Centre for
Climate Change
Economics and Policy

Grantham Research Institute on
Climate Change and
the Environment

WHY ARE WE WAITING?

THE LOGIC, URGENCY, AND PROMISE OF TACKLING CLIMATE CHANGE

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The Challenges for the World

The two defining challenges of our century:

Managing climate change and overcoming poverty

- If we fail to manage climate change: we will create an environment so hostile that lives and livelihoods will be destroyed.
- If we try to manage climate change in ways which put barriers to overcoming poverty: we will not have the coalition we need to manage climate change.

If we fail on one, we fail on the other

Structure

1. **Science: scale, risks and urgency**
2. Attraction of the transition to a low-carbon economy
3. Public policy for transformation
4. Ethics: why and how we ought to act
5. Psychology and politics: will we act in time?
6. A note on Paris 2015

Climate change starts and ends with humans

- Understanding the relevant processes:
  - Human activity to emissions of greenhouse gases (GHGs);
  - Emissions ('**flows**') to increased concentrations ('**stocks**'). Ratchet effect because CO_2 long-lived and difficult to extract;
  - Increased concentrations to increased temperatures and climate change;
  - Climate change to human impacts.
- All links in the chain subject to uncertainty.

The science shapes economics and politics

- The structure of the science embodies four major difficulties for understanding, analysing and setting public policy:
  - **Immense scale,**
  - **Large risk/uncertainty,**
  - **Long lags,**
  - **'Publicness' of the causes and effects**
- Key implications for economics and analysis: about management of immense risk.

The science is robust and GHG concentration rising rapidly

Climate science is built on two centuries' of theory and evidence

- 1820s: **Joseph Fourier** recognized the atmosphere was trapping heat.
- 1860s: **John Tyndall** discovered the gases that were doing so – the GHGs.
- End of 19th century: **Svante Arrhenius** provided calculations of the effect.
- 1940s: **Walter Elsasser** explained that GHG molecules oscillate at a frequency that interferes with the escape of infrared radiation.

CO_2e concentrations now around 450ppm (Kyoto gases).

- **Adding CO_2e at a rate of over 2.5ppm per year** (likely to accelerate with little or weak action).
- This is up from 0.5ppm per year 1930-1950, 1ppm 1950-1970 and 2ppm 1970-1990.

Inaction could take us to 750ppm CO_2e over a century. Strong possibility of **eventual temperature increase of more than 4°C (or more than 5°C)**

The risks are unprecedented for humankind

Damage from climate change intensifies as the world gets warmer:

- Already 0.8°C at edge of experience of Holocene and civilisation.
- Seeing strong effects now; yet small relative to what we risk.
- Beyond 2°C is dangerous – risk of tipping points.

Temperature increase of 4 or 5°C or more not seen for tens of millions of years (homo sapiens, 250,000 years):

- Likely be **enormously destructive**.
- **The reasons we live where we do, would be redrawn** (too much or too little water).
- Potential causing **severe and sustained conflict** with migration of hundreds of millions, perhaps billions of people.

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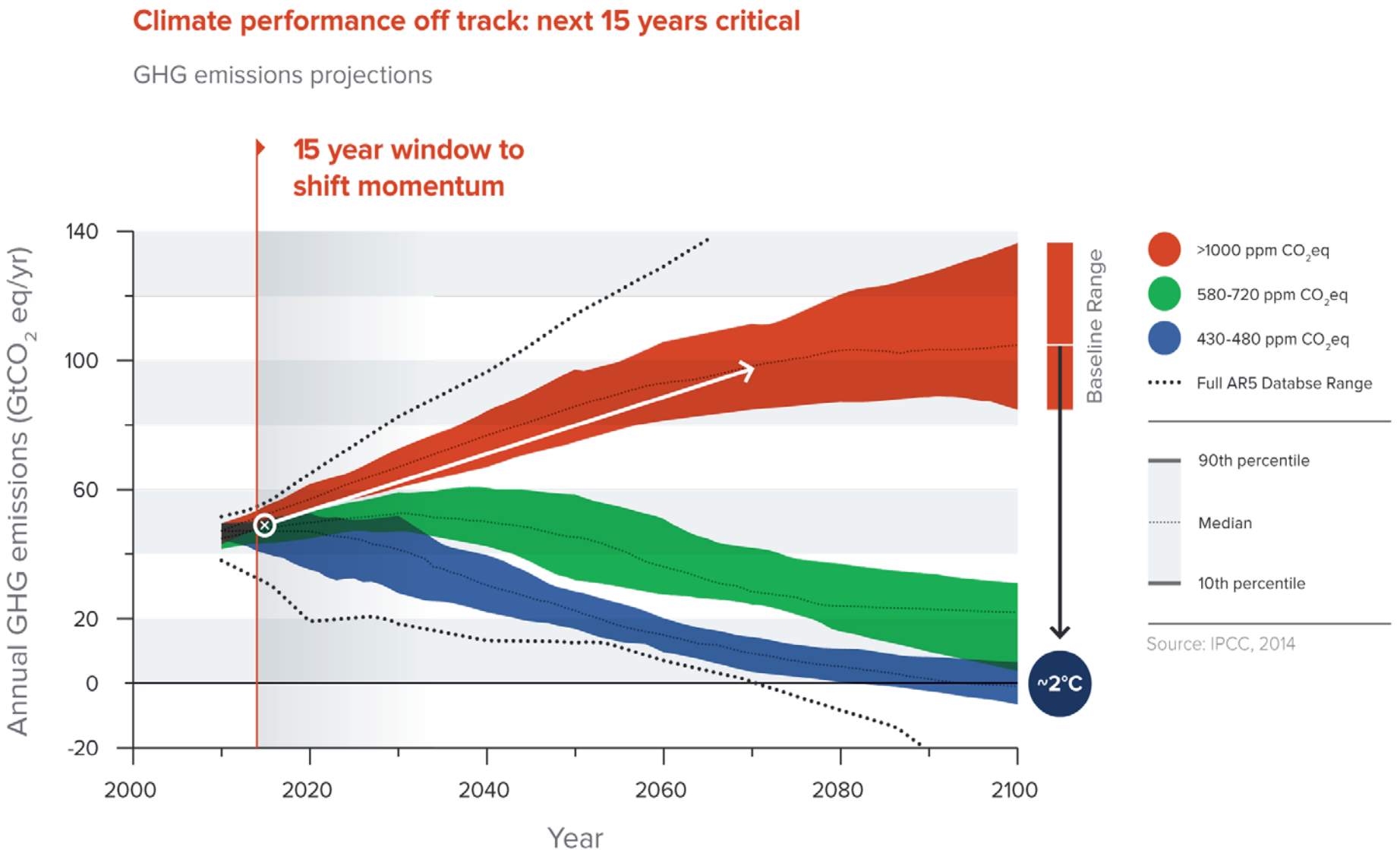
What to do to hold warming below 2°C?
On the Road to Paris: Identifying the gap

- Current pledges look around 55–60 $GtCO_2e$ per annum in 2030 (e.g. *Boyd et al*). An improvement on BAU (ca. 65–68).
- But **far higher** than emissions path for 50:50 chance of 2°C: around 40 Gt which still requires very strong action later.
  - Or ca. 35 Gt in 2030 with no negative emissions technologies.
- Necessary path likely to require:
  - **zero emissions from electricity** around mid-century.
  - **zero total emissions by the end of century**.
  - **Net negative** in **major sectors** well **before end of century**.
- Can burn (uncaptured) less than half of established hydrocarbon reserves and retain a reasonable chance of holding to 2°C.

Why the next 15 years are critical



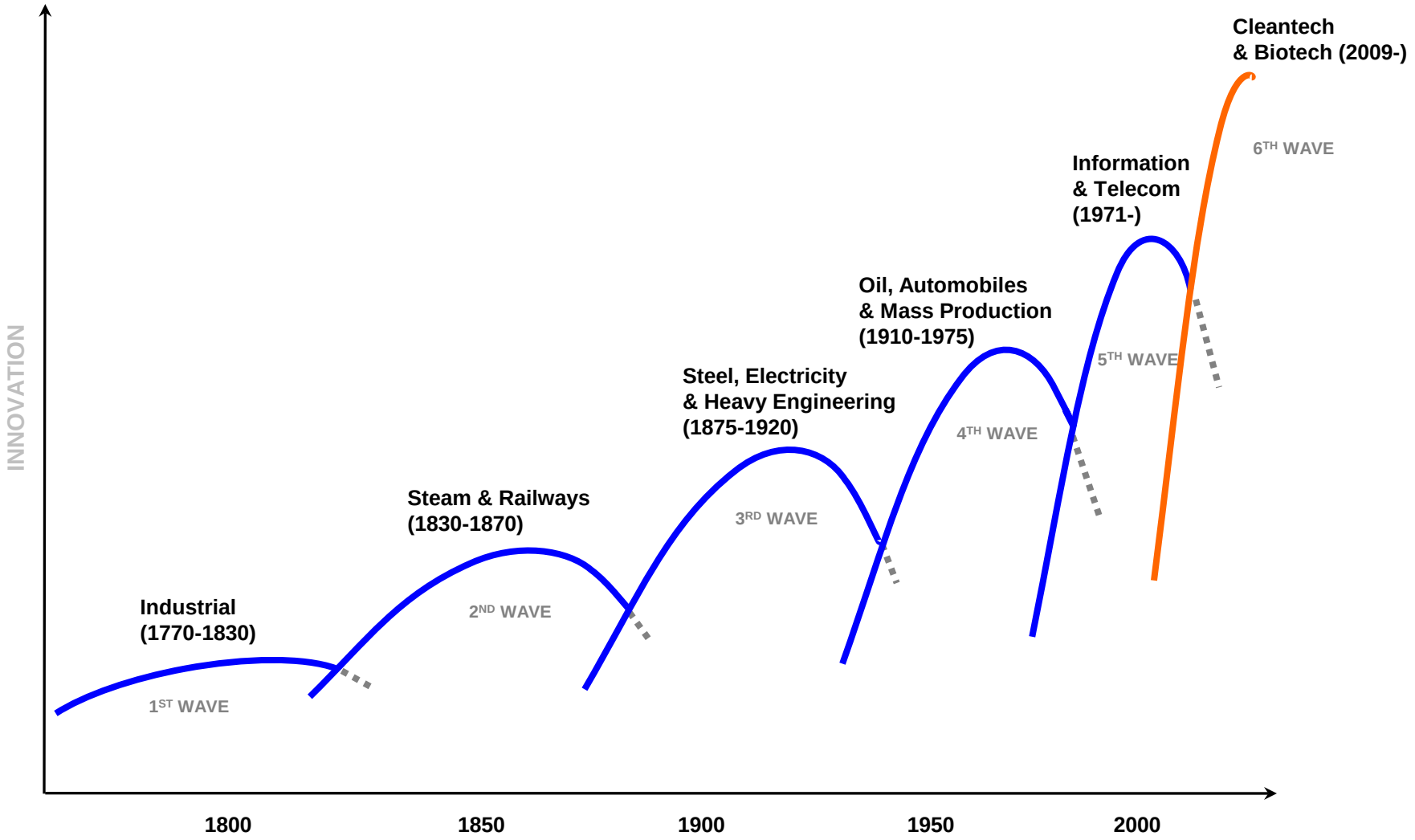
Source: New Climate Economy
http://newclimateeconomy.report/overview/

Scale and nature of response needs to be rapid and strong

If world **emissions are to be cut by factor of 2.5** (50 Gt (2014) → below 20 (2050)) and world **output grows by a factor of 3** (3% growth p.a. to 2050), then **emissions/output must be cut by a factor of 7 or 8**.

- Requires strong action **in all regions** of world, **in all economic sectors**.
- The transition to **low-carbon growth represents a very attractive path**: could, if economic history is a guide, stimulate dynamic, innovative and creative growth.
- Will need **substantial investments** and will involve some **dislocation**.
- A new **energy-industrial revolution**.

Waves of innovation



Source: DONG Energy (2009); diagram based on Merrill Lynch (2008) drawing on Perez (2002) (schematic not precise quantitative vertical axis).

Understanding the critical insights since Copenhagen (II)

1. **Greater understanding of how economic growth, development, and climate responsibility are intertwined.**
   - Growth and development complement and support climate action (see e.g. NCE "Better Growth, Better Climate", 2014)
   - Portraying them in conflict misunderstands development and the opportunities of a low-carbon transition → an 'artificial horse race'
2. **More intense understanding of the dangers of delay**.
   - Economies are transforming.
   - Next two decades fundamental. Long-lasting investments are being made in urbanisation and energy systems.
   - Our cities will grow from 3.5bn to ca. 6.5bn by 2050. They could be more congested, more polluted, more wasteful → patterns of the past.
   - Continuing structural change and inadequate management of cities and energy intensifies the danger of delay.

Understanding the critical insights since Copenhagen (II)

3. **The damages from fossil fuels (beyond climate) immense and more apparent.**
   - Air pollution destroying many millions of lives and livelihoods per year.
   - Because of the unpriced costs associated to using fossil fuels, the (direct and indirect) subsidies cost taxpayers and governments trillions of dollars per year.
   - China air is equivalent to 40 cigarettes/day, kills 4000/day (Berkeley Earth 2015); India worse; Germany, Korea, and indeed most countries have severe problems.

Translating new understanding into dialogue for COP21

i. Focusing attention on the urgency in accelerating the transition to low-carbon economy.

- Emphasise importance of SDGs (New York, September) and the finance of the necessary investments (Addis Ababa, July).
- Vital that these investments promote (rather than derail) sustainable development.
- $100bn per year important commitment by rich countries to support transition in developing economies set in the context of the trillions per annum in infrastructure over the next two decades.

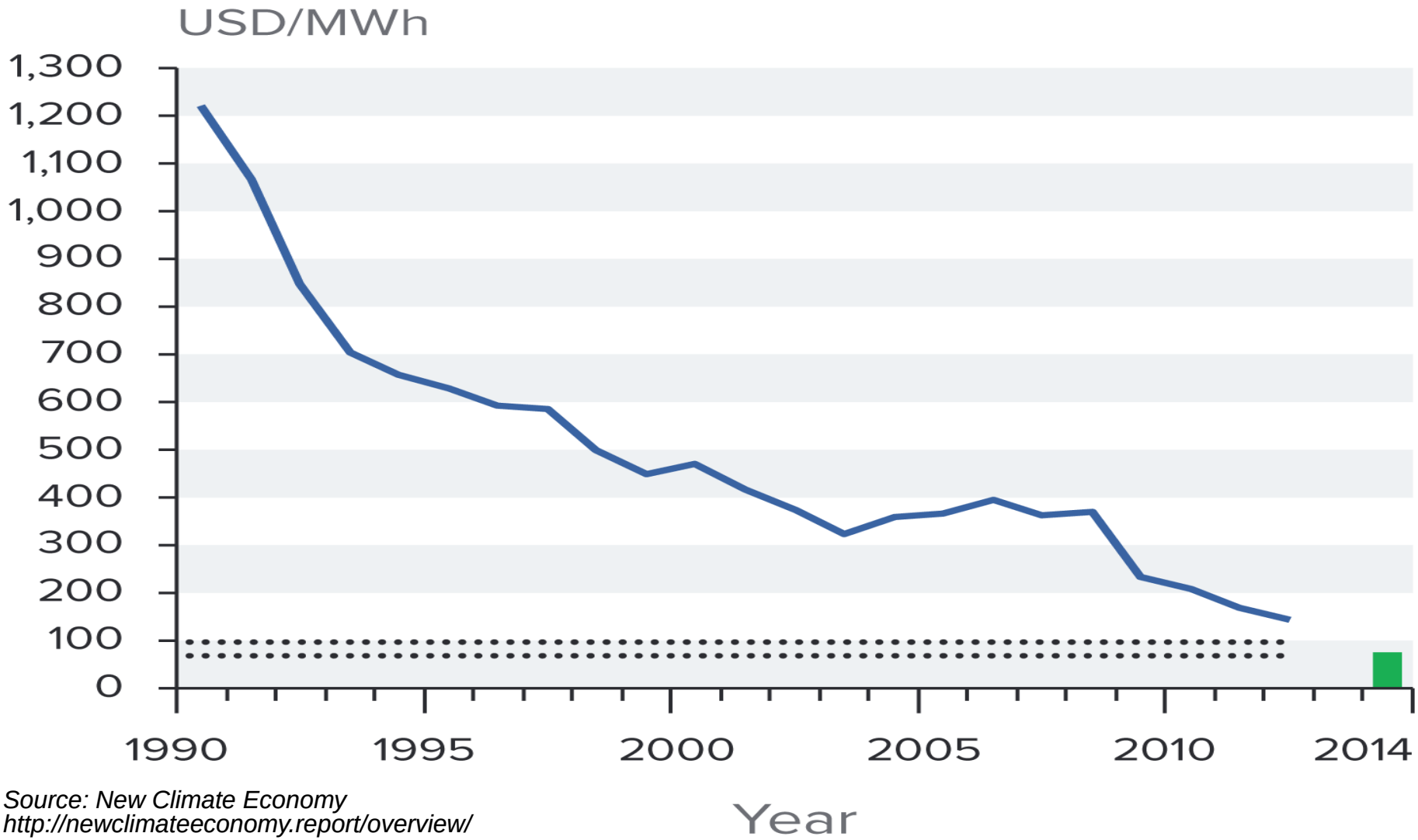
ii. Unlocking the enormous opportunities from low-carbon economy.

- We lose many or most of these opportunities if we hesitate.
- There is much we can do now that is in our self-interest, in each country. (See next four slides).
- We must coordinate and collaborate to realise the powerful collective interest.

Technical progress – a focus on solar

Solar PV module installed costs have fallen around 50% since 2010: currently well below $1/watt.

Delivered prices of energy now competitive generation in 79 countries.



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Casting the economic policy responses: the dangers of delay

- Uncertainty and 'publicness' of the causes might suggest delay to learn more.
- That would be **a profound mistake for two reasons:**
  - "Ratchet effect" from flows of GHGs to concentrations.
  - Much of infrastructure and capital investment results in technological "lock-in".
- Delay increases the risk and cost.
- Would need to undertake radical, rapid and expensive decarbonisation in 2 or 3 decades time, **resulting in the scrapping of vast amounts of 'locked-in' capital**. Politically feasible?

Policy and market failures: GHGs biggest externality the world has seen

- Unless appropriate policy is in place we do not bear the costs of the damage from GHGs.
- Different failures point to different instruments.
- But the collection is mutually reinforcing:
  - ***Greenhouse gases***: e.g. carbon taxes / cap-and-trade / regulation;
  - ***RD&D:*** e.g. tax breaks, feed-in tariffs (FIT) for deployment;
  - ***Imperfection in risk/capital markets:*** e.g. risk sharing/reduction through guarantees, equity, green investment banks.
  - ***Networks:*** e.g. electric grids, transport, broadband, community-based insulation schemes;
  - ***Information:*** e.g. "labelling" requirements on products more generally. Awareness of options for production and consumption;
  - ***Co-benefits:*** e.g. local and regional air pollution from burning hydrocarbons very damaging, valuing ecosystems and biodiversity, valuing energy security.

Policy and the dynamics of learning and change

- Need a “dynamic public economics”.
- As we learn about technologies (see next section), organization, and design along the way, **so too will we learn about policies**.
- Transparent, long lasting and stable polices: **provide investors and entrepreneurs with long-term confidence**.
- The **right climate policies will likely trigger exciting new waves** of global **investment, innovation, and discovery**.
- Should design policy to foster learning and **flexibility** – new opportunities will arise.
- Invest strongly in **research** and **innovation**, e.g. **Apollo Programme**.

Critical importance of infrastructure investment

- Magnitude of global investments needed over next 15 years: order of $90tn (mostly in developing economies), $6tn a year on average:
  - We need both better quality and greater scale.
  - Requires massive investments in sustainable cities, energy systems and elsewhere
- Lack of infrastructure is one of most pervasive impediments to growth and sustainable development.
  - Good infrastructure: **unshackles** and **removes constraints** to growth and inclusion. It **fosters** education and health
  - Bad infrastructure: **kills** people, leaves **unsustainable** economic burdens for future, puts **pressure** on land and natural resources
- Investing in infrastructure can boost demand, raise productivity and long-term growth.

Unlocking sustainable infrastructure

- What is holding back the scale and quality of investment in sustainable infrastructure?

i. Government-induced policy risk

- Infrastructure investment is long-lived and largely built on incumbent policy frameworks – the right investment climate.

ii. Financial system

- We are unable to mobilize key financing sources. Institutional investors assets hold very little of their assets in infrastructure.
- We need to better identify financial risks and understand how to manage them in order to scale-up and deliver.

- Unlocking good infrastructure needs action on **both** policy **and** finance.
- Must expand capacities of development banks and to foster profitable and long-term capital, including from institutional investors.

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Ethics of climate change (I)

- Climate change gives rise to important & complex normative questions.
- All major approaches to moral philosophy seem to point in same general direction: strong action to reduce emissions is morally required. Book examines number of approaches beyond the standard economics: Kantian, virtue ethics, social contracts, rights/liberty…
- The details are challenging: *who*, *when* and *how much*?
- I examine here two sub-topics in the ethics of climate change:
  - Inter-generational ethics: inter-temporal values; discounting.
  - Intra-generational ethics applied to real-world international cooperation: a new approach for Paris 2015.

Ethics of climate change (II): Inter-generational issues

- How can we compare the value of something to people today vs its value to future people?
- Discounting future *goods*
  - How do we value (today) goods consumed in the future? Should we discount the value of future goods because "people in the future will be richer"? It matters *which* goods. And which people.
  - Discount rates cannot simply be "read off" from markets.
- Discounting future *welfare* or *lives*
  - Weights the *welfare* or *lives* of future people lower (irrespective of consumption/income) purely because parts of their lives lie in the future.
  - It is discrimination by date of birth.

Ethics of climate change (III): Intra-generational issues

- Equity question for international cooperation – which countries should do what and when?
- Context
  - World must be at 2 tonnes CO_2e per capita by 2050 globally for 2°C.
  - **Developed countries**: 1 billion in 7 billion population; Responsible for around half of global emissions since 1850; Average per capita emissions still >15tCO_2e per year.
  - **Developing countries**: Responsible for around 2/3 of current emissions; will be responsible for most of future emissions; but per capita emissions still 1/3 to 1/2 of rich countries.
- Arithmetic implies faster cuts for rich countries. And if few people below 2 tonnes there can be few above.
- Double inequity – rich countries major responsibility for past emissions, poor people hit earliest and hardest.

Ethics of climate change (IV): Intra-generational issues

- A proposal: Equitable Access to Sustainable Development. Language of COP16 in Cancun, 2010.
  - All are entitled to **sustainable development** as part of **dynamic** and **collaborative** transformation to a zero-carbon world.
  - **Choice of sustainable development** path is determined by nations; for developing countries that path **supported by rich countries**.
- Common actions; but rich countries cut faster and generate strong examples; promote flows of finance and technology.
- Contrast with "burden-sharing", "others should pay incremental cost", zero-sum games; "common but differentiated responsibility" (CBDR).
- EASD language and concept contain ideas of CBDR but are more dynamic and collaborative.

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Psychology (I)

Perceptions of or concern about climate risks have complex and not necessarily rational foundations.

- People assess frequency or probability of an event by the ease with which instances come to mind.
- Frequency and nature of media reporting affects public concern about climate change.
- Concern about climate change also affected by:
  - "Elite cues" (→ importance of trusted elites as "messengers")
  - Prominence of other issues (economy, security etc.).
  - Situational influences. e.g. local temperature.
  - The person's pre-existing worldview (e.g. communitarian/ egalitarian vs individualistic/hierarchical).

Psychology (II)

People's support for climate change mitigation policies have complex and not necessarily rational foundations.

- People weight negative effects higher than positive ones, are "loss-averse", and have "status quo bias".
- People discount *future* costs and benefits of policies – main reason appears to be perceived *uncertainty* about whether these will eventuate.
- Most costs associated with climate policy are more immediate and less uncertain; climate benefits are long-term, and co-benefits are medium-long term and less certain and less directly "individual".

→ Low willingness to accept perceived short-term costs of policy for (larger) medium or long-term climate benefits and co-benefits.

Politics (I)

- Political incentive structures are biased toward short-term electoral cycles / terms of government.

  → not conducive to a politics of structural change with short-term costs for (very large) medium and long-term benefits.

- Structural issues and political economy:
  - Vested interests are powerful.
  - Short-term incentive structures in business and finance direct capital away from long-term value creation.
  - Structure and operation of the media is often poorly serving the polity.
  - Existing inequalities make it harder to tackle collective challenges like climate change. More equal societies tend to be more socially cohesive and have higher environmental consciousness.
- A better understanding of national interest could help…

Politics (II): "Better Growth, Better Climate": report of Global Commission, September 2014

- Commission chaired by President Felipe Calderon (I was co chair): business leaders; former Finance Ministers, Prime Ministers, Presidents; leaders of IFIs; and mayors. **Economic decision-makers.**
- Next decades embody **remarkable coincidence** of (i) profound global **structural transformation** (including urbanisation, energy systems, and land use) and (ii) need for **transition to low-carbon**.
- Additional advantage of very rapid technical progress (digital, materials, bio). Also currently low interest rates.
- If conduct **structural transformation well** (relative to congestion, pollution, resource efficiency, land use) then **much of what is necessary** for low-carbon transition will be achieved.
- Structural transformation will happen anyway and need around $90 trillion of infrastructure investment in next 15 years. Doing it well would cost only a few trillion more.
- Most of necessary investment in **national interest**, even without valuing emissions reductions. ***Better growth, better climate.***

Politics (III)

- Slow progress around the world and at international level.
- Some positive signs from key players: China; US; EU.
- But politics not moving far and fast enough.
- National leadership is critical.
- Also international cooperation.
  - Not dominated by incentives to “free-ride” given the attractiveness of the transition for each country, and “environmental responsibility” is taken seriously;
  - Yet international cooperation remains challenging;
  - But it can help give clear goals and signals, coordinate national efforts, provide financial, technology and capacity building support

Politics (IV)

- Business, cities, young people, social movements, can and are bringing pressure.
- Public pressure on investors, firms governments: e.g. “keep it in the ground”.
- Some leadership: AP4 (finance); Unilever, etc. on palm oil…
- Cities: C40, NYC, Bogota…
- Religious leaders.
- Arguments that we can have better growth **and** better climate and that this is very urgent are key.

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From Kyoto to Paris: a new approach (I)

- Shift **away** from attempt at comprehensive, legalistic, formal enforcement of **"burden-sharing"**.
- Toward **dynamic, collaborative**, transitions to zero carbon embodying growth and poverty reduction & **"equitable access to sustainable development"**.
- "**Collaborative**" – implications for structure of agreement.
  - Emissions reductions ("contributions") are "nationally determined"/ non-binding; enables participation of US and BASIC countries.
  - Conduct/processes are **obligations**: to 'submit', 'revise' etc. under structured processes.
  - *Ex ante* review of contributions to build understanding.
  - Transparent MRV and ex post review (to facilitate improvement and understanding).

From Kyoto to Paris: a new approach (II)

- *"Dynamic"* – implications for structure of agreement.
  - Recognition of "**emissions gap**" and need to build ambition over time in dynamic way (as technologies, prices, politics change).
  - Structure for **upward flexibility**, e.g.:
    - Rolling 5–10 year targets and commitments, revised every 5 years.
    - Lower and upper "range" of commitments.
  - Commitments should include not just targets, but also **policies and measures**, and local institutions to implement.
  - Strong focus on MRV, examples, good practice.
  - Strong focus on **innovation and technology.**

→ A "hybrid" agreement: mix of 'ends' and 'means', binding/ centralised and non-binding/decentralised.

Implications for Paris (I): the changes since Copenhagen

- Poverty reduction, sustainable development and climate action support each other: "**Better Growth, Better Climate**"
- Much or most of the necessary action, country-by-country, is in the **vital interest of the country itself**
- The **urgency is still greater than we thought**: great danger of lock-in to high-carbon systems as our economies are transformed
- This underlines still more strongly the returns to and **importance of collaboration to generate the scale and quality of investment necessary:**
  - Finance and technology,
  - Rich countries setting strong examples, and
  - Clarity, soundness and stability of policy
- Examples will come from everywhere: we can now enter a period of extraordinary **creativity, innovation, investment and growth**

Implications for Paris (II): Identifying the gap and ramping up ambition

- Closing the gap to 2°C. Current pledges look around 55-60 $GtCO_2e$ per annum in 2030. An improvement on BAU (ca. 65-68).
- **Strong efforts needed to ramp up** ambition before and after Paris: most or many 2°C paths would be around 40 by 2030.
- Paris should **not be regarded as a one-off opportunity** to fix targets. It should be the first step of many, including regular reviews.
- Must now recognise that high emission levels over the next 20 years imply **zero carbon** by the second half of this century looks necessary (G7 Communique, Elmau, Germany 2015)
- More broadly, Paris is chance to build understanding not only of threats and **risks** but of the great **opportunities** that lie in the transition to the low-carbon economy.

Implications for Paris (III): Giving confidence for action

- **There is no horse race between economic growth and climate action**, and **richer countries must support poorer countries** in making the transition to low-carbon growth.
- By creating this understanding, Paris should provide confidence to underpin the ramping up of ambitions:
  - Review, assess and learn from experience;
  - Support finance and technology collaboration;
  - Understand that the transition to a low-carbon economy supports growth, poverty reduction and sustainable development;
  - Recognise that action on the SDGs and action on climate are part of the same story and mutually supportive;
  - Bring together and intensify efforts of international institutions (MDBs, UN, G20…).
- Not only environment or foreign ministers: Presidents, Prime Ministers, ministers of economy, finance are crucial. This is all about development.
- Then we can rise to the two defining challenges of our century – **overcoming poverty** and **managing climate change**. If we fail on one, we fail on the other.