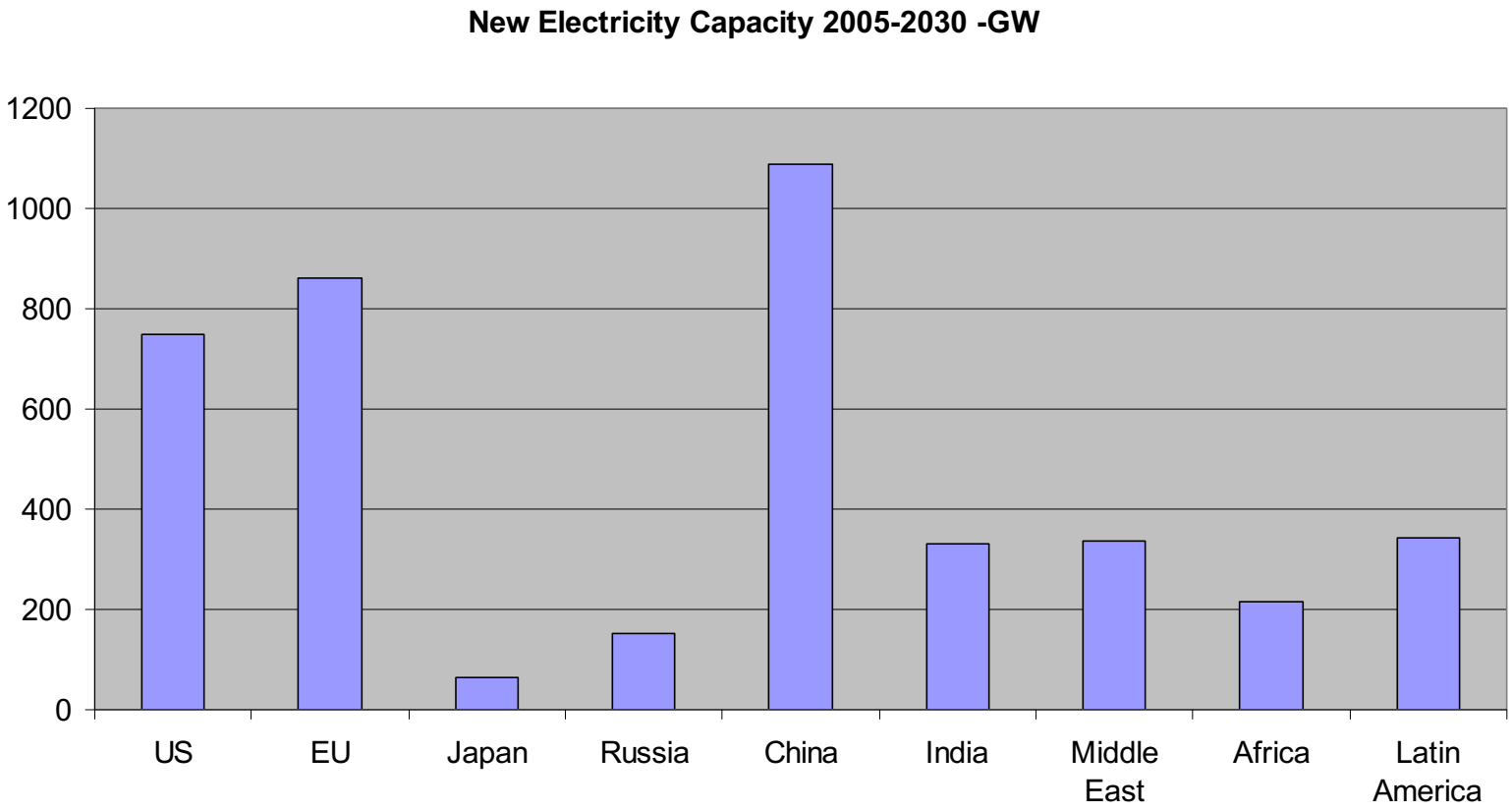
Cumulative CO2 reduction in BLUE Scenario, 2008-2050

End-use fuel efficiency	**24%**
Electricity end-use efficiency	**12%**
Electrification	**6%**
Total renewables	**21%**
CCS power	**10%**
CCS industry and transformation	**9%**
Nuclear	**6%**
Power fossil fuel and switching efficiency	**7%**
End-use fuel switching	**1%**
Hydrogen FCVs	**4%**

43% reduction through energy efficiency; 19% from CCS

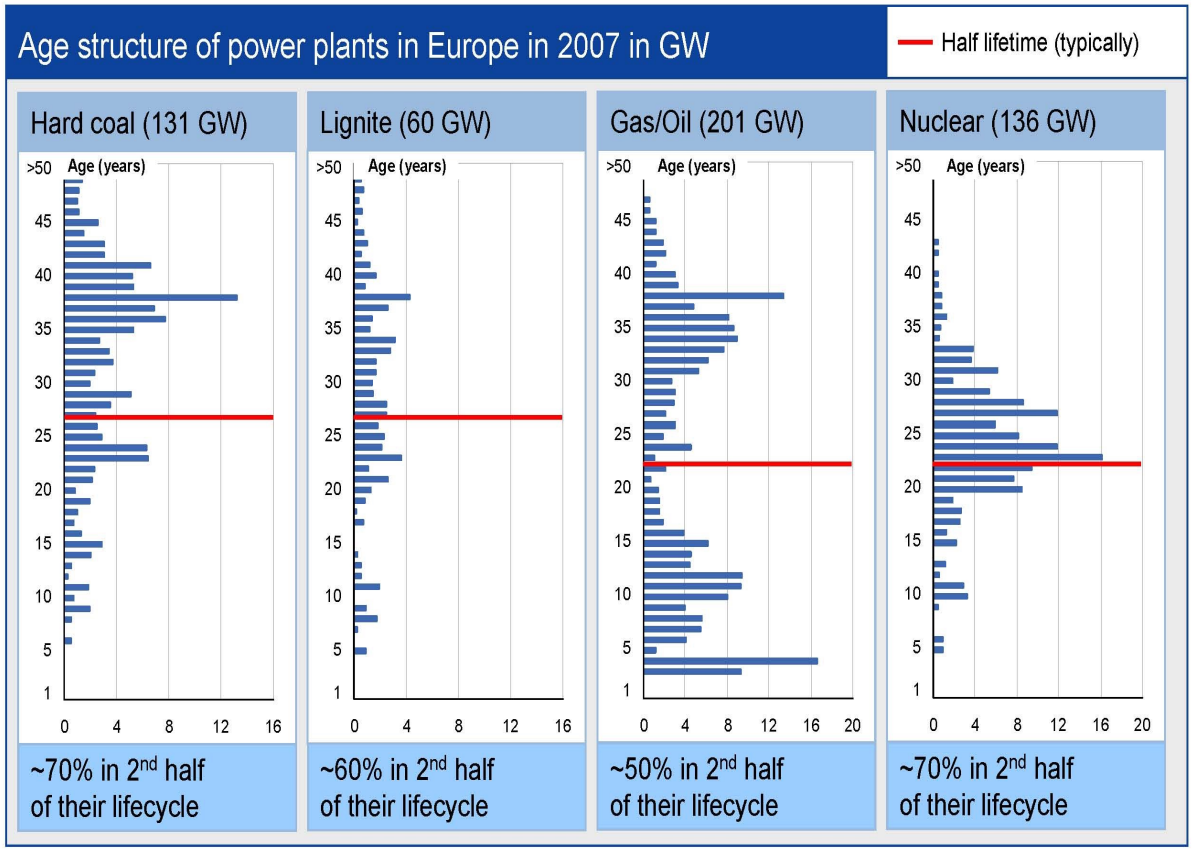
Source:Adapted from IEA ETP 2008 by Froggatt and Viswanath, 2008

Aging infrastructure means significant new energy investment even in EU



Source: IEA, 2006; Euroelectric 2007

In Europe more than half of current generation capacity will need to be replaced by 2030



Sources: BCG, RWE

- IEA 2005-2030 the total new capacity in EU will be 862 GW, additional installed capacity is 395 GW; 61% of current capacity.
- Eurelectric 822 GW of new power stations replacement of old capacity (439 GW).
- In 2030-2050 new investment is estimated at 605 TW and decommissioning at 470 GW

Source: Euroelctric (2007)

Lock-in of unabated coal power and standard power infrastructure

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- Business as usual development would see lock-in to a new generation of coal and conventional power infrastructure

- Even with carbon capture and storage (CCS) unless systems are made truly CCS-compatible now – location; technologies; supply chains – retrofit is highly unlikely

- Lowest risk to climate security would be to have a moratorium on new coal generation without CCS (now UK policy); first impact would be to drive a dash to gas.

Europe has good reasons for using indigenous coal and avoiding gas

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- Fear of dependency on Russian gas and uncertainty over the delivery of next round of Russian gas investment
- North Africa seen as a more reliable supplier but limited and still risky
- Central Asia gas still unlikely due to geopolitical blockages
- Iranian gas likely to remain of limits due to nuclear issues and US pressure to disinvest

Europe's major strategic low carbon resources require new infrastructure

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- Europe's Strategic Renewable Options
  - North Sea wind
  - Atlantic wind
  - Scandinavian, Alpine hydro (existing and expansion)
  - North African solar
  - Central/Eastern European biomass

- CCS Large Scale Aquifers: North Sea; Baltic Sea

- Longer term
  - Distributed solar power
  - Enhanced geothermal systems in the south and east
  - Tidal power in the north

Plans exist for new infrastructure but what elements should come first?

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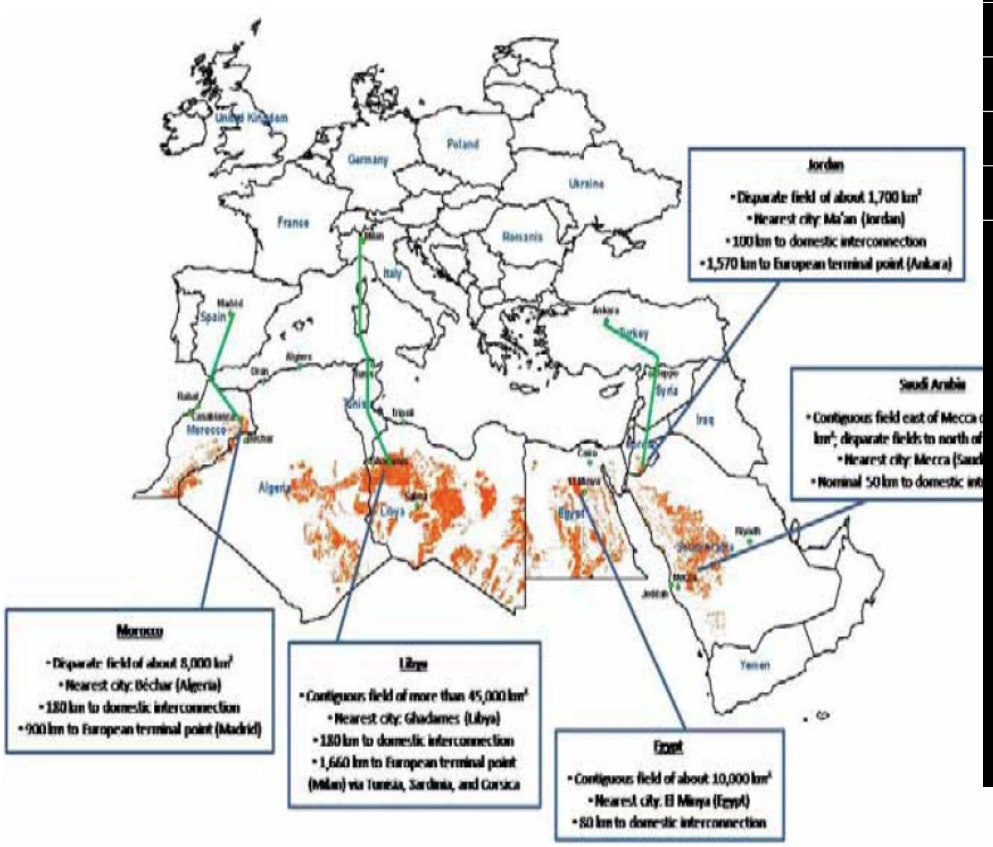
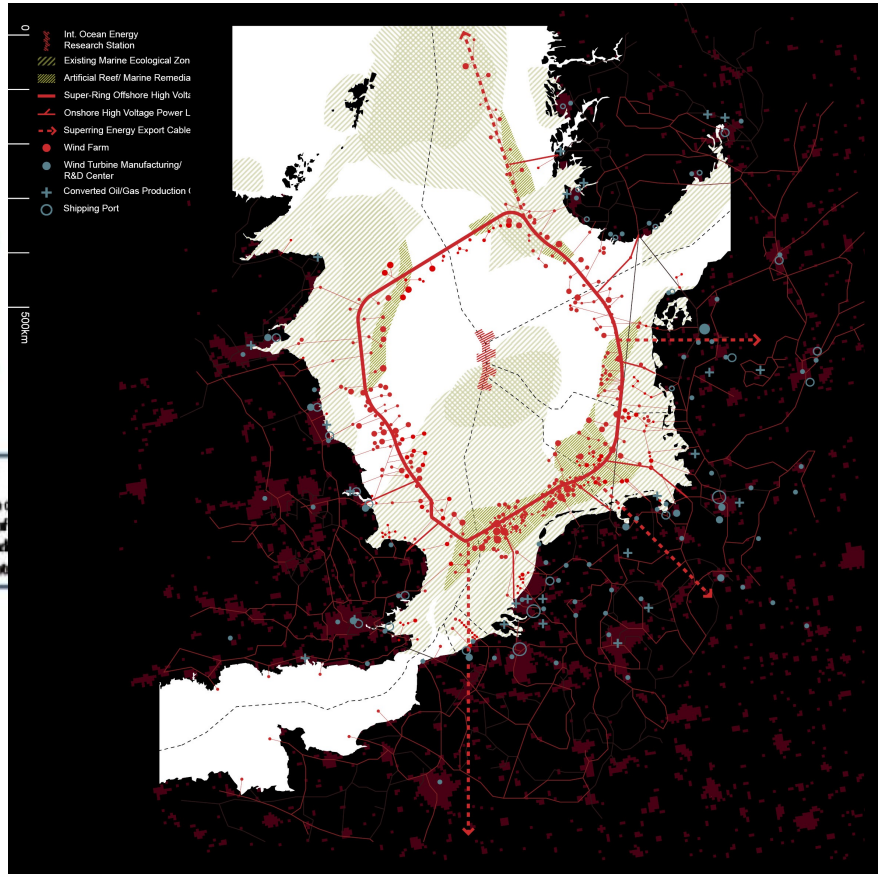
Figure 6: Location of Preferred Solar Fields and Transmission Corridors[11]





Energy and Climate Security are public goods; markets will not automatically give signals to shift investment

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- Fossil fuel price increases dwarfed carbon prices projected by Stern Review/IEA but are not driving carbon-free economy
- Combination of economic recession and policy has reduced emissions growth in US and EU but not in emerging economies
- Volatility of EU carbon prices and weakness of targets has resulted in heavy discounting in investment models
- Lack of pan-European energy grid and carbon pipelines reduces ability to make large scale use of EU low carbon energy resources
- Policy, political and price uncertainty combine with technology risk to make companies very cautious of new investment outside guaranteed renewable energy markets.

Need coherent, strategic and effective policy signals to drive investment to deliver energy and climate security together

Lesson: Centrality of Managing All Systemic Risks and Understanding Actors

- In political markets you cannot replace government decisions with price signals as underlying risks remain to private investors; EU ETS design did not address risk issues and business/investment ecosystems
- Recognise that price, technology, investment and political uncertainty will not be fully resolved over critical decision period (2010-2030)
- Need systemic understanding of how much you are prepared to pay for certainty of decarbonisation and maintenance of energy security.
- Governments need to take specific risks away from markets (e.g. infrastructure, price, demand) to avoid paying very high risk premium for delivery of private investment
- EU debate now evolving to embrace electricity market reform, regulation of carbon emissions (EPS/coal bans) and Green Investment Banks.

New forms of strategic intervention needed to drive market reform and create effective investment and innovation incentives

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Climate change poses a unique challenge for innovation policy

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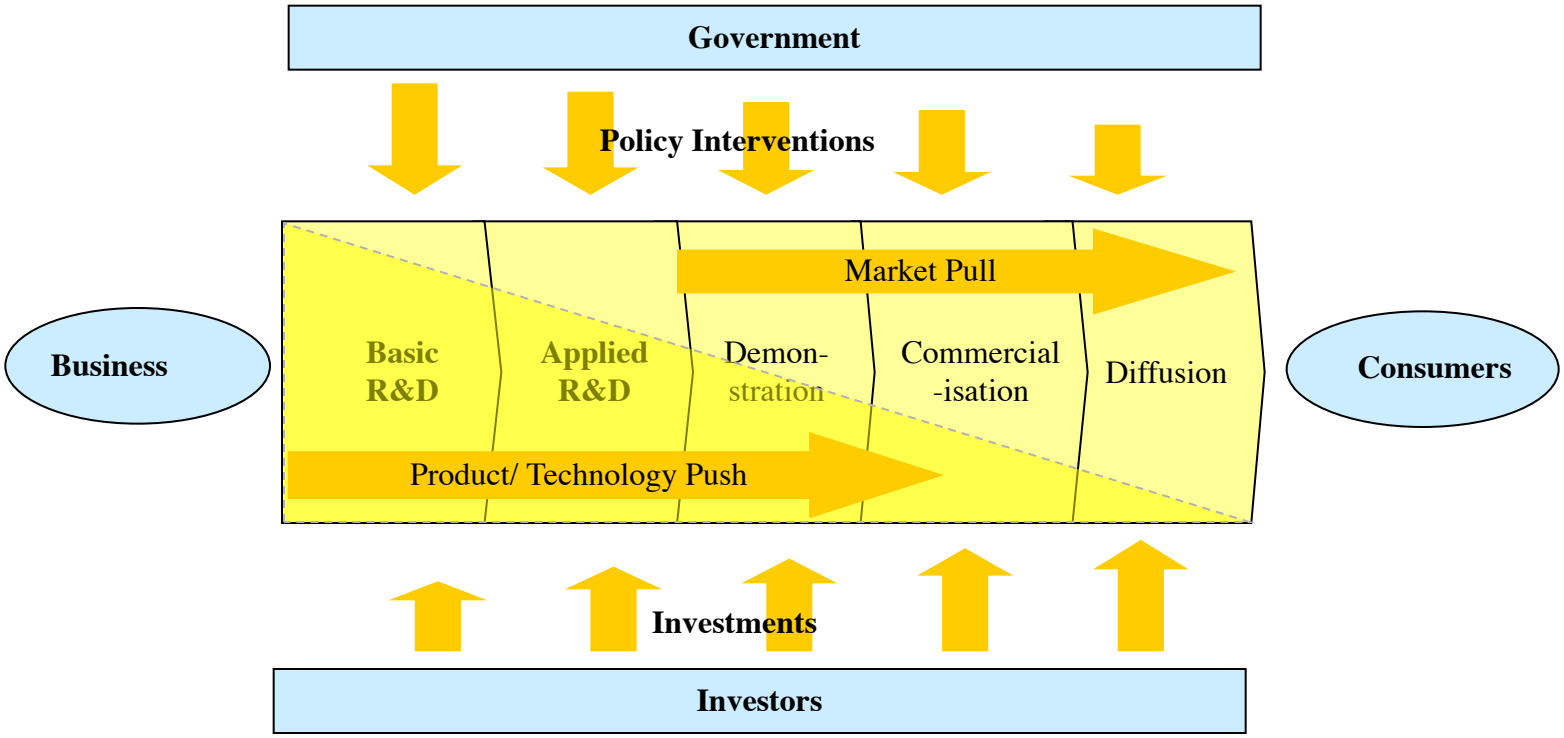
- Need to develop new technologies and business models **within a given timeframe** to avoid carbon lock-in
- Need to deploy innovations simultaneously in developed and developing countries
- Need to shift the full range of economic growth onto a low carbon development pathway – not just one sector

Meeting this challenge will require a new approach to innovation

This response must balance 'push' and 'pull' factors along the innovation chain



Need to reverse the decline in public sector support for energy R&D to support innovation

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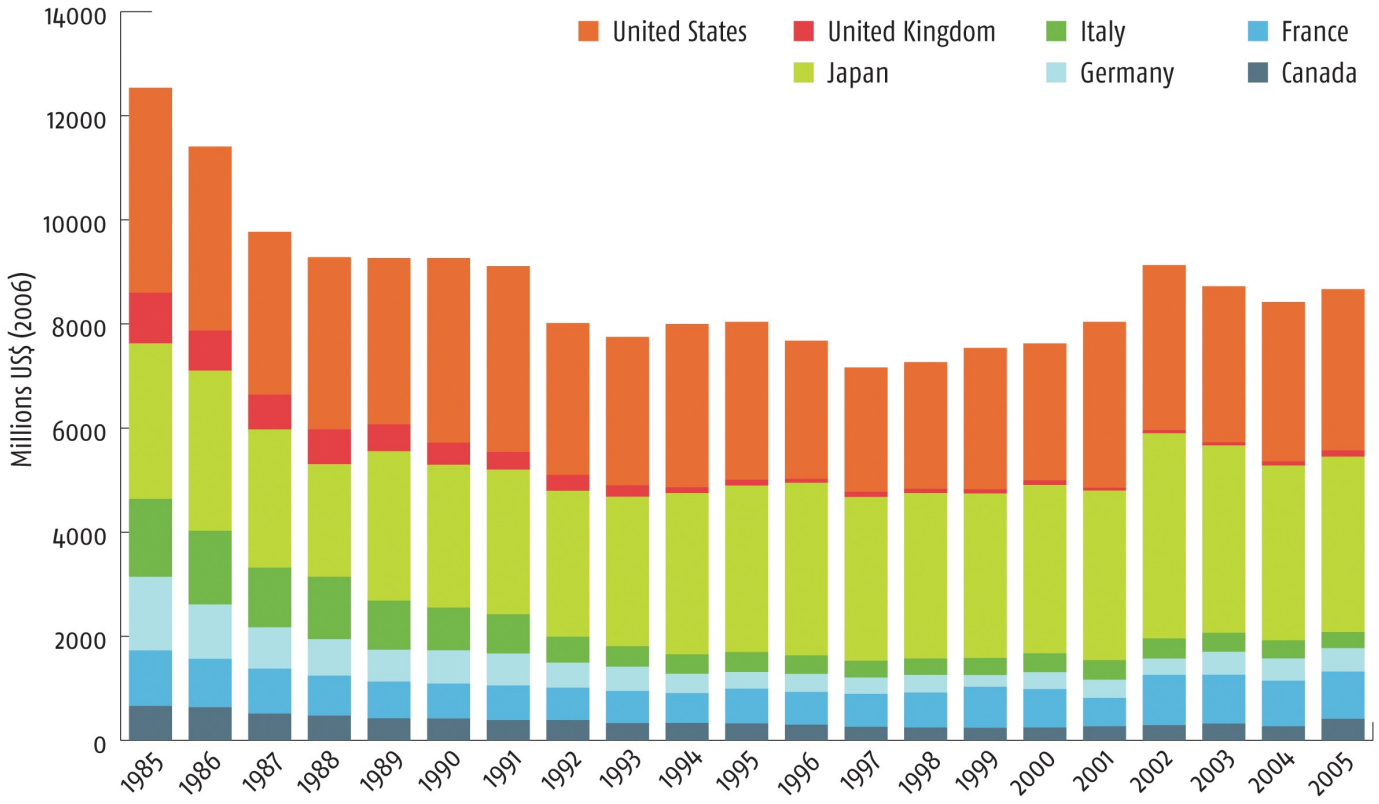
Public energy-related R&D spending G7 countries 1985-2005



Source: IEA database of R&D (IEA, 2008b)

Global support for RD&D and Diffusion needs to be rapidly scaled-up

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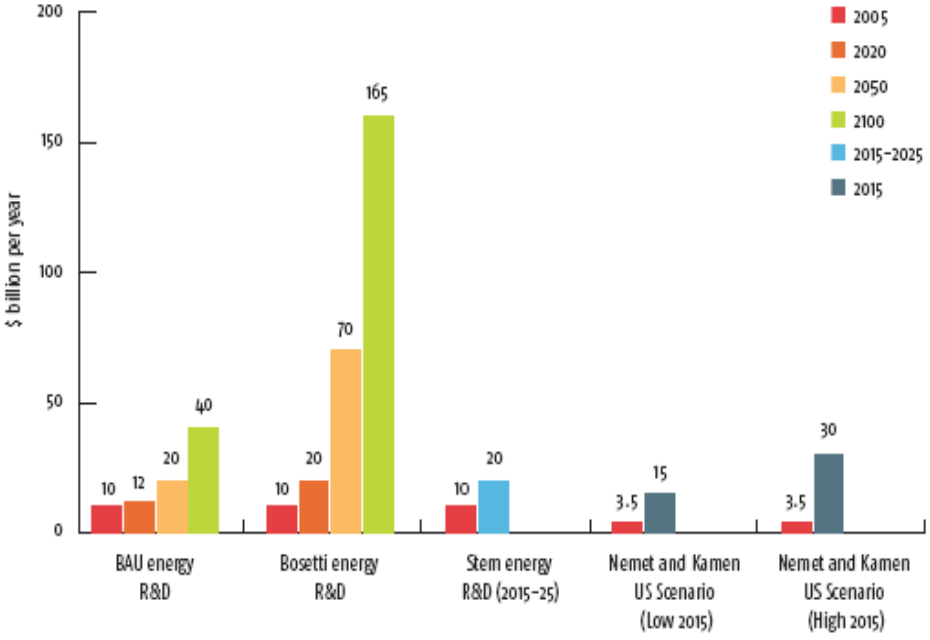
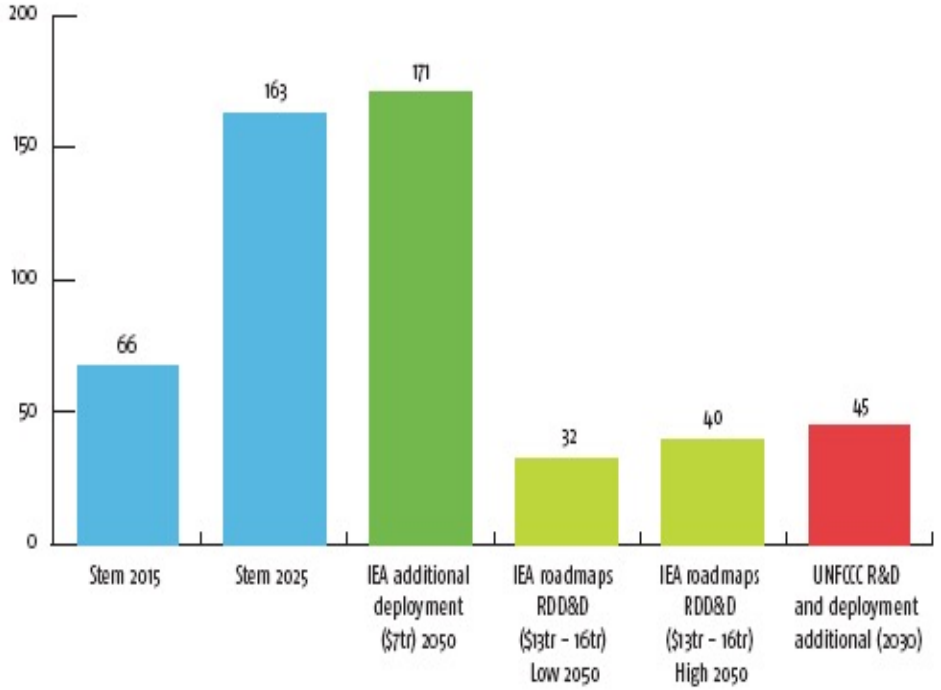
Estimated scale of current and necessary global public R&D support



Estimated scale of necessary deployment support



Most R&D support will need to be directly financed; however, a significant share of the deployment support could be leveraged through the carbon market

Scientific innovation and invention is almost exclusively a high-income activity

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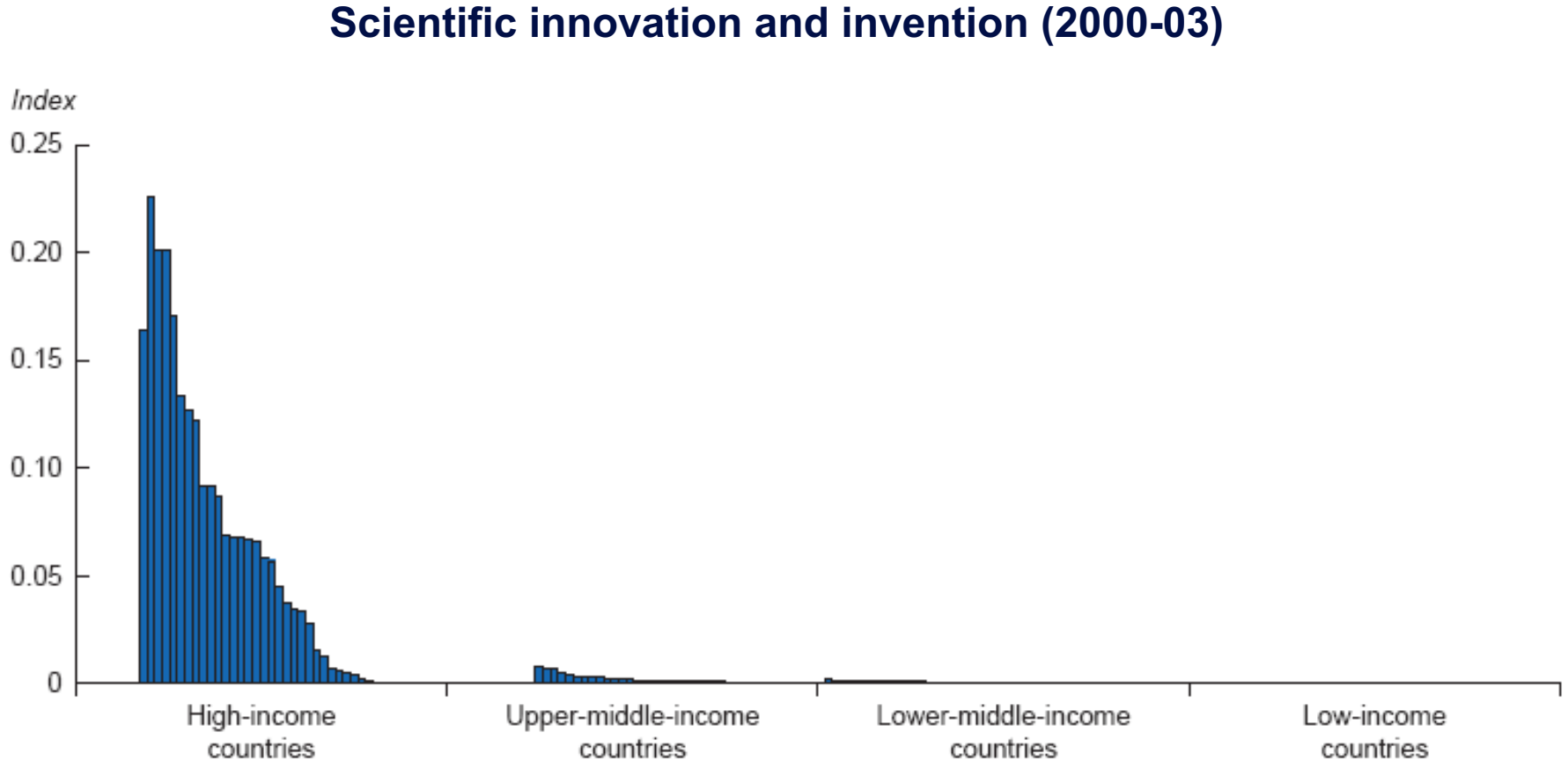

Source: World Bank (2008) Global Economic Prospects: Technology diffusion in developing countries

The penetration of older and more recent technologies depends on more than income

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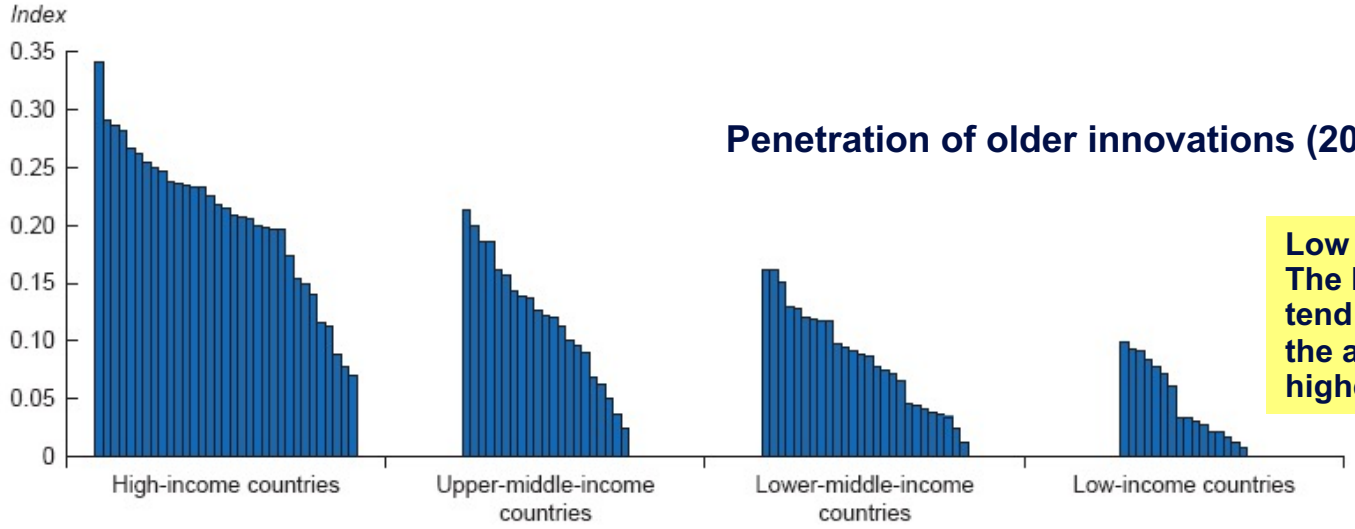
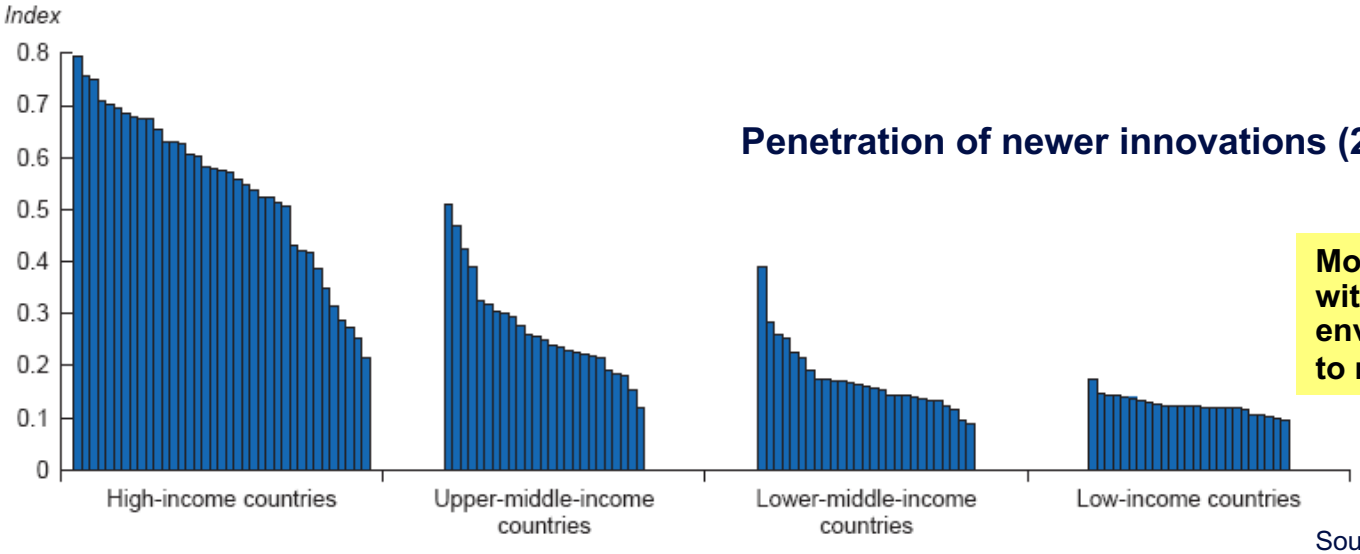


Penetration of older innovations (2000–03)

Low correlation with income - The highest utilization rates tend to have rates that match the average rate of the next highest income group

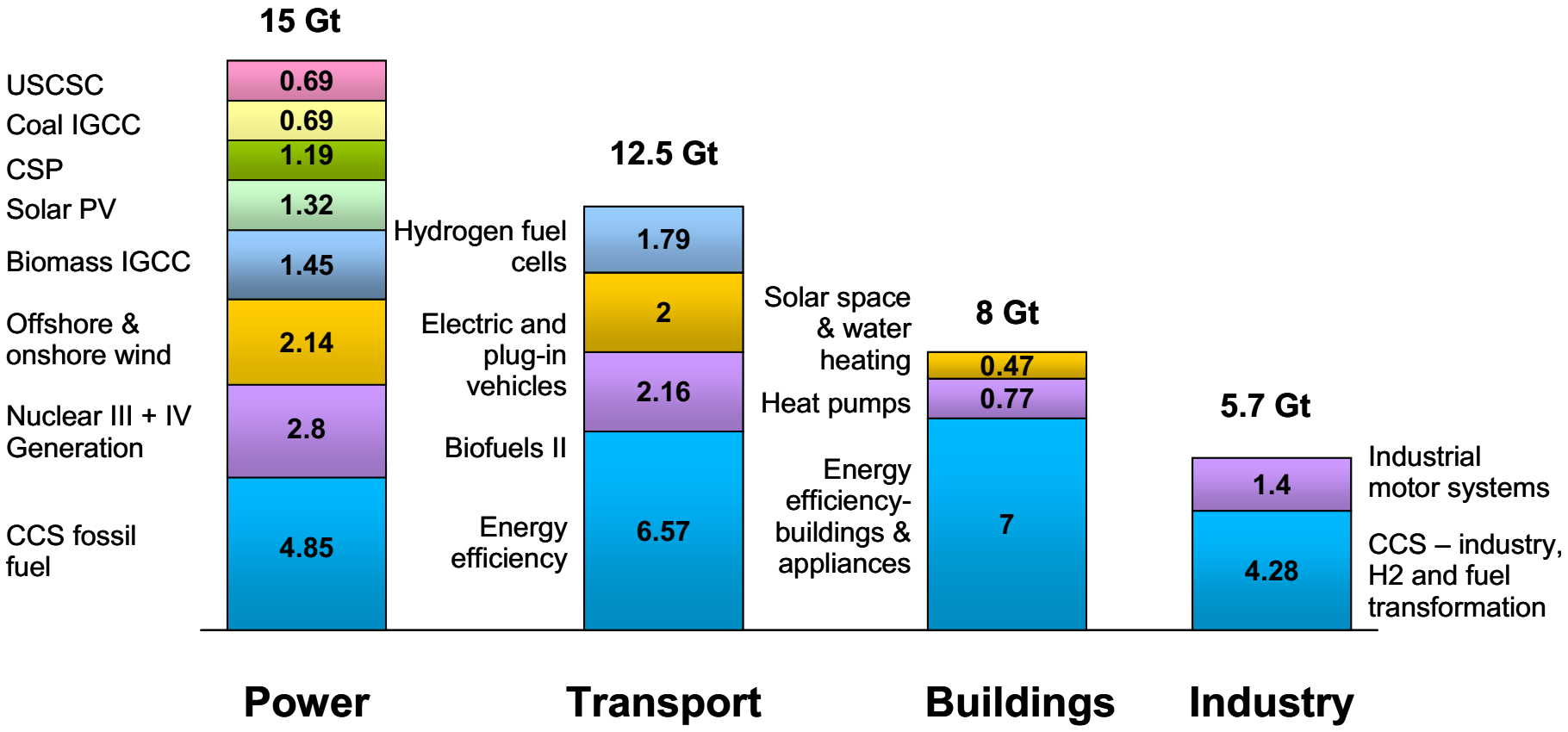


Penetration of newer innovations (2000–03)

More directly correlated with income – Competitive environment, responsive to market demand

Source: World Bank (2008)

What do we need? Critical technologies for meeting the 2050 goal.



Source: Project Catalyst 2009

The risks of delivering climate security suggests we need more innovation than models suggest

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Technology risks

- Policy failure: may not be able to deliver assumed savings on energy efficiency, infrastructure and REDD
- Climate sensitivity: may have to act faster than anticipated as climate science improves
- Technology failure: certain key technologies in the models may not be feasible e.g. biofuels

Investment risks

- Investment shifts are not automatic and will require significant action to achieve (both market size and certainty will be important)
- Need to shift patterns of investment across both sectors and countries
- System lags between investment and innovation mean that urgent action is required

To manage these risks we will need more low carbon technologies earlier than currently estimated

Low Carbon Innovation Strategy

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- Use technology to manage climate change risk
- "Top down" strategic approach to ensure critical technologies arrive "on-time" plus investment in disruptive options
- Not picking winners but making sure there are enough winners to pick from
- Reduce costs and risk by using international cooperation where high value-added e.g. CCS; CSP; Grids; Vehicles; Cement etc
- Recognise there is no decarbonisation in China, India etc unless they can innovate low carbon technologies – and profit from them

Constructing a Global CCS Strategy

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- Whether you "believe" in CCS or not – it is critical to have an early answer to CCS feasibility and costs.
- First step to is avoid lock-in to unabated coal: moratorium in developed countries; truly carbon capture compatible in developing countries
- Second step is global demonstration programme of at least 20 full scale plants by 2015. Public funded to ensure technology and geographic spread – and public IPR generation.
- Third step is regulatory and financial incentives for technology diffusion and deployment from 2015 onwards

Aim is not to pick winners - but to ensure there are enough winners available to avoid catastrophic climate change

CCS strategy needs a balance of 'push' and 'pull' factors on innovation chain

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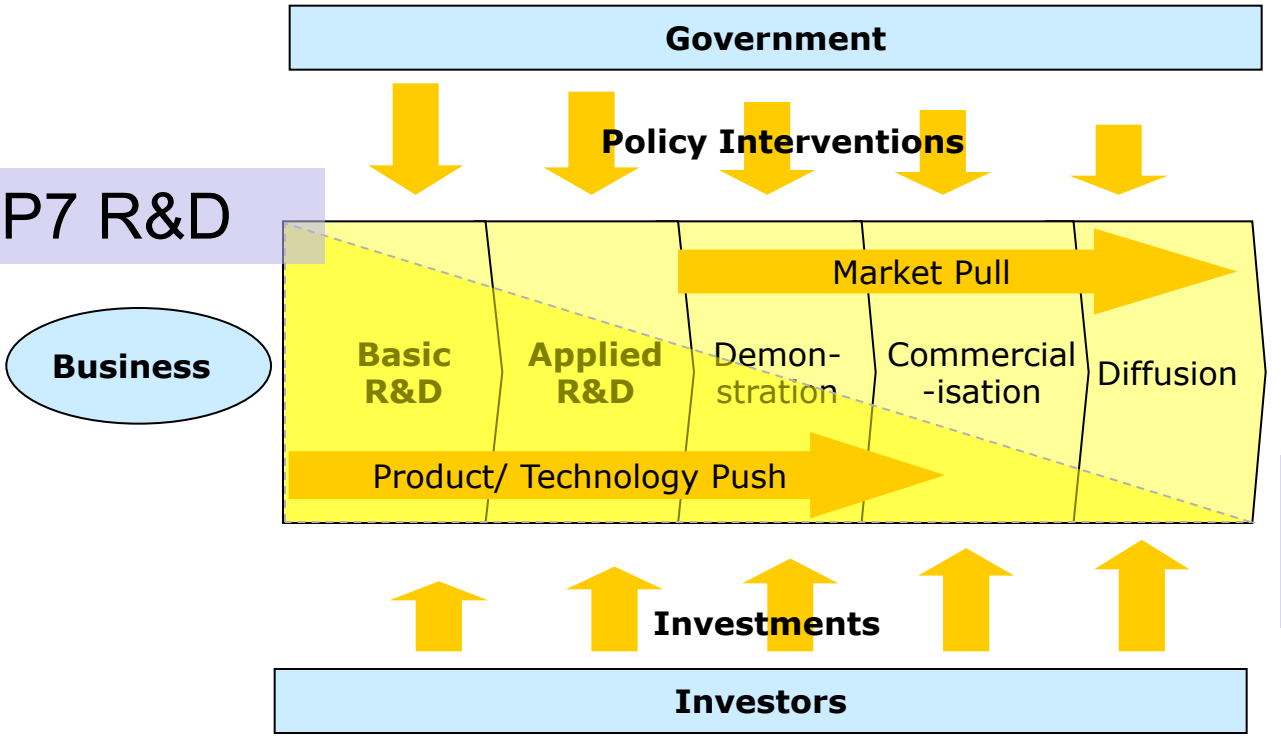
CCS Env Regulation



FP7 R&D

CCS Mandation

EU and Global Demonstration Programme

Global Sequencing

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- Need to demonstrate developed countries can and will use CCS
- Need parallel development of expertise and workable technologies in developing countries
- Future role of CCS needs to be incorporated into developing country planning structures
- "Fast-start" programme of industrial CCS followed by full size demo plants in key countries

Need to "get real" on CCS as quickly as possible to avoid lock-in and bad investment decisions

Lesson: Using System Tools to Break Open Stalled Debates

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- Need to understand innovation as a critical part of risk managing the decarbonisation process; not how technology used in models
- Private innovation chains will deliver innovation in some areas (vehicles; solar PV), others need govt support (CCS; smart grids). All need intelligent market pull.
- Innovation chain approach has helped convergence of national and global discussions and helped broker pragmatic agreements
- Tailored innovation chain policies are paying dividends, but still challenge of supporting areas with strong network effects, high demonstration costs and weak markets (orphan technologies)
- Innovation ministries motivated by national competitiveness so international cooperation on RD&D is sub-optimal
- Diffusion instruments are still highly contentious – where IPR needs to be shared

Still need to win case for public-good approach to low carbon technology

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The Reality of Climate Security

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"The expanding Sahara desert had brought with it some cross-border problems … nomadic Fulani cattle herdsmen arming themselves with sophisticated assault rifles to confront local farming communities…

It was important that, from time to time, the Council evaluate the dangers of such confrontations. The deadly competition over resources in Africa could not be glossed over; be they over water, shrinking grazing land or the inequitable distribution of oil."

L.K. Christian, Representative of Ghana,

UN Security Council debate on Energy and Climate Change, 17th April 2007

A Security Sector Consensus?

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CNA Report "National Security and the Threat of Climate Change"; 3-4 Star Retired US Officers from all services

1. Climate Change is a serious national security threat
2. Threat multiplier, particularly in the most fragile regions of the world
3. Will add to tensions even in stable regions
4. Climate change, energy security, and national security are related

Geopolitical Issues: Climate change changes contexts, interests, threats and relationships

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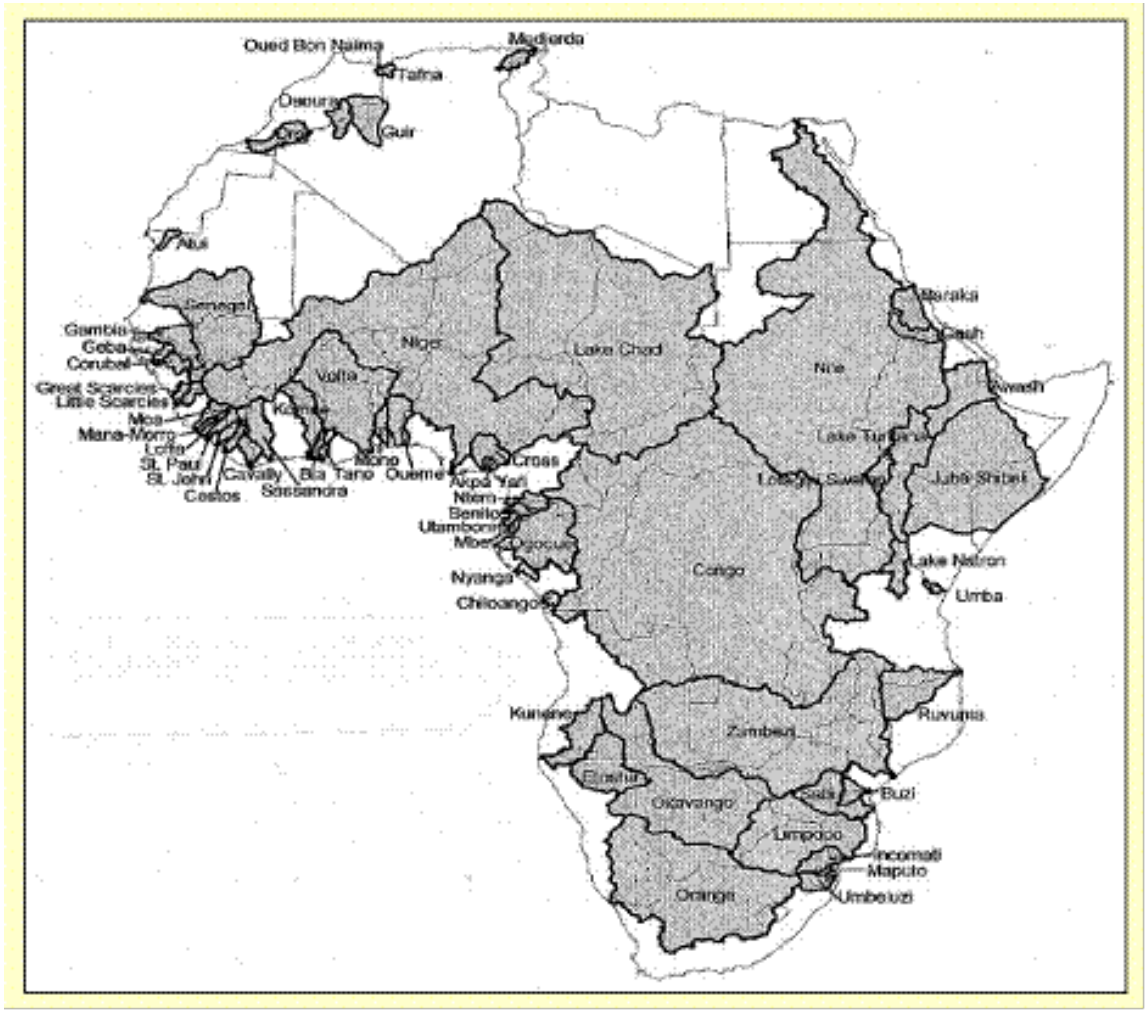
- **Mitigation policy**: balance of interests with China/India – from competition to cooperation; intellectual property rights; trade and investment policy.
- **Energy security**: move from producer to consumer relationships; managed transition in strategic producers (Russia; North Africa); politics of biofuels.
- **Nuclear proliferation**: large increased use of civilian nuclear power widespread, stresses on control of security and safety issues
- **Mananging Borders and Neighbours**: Scramble for the Arctic; moving fisheries (collapse of the CFP!); managing migration and environmental refugees.
- **Global resentment**: increase in "anti-globalisation" resentment of developed world; Al-Qaeda statements;

Boundaries and Resource Sharing: African Transboundary Water Management



Uncertainty increases existing tensions – leading to conflict if not managed?

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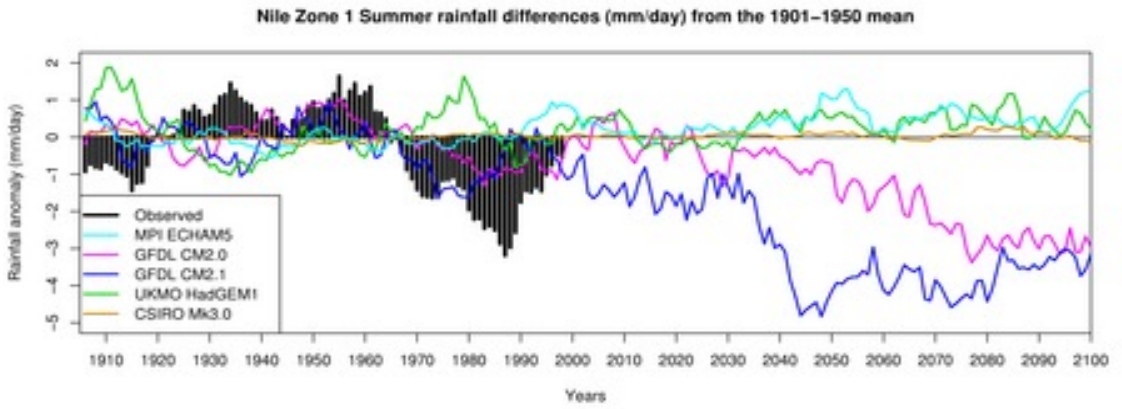
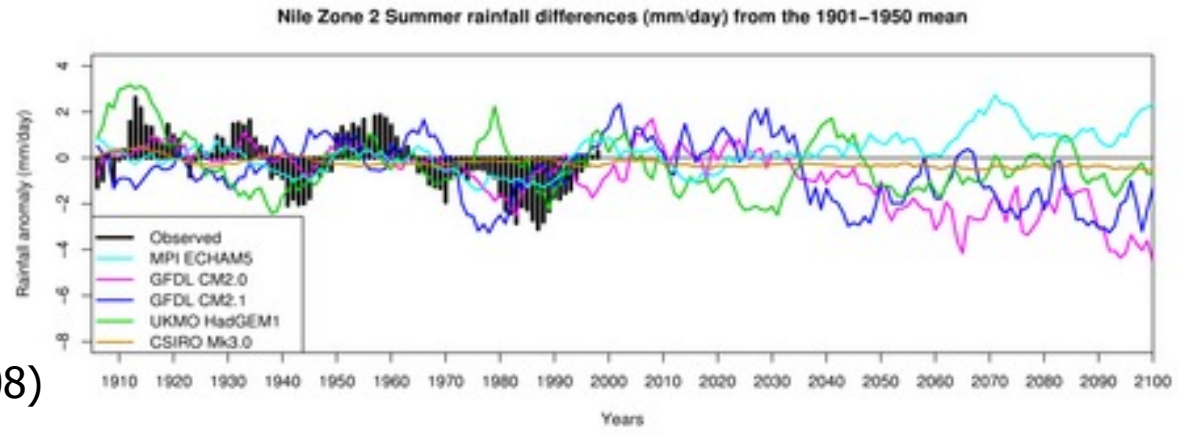
Projected rainfall in Eastern Sudan from selected climate models

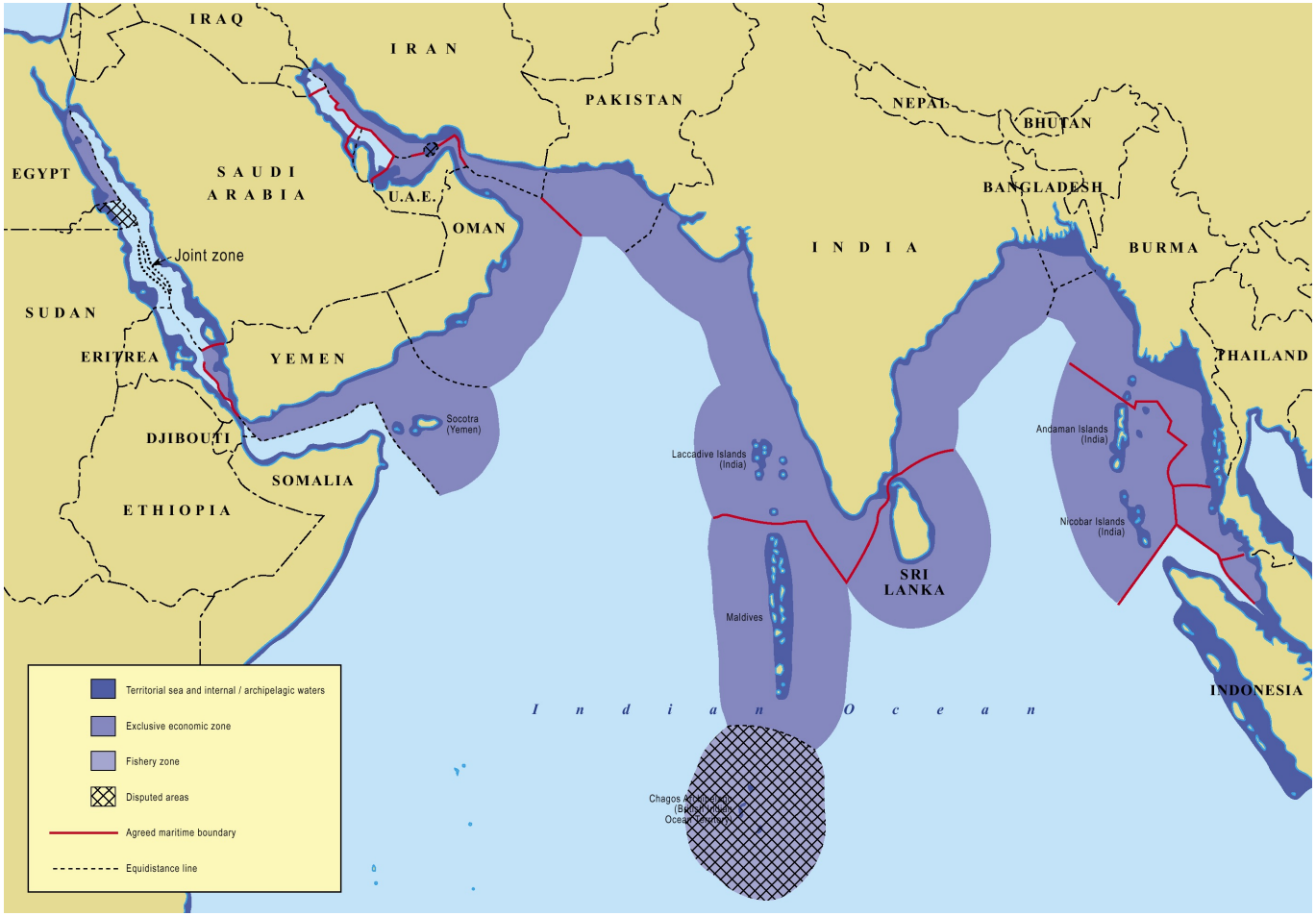


Projected rainfall in Ethiopian highlands from selected climate models



Source: Bates (2008)

Shifting Borders and Boundaries: Policy Responses?



Response is better prevention/resilience but where to invest?

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- Climate Change is another serious stressor in already unstable countries, regions and communities (Africa, ME, S Asia, SIDS)
- If worst impacts hit it will dominate most other factors by 2020-50 in many vulnerable countries, and earlier in vulnerable areas (e.g. Sahel)
- Its practical impact on policies to lower risks of conflict and instability can only be understood through comprehensive analysis – have yet to develop adequate tools to do this. Limited by weakness of broader conflict analysis tools and models.
- Responses imply a greater focus on governance, resource management, local conflict resolution capability etc. Key issue is providing analysis to practitioners allowing them to prioritise.

Targeting interventions is biggest challenge

Climate Change and Instability: We have yet to develop holistic analysis tools

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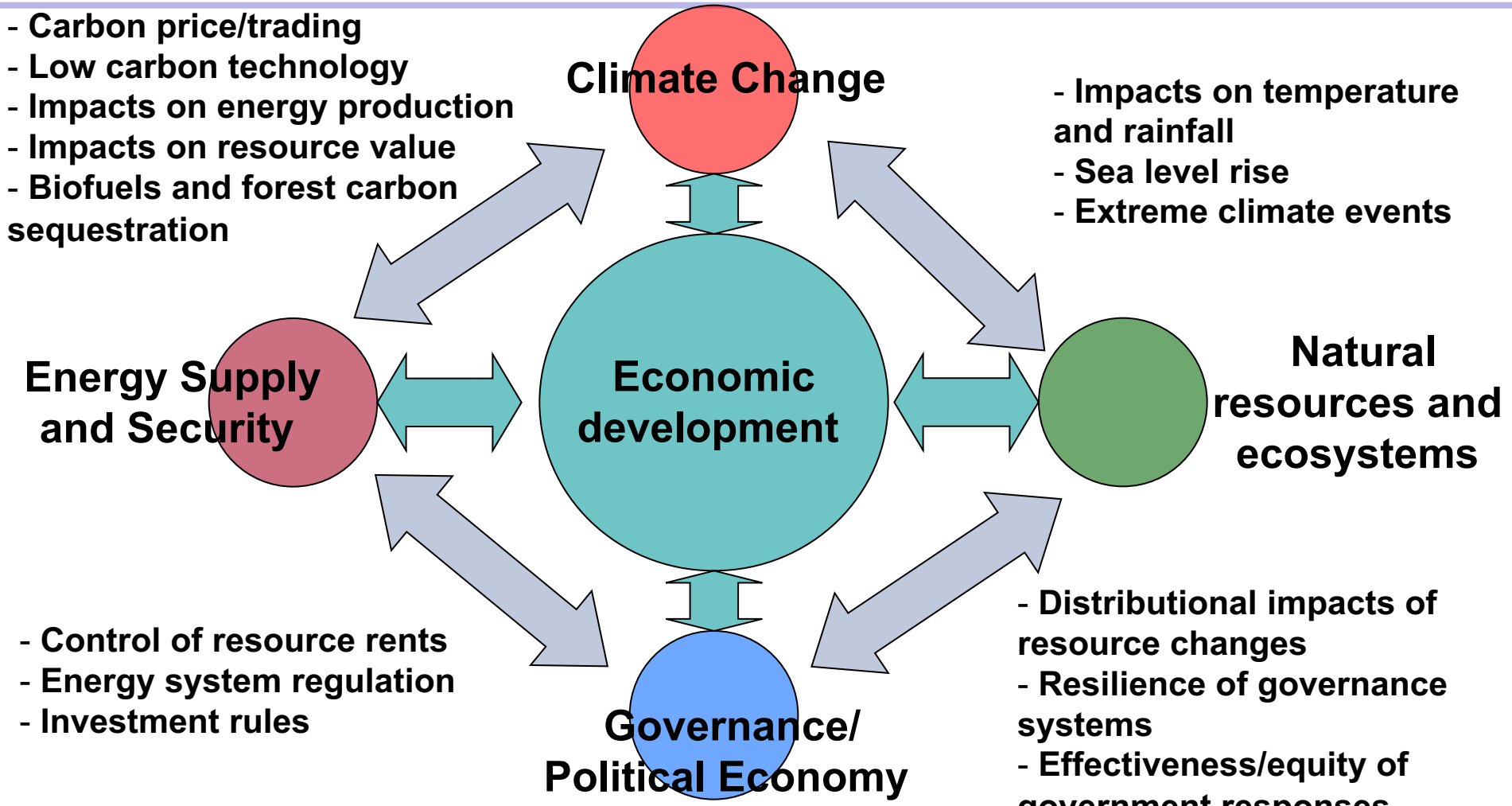
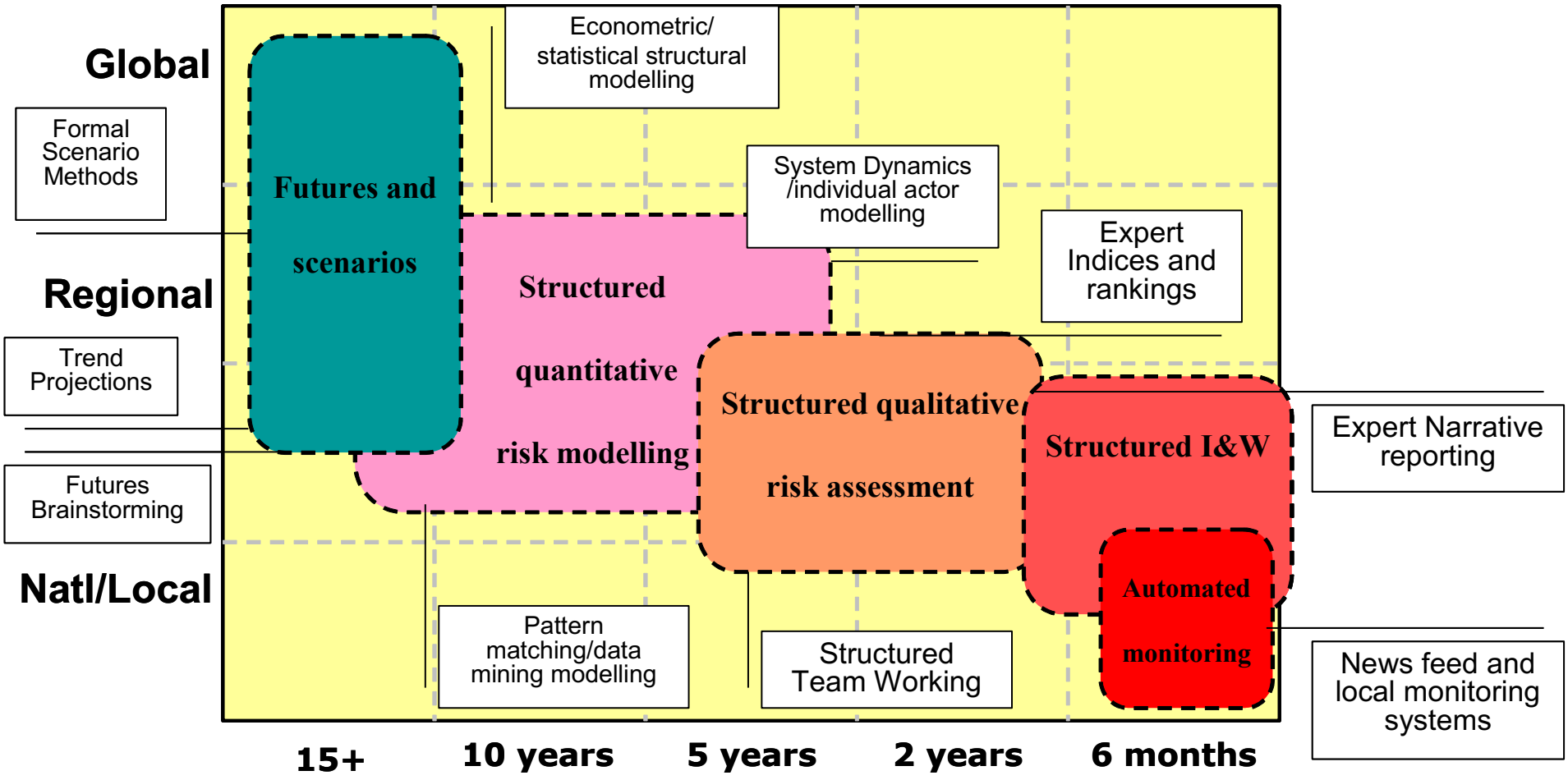


Multiple Risk Tools at Different Levels



Five Critical Areas for Improvement

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- **Threat analysis**: understanding links between instability/ungoverned spaces a policy objectives e.g. counter-terrorism
- **Understanding adaptation policies as driver of conflict:** better understanding of how adaptation policies need to be designed to reduce rather than increase conflict risks.
- **Strategic geographic risk assessment**: more detailed understanding at regional level of stress drivers through "mapping and monitoring" studies
- **Dynamic economic modelling**: dynamic models of how convergence of climate volatility, resource scarcity and economic weakness can provide endogenous shocks in vulnerable countries; 2008 perfect storm energy, climate and food crisis.
- **Bottom-up data gathering**: improve reporting of tension and conflict through bottom-up conflict data collection/monitoring in vulnerable regions

Lessons: Careful systemic analysis helps acceptance and sets scene for policy integration

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- Instability and conflict issues are highly complex and not amenable to simple one size fits all policy solutions.
- Real dangers that “over claiming” on climate and security would undermine credibility of whole field
- Basing analysis firmly in established security analysis techniques and acknowledging uncertainty helped win confidence of security analysts.
- Need to develop new tools and analytical techniques for decision support; this is now EU and US policy
- Expanding analysis to develop full “risk management” framework on climate change for security decision makers

In five years issue has gone from margins to nearly mainstream; now need to ensure it is carefully embedded in decision support

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Corruption and Natural Resources

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- Natural resource extraction is highly correlated with corruption and instability in countries at all levels of development
- Climate change will exacerbate resources scarcity in many regions increasing incentives for corruption
- Growth of low carbon economy will increase value of cropland (biofuels) and standing forests (REDD; LULUCF)
- Corruption already associated with carbon offsets (CDM)
- Copenhagen set goal of $100bn per annum in new transfers by 2020 to support adaptation, REDD+ and mitigation support

Failure to limit corruption could undermine climate change regime; corruption is a highly complex area to tackle

There are six main areas that contribute to global corruption

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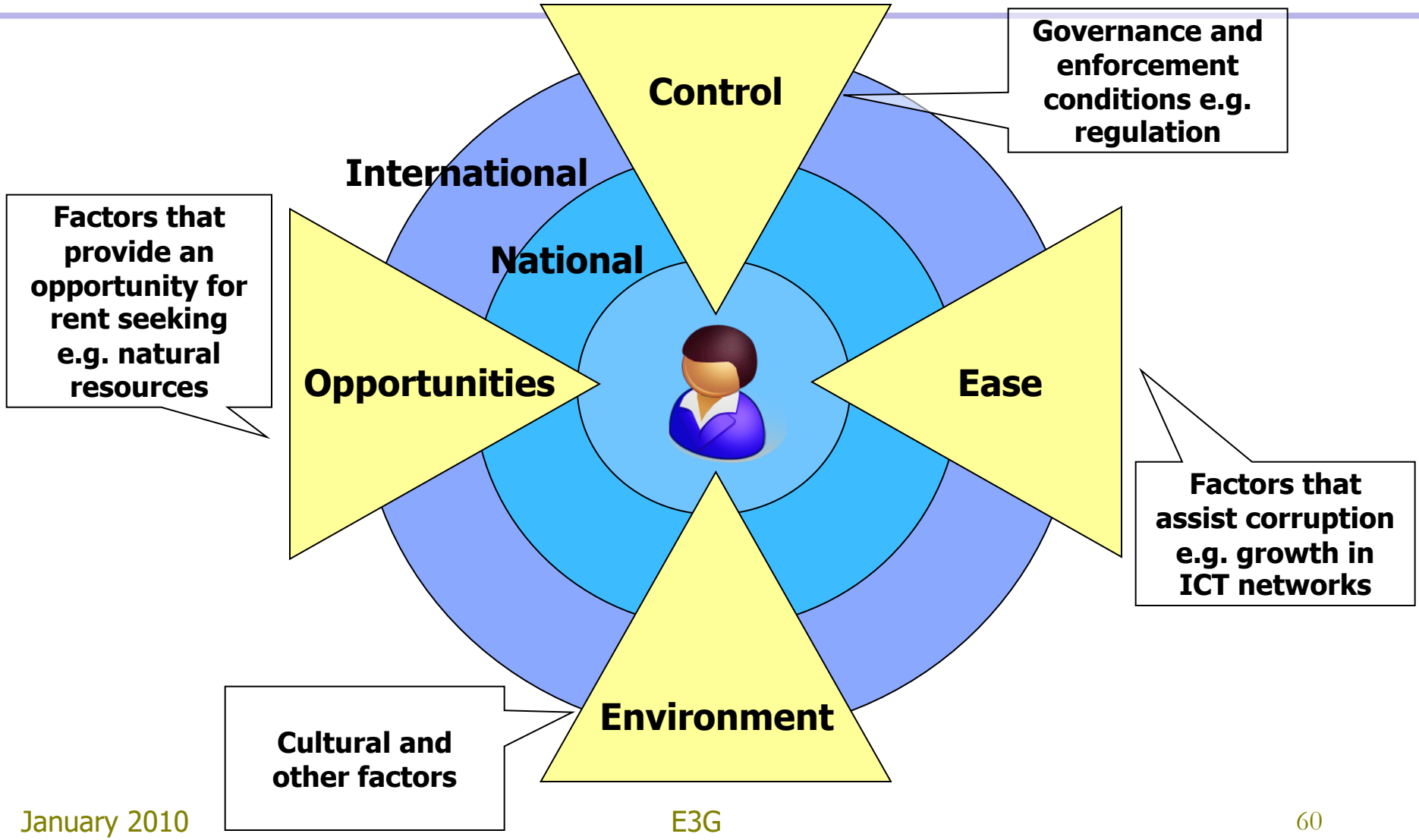
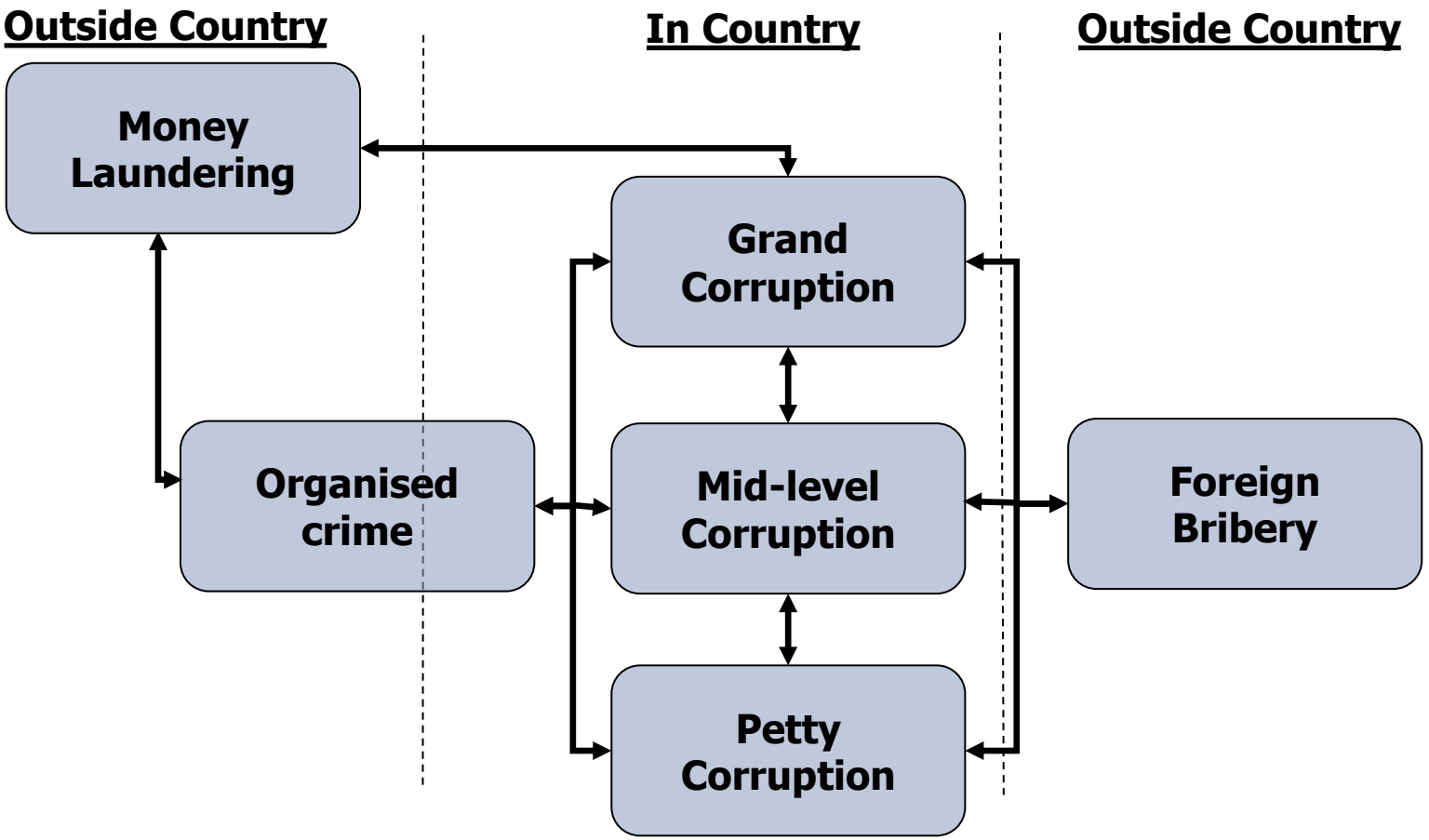
There are many different definitions of corruption. However, there are six key areas highlighted across the literature:

Grand Corruption	• Refers to corruption on a major scale usually by high-level officials or politicians
Mid-level Corruption	• Corruption by mid-level professionals e.g. lawyers and accountants
Petty Corruption	• Typically characterized as an everyday low level abuse of power that citizens and businesspeople encounter
Foreign Bribery	• Providing or promising to provide a benefit that is not legitimately due to influence a foreign public official in the exercise of the official's duties in order to obtain or retain business or a business advantage
Organised crime	• Large-scale and complex criminal activity carried on by groups or persons, however loosely or tightly organized, for the enrichment of those participating and at the expense of the community and its members
Money Laundering	• To move illegally acquired cash through financial systems so that it appears to be legally acquired

The decision to engage in corruption is driven by four key factors



Corruption acts as a system and so need a coordinated approach to simultaneously tackle both in country and out of country factors



A number of global trends are driving and suppressing risks of corruption

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DRIVERS

- Race for Natural Resources
- Increased Infrastructure Investment
- Spread of organised crime and terrorist networks

- ICT Development
- Trade
- Financial markets control

- International standards/National Legislation
- Supply chain management

SUPPRESSORS

Mapping current HMG policy activity

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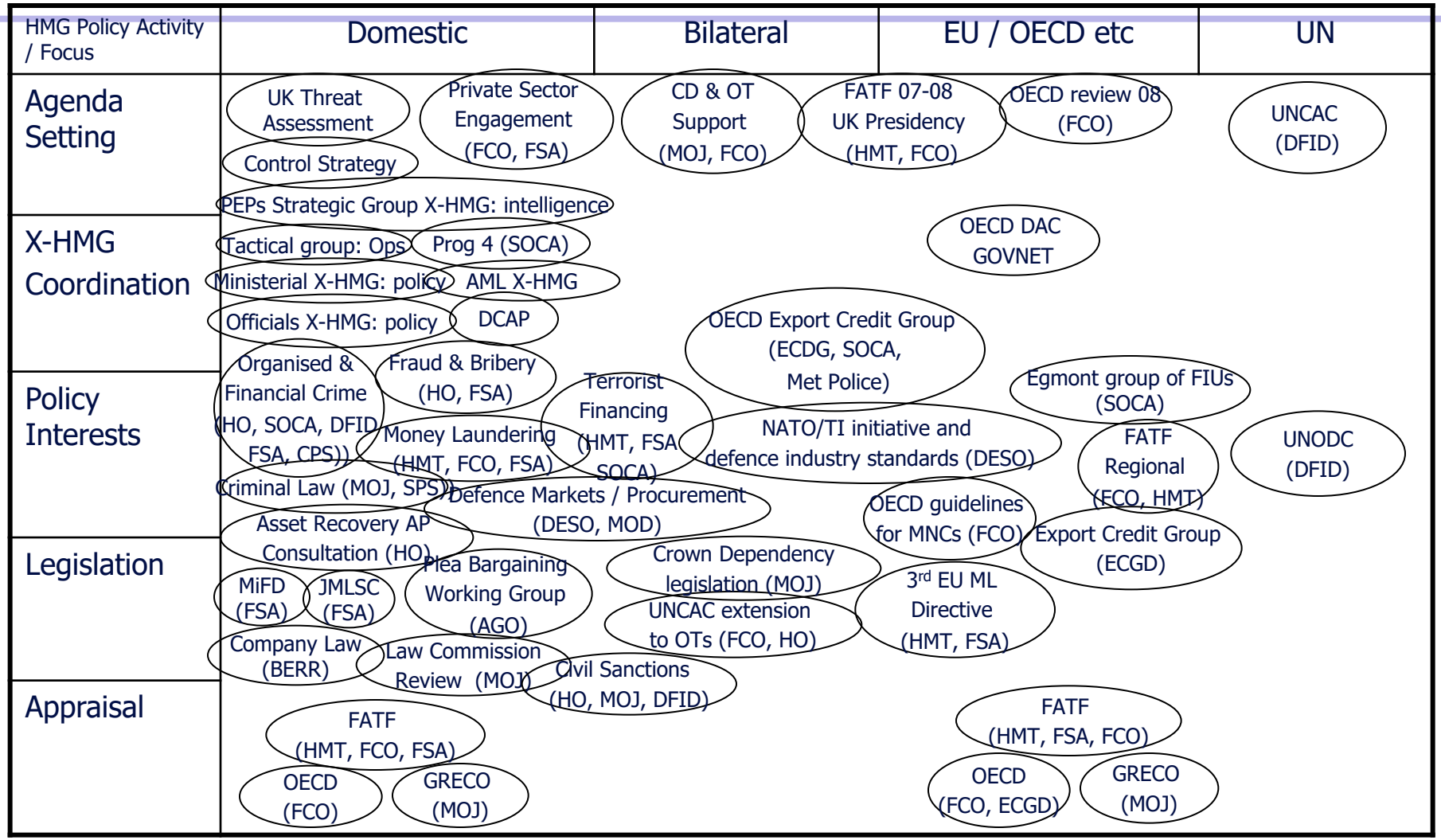

Multiple Actors engaged on each Activity Area

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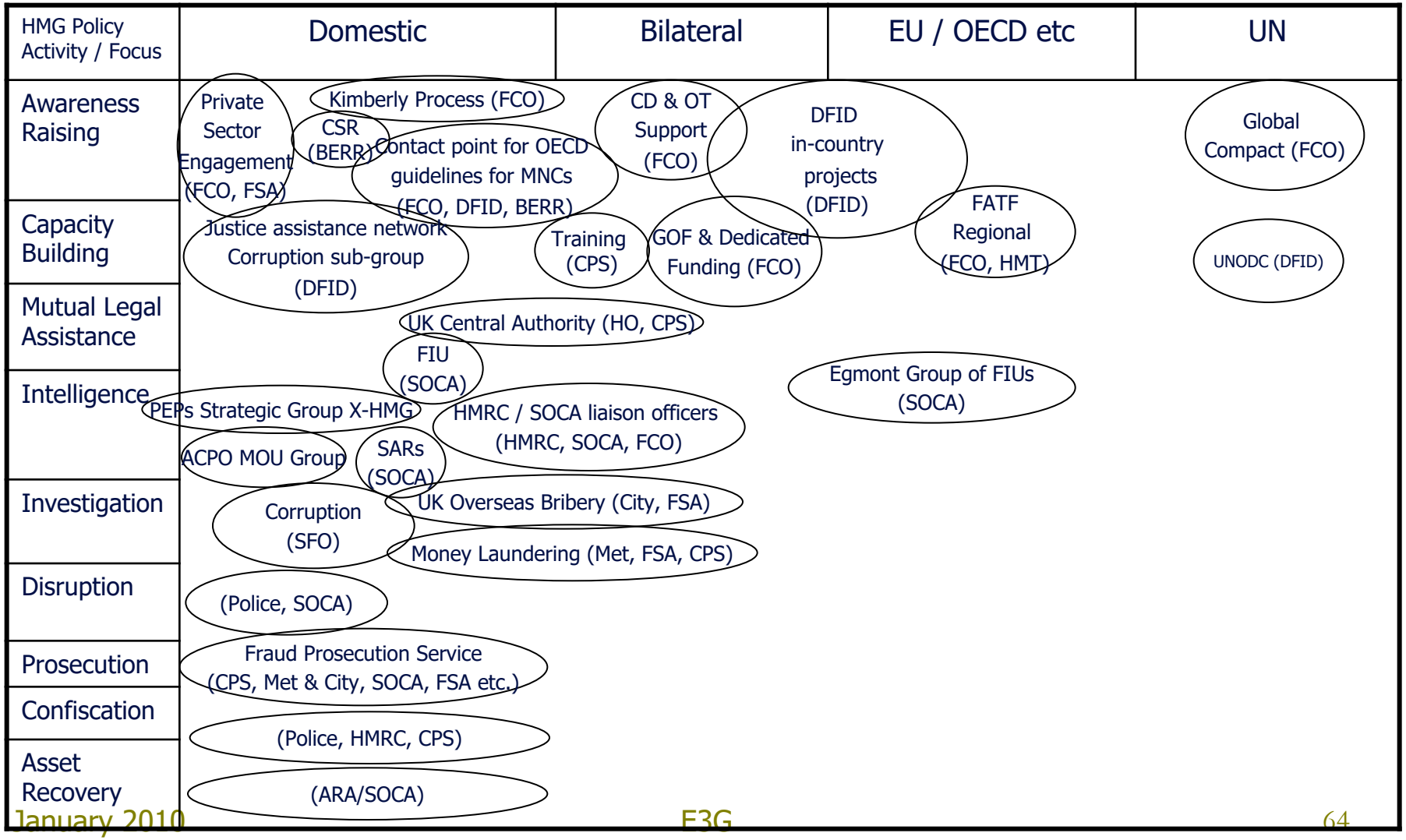

UK should work towards three high level objectives for anti-corruption

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Compliance and protection of the UK's reputation

- Ensure UK business operations and the City of London are fully in line with global standards of best practice
- Ensure UK government spending overseas is not misappropriated
- Increase the credibility and effectiveness of HMG's international anti-corruption leadership efforts

Fighting organised crime and terrorism

- Ensure the City of London remains a leading centre for combating money laundering
- Disrupt criminal and terrorist networks linked to the UK
- Reduce the ability of PEPs, international terrorist networks and organised crime to find safe haven for their financial assets

Improving governance for development

- Build effective states that promote development by addressing corruption and improving governance at a national level
- Work to address long-term environmental factors that help shape in country corruption
- Improve international governance systems for anti-corruption

Lessons: building alignment around system description helps set priorities for complex interventions

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- Corruption is a complex and multifaceted area touching many UK objectives, and multiple re-enforcing causes
- Spread of responsibilities and activities across government hampered setting of common agendas and made many interventions ineffective
- Developing common system for analysis enabled alignment around priorities for cooperation; hopefully giving interventions critical scale and political support
- Will hopefully increase resilience of governance system to multiple climate change challenges

Tackling complex threats requires prioritisation of multifaceted interventions; systemic challenge needed to create common understanding

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Climate change will not be solved by "muddling through"

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- Delivering climate security requires changes in technological, economic and regulatory systems inside a specific timeframe
- The need to drive "intentional change" requires explicit understanding of drivers, constraints, blockages, uncertainties
- The need to build new institutions between different policy communities means creating common frames of analysis and shared objectives

Biggest challenges for tackling climate and energy security will not be technological or financial but institutional

Key policy community integration challenges

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- **Energy and climate security**: lack of common objectives, divergent world views and professional cultures is hampering construction of integrated policies
- **Finance**: better joint understanding of how investment and climate risk are perceived by finance community and method for accurately quantifying domestic "carbon liability"
- **Innovation Policy**: stronger understanding of national and global innovation systems; how key climate and energy technologies will be delivered; and explicit trade-offs between fast low carbon technology diffusion and narrow national competitiveness goals
- **Security, development and climate change**: joint tools for analysing impact of climate change on country stability and conflict in order to shift development investment and diplomacy towards preventive resilience building and risk reduction strategies

Key Systemic Policy Challenges

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- **Low Carbon Infrastructure Investment**: route map for building power grid (and CO2 grid) capable of delivering zero emission power sector by 2030-2035
- **Regional Transport Planning**: developing flexible urban and regional transport infrastructure systems economic under high energy and carbon price scenarios
- **Technology Policy and Competition**: balance of centralised and decentralised programmes to drive near to market technologies owned by incumbents to commercialisation while providing incentives for disruptive and new entrant solutions
- **Resilience Planning**: smart planning for infrastructure investments, information systems and management systems to prepare for increased climate variability

Public/Private Market Creation

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- High efficiency building supply and innovation chains
- Retrofit energy efficiency markets in liberalised electricity markets
- Active/smart grid business models in liberalised electricity systems
- Scalable CCS business models
- Low carbon infrastructure and construction materials

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Simplicity not Simplistic

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"I would not give a fig for the simplicity this side of complexity. However, I would give my life for the simplicity on the other side of complexity"

Oliver Wendall Holmes

Do the Politics with the Policy – or build the delivery coalition around the idea

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E3G spends 50-60% of its resources on building coalitions, understanding political environment and shaping critical "domino" ideas which will motivate decisions;

- **Decarbonisation**: changing a flow of payments on fossil fuels into up front investment; understanding how policy drives finance and risk is critical.
- **Low Carbon Technology**: the certainty of multiple policy failures and scientific surprises requires greater investment in technology development and diffusion;
- **Climate Security**:
  - There are hard security consequences of climate change but no hard security solutions
  - cannot preserve the current security environment under unconstrained climate change; whatever the level of military expenditure.

Techniques for tackling difficult problems

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Difficult problems are often stuck in "impossible" loops which make it difficult for policy makers to see a way out, this can be addressed in several ways:

- "**Reframing the problem**" to bring in new constituencies and approaches: e.g. "need incentives to deliver energy and climate security together"
- **Looking to the long term**: e.g. "is our climate policy developing the technology options we will need beyond 2020, and the infrastructures to use them?"
- **Bundling multiple policy benefits**: e.g. "investment to prevent instability and conflict in Central Asia will benefit the UK's WMD, terrorism, energy and OC policy priorities"

Change the Operating System

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- Throwing more uncertainty at any decision maker without a clear framework for managing risk will motivate short term reactive approaches e.g. no investment in any energy sources.

- Improved outcomes require decision support systems and tools which can motivate investment in both preventive and reactive strategies.

- Design innovation, learning and creativity into responses to handle deep uncertainty and complexity; often requires new institutions (UK Climate Committee; Green Investment Bank)

- Professional cultures must be understood and if possible incorporated into new approaches, or change is unlikely to happen. Though that does not mean biases and false assumptions should not be challenged.

Further Information

E3G

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E3G materials can be found at www.e3g.org