A Growth Story for the 21st Century: building sustainable, resilient, and equitable development

Lecture 2: A new growth story; structural transformation; policies and institutions

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Slides sufficiently detailed to be read independently of lectures. Not all detail will be presented.

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LSE The London School of Economics and Political Science

Grantham Research Institute on Climate Change and the Environment

Grantham Foundation for the Protection of the Environment

The Queen's Anniversary Prizes For Higher and Further Education 2021

This is the time for economics and the social sciences to chart a course for fundamental and rapid change

- These lectures are about **economic analysis, ideas, policy, and action that can guide a rapid change of course** and the creation of sustainable, resilient, and equitable growth and development.
- Building on the science, they show what is necessary, and on the technology, what is feasible. The scale, speed, and nature of the necessary change imply that the **transition will not be easy. The obstacles lie mostly in economics, politics and society rather than technology.**
- The prize is the **avoidance of a catastrophic future for the generations to follow and the creation of the growth story of the 21st century.** Far more attractive than the dirty, destructive paths of the past.
- Our focus then is on the **economics of change**. But we must also recognise that **economics must itself change towards the economics of rapid structural, systemic, and technological transformation.**
- This is the moment **economics must step up**. But its analysis must be interwoven with politics, finance, law, geography, international relations, history, culture, and crucially, moral philosophy. **With the social sciences and the humanities.** I trust that the great Lionel Robbins would have recognised this clearly and lead the way.
- **This is a moment for the LSE "to know the causes of things", "for the betterment of society"; its motto and its purpose.**

Essence of the lectures

Lecture 1 : A world re-drawn; a world in crisis; a moment in history; the agenda for growth and transformation (12th March)

1. Looking back: growth and development since the second world war.
2. A world redrawn: a series of crises and deepening understanding of the unsustainability of current paths.
3. Climate and biodiversity crises: science and necessity of rapid and fundamental, structural, and systemic change.
4. The ethics, the economics, and the politics of sustainable development and fundamental change.
5. A decisive decade: urgency and scale of action.
6. Implication: the agenda for analysis and action is the building of sustainable, resilient, and equitable growth and development; rapidly and effectively.

Lecture 2 : A new growth story; structural transformation; policies and institutions (13th March)

1. The basics of the new growth story.
2. Climate action, development, and poverty reduction.
3. Investment and innovation.
4. The analytics of the new growth story.
5. Policies and institutions.
6. The role of the state.

Lecture 3 : Recasting the global economy and international institutions: collaboration, competition, and the new growth story (14th March)

1. Vulnerability, history, and opportunity: differences across countries.
2. Technology, geography, trade.
3. International action, responsibilities, and collaboration. Five key areas: trade; technology; land; overshooting; finance.
4. Land, forests, and biodiversity.
5. Overshooting, removal, and geoengineering.
6. Fundamental reform of MDBs and international finance system.

Closing call; optimistic about what we can do as a world; anxious about what we will do; challenge is to turn "can" into "will".

References provided in a separate document.

Structure

- **The basics of the new growth story**
- Climate action, development and poverty reduction
- Investment and innovation
- The analytics of the new growth story
- Policies and institutions
- The role of the state

Lessons from Lecture 1: A critical moment in time and a new growth story

Looking back

In the past 70 years, advances in **human welfare and economic output have been remarkable and unprecedented**, albeit with persistent regional disparities. **The structure of the world economy has been transformed**; now multi-polar. **Severe climate, biodiversity, and environmental stresses** have emerged from weight of output and dirty, wasteful and destructive processes.

A world redrawn

A series of crises, the transformation of the world economy, and the recognition of the **unsustainability of our economic methods and models**, where gains in well-being are marred by environmental damage and social division, has prompted **a re-evaluation of global objectives**. Sustainability and social cohesion as central issues. In particular, the SDGs and Paris climate agreement of 2015.

Climate and biodiversity crises

Accelerating climate and biodiversity crises demands urgent and fundamental systemic change. Meeting Paris Agreement targets crucial to avoiding severe impacts of warming and further damage to biodiversity. Need for **integrated and economy-wide and rapid action on mitigation, adaptation and sustainable development** in all countries.

The ethics, the economics and the politics

The underlying ethics point to an approach to sustainable development founded in **human rights and intergenerational justice,** based on the right to development, itself embodied in a notion of common humanity. Rejection of discrimination by date of birth. Recognition of the role of past historical emissions and injustice. All this goes beyond standard "welfare function" approaches of most economics; but sensible application of standard "consequentialism" points in similar directions for actions. The necessary **transformative change requires public action and decisive political leadership** to navigate the disruption, foster intragenerational equity, and seize the opportunities the transformation presents. The **obstacles lie more in the economics, politics, and society** than in science and technology.

A decisive decade

The decisions of the next decades, particularly on infrastructure in EMDEs, will dictate whether we lock in high carbon emissions or transition to **sustainable, resilient, and inclusive development**. **A big push on investment is central to this transformation**, requiring at least $4 trillion p.a. globally by 2030. **A new model of growth and development** is in our hands but action must be swift and strong. Much more attractive than the dirty, destructive paths of the past. A growth story for the 21st century: many opportunities along the way; rewards are great; obstacles and difficulties are real; but failure risks catastrophe.

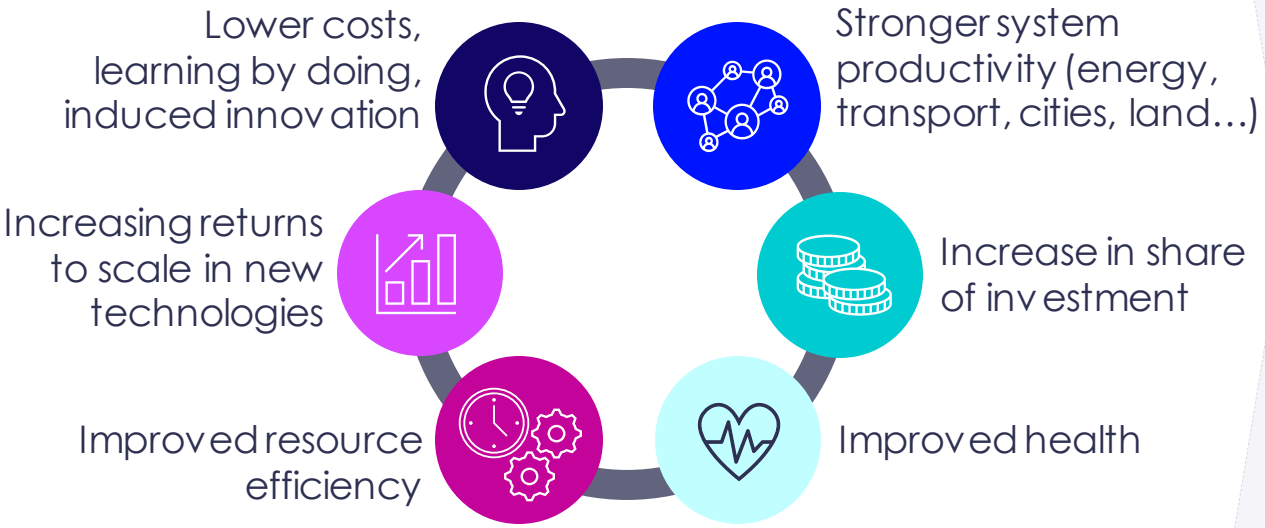
Implication

Sustainable, resilient and equitable growth requires **integrating natural capital and social equity into economic analyses and actions.** And placing rapid **structural, systemic and technological transformation** at centre stage. As technology advances, we can see that the **major difficulties lie in economics, politics, and society**. International collaborations that foster and finance investments in new clean and robust activities in affordable ways, particularly energy infrastructure and resilience, are essential for transformative change at the pace now required. **Global cooperation and a new multilateralism are crucial**. **Economic analysis, policy, and action** should be oriented to fostering the transformation, realising the new growth opportunities, and underpinning global cooperation. **This is the new agenda for economics and the social sciences**.

The 21st century growth story

No horse race between climate action and growth. Investment and economy-wide structural transformation are at the core of the new growth story. Most of the processes embodied in the drivers of the new growth story are excluded from standard macro modelling or general equilibrium modelling.

Six interwoven mutually reinforcing drivers



A short, medium and long-run story

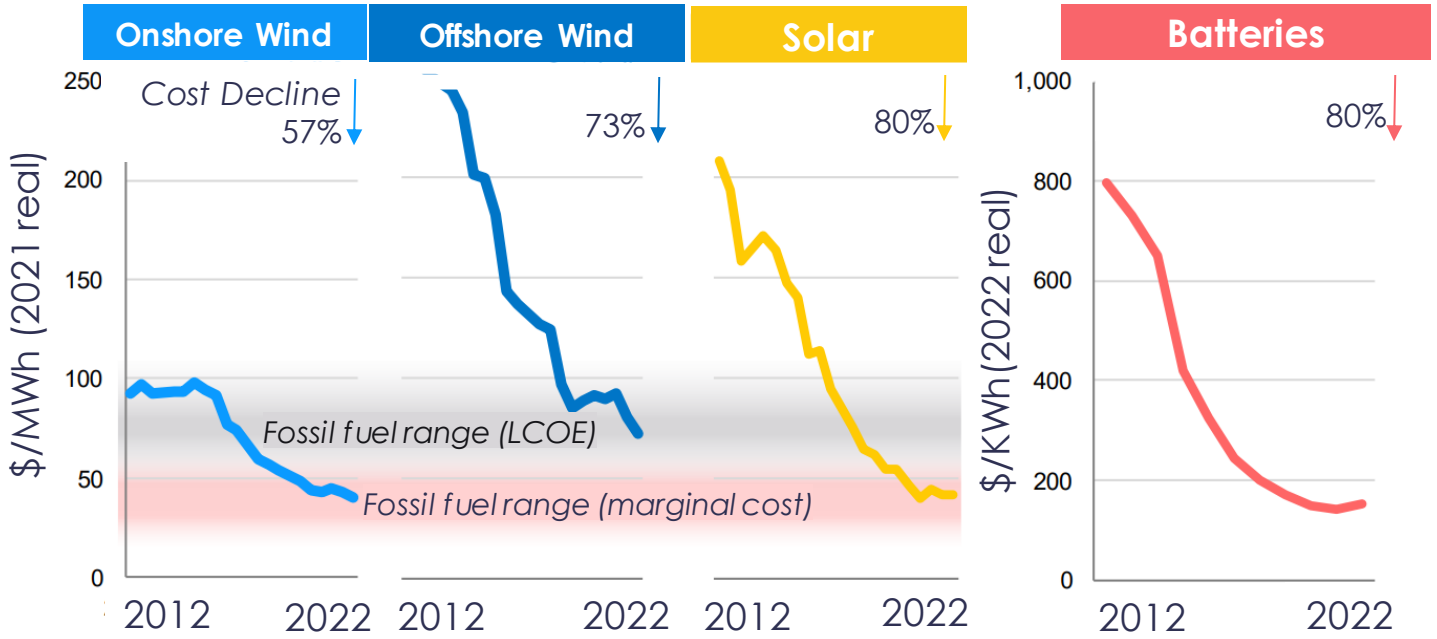
5 - 10 years	Investment in sustainable infrastructure and other assets can boost shorter-run demand and growth, sharpen supply and efficiency, reduce waste and pollution, promote sustainable development, improve health and reduce poverty.
~ 10 years	In the medium term, low-carbon investment can spur innovation, creativity and growth, unleashing new waves of innovation and discovery.
~ 20 years	Low-carbon is the only feasible form of longer-run growth on offer. **High carbon growth self-destructs.**

The driving forces of a new growth story:

1 Lower costs, learning by doing, induced innovation

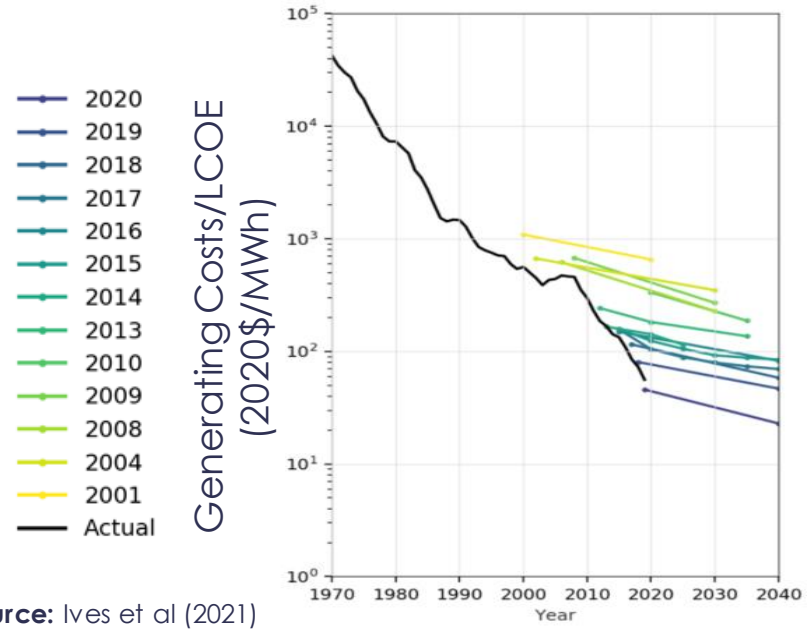
The pace of technology advancement and cost reductions has been rapid and faster than expected. Capital costs for renewables continue to fall much faster than those for conventional technologies. Standard models do not embody the rapid, structural/systemic change, disruptive technological change, and increasing returns to scale, that can, with strongly increased investment, drive an early transition.

Renewable power technologies: decreases in levelized cost of electricity



Source: RMI (2023a)

Actual versus IEA projected LCOE of solar PV



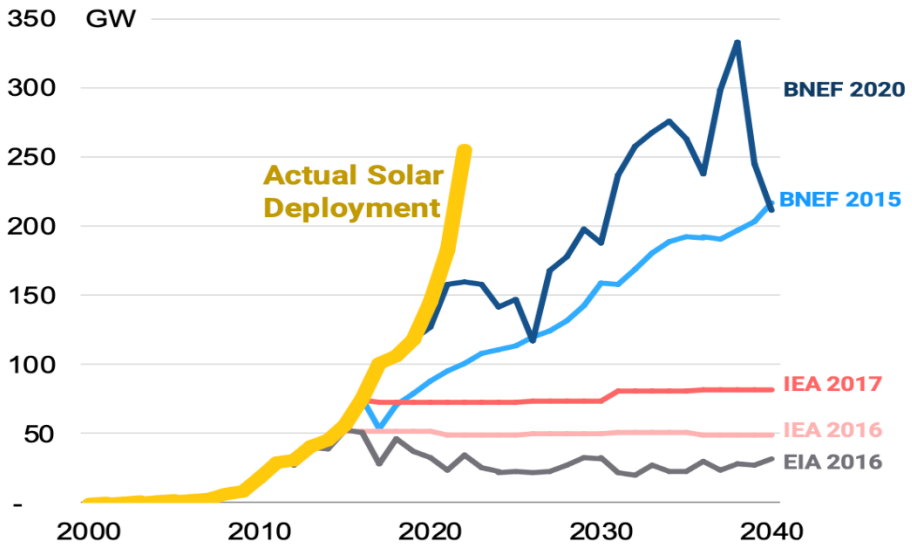
Source: Ives et al (2021)

Technological tipping points: through learning by doing the technology can become more efficient and, with economies of scale, can reduce costs below incumbents, attracting new investments and markets.

Solar deployment is exploding and investments in renewables are already higher than in fossil fuels

Investment in clean energy is outpacing fossil fuels, with solar power expanding rapidly, particularly in China which added 40% of the global total in 2022. Major shift in global energy investment priorities over last 5 years.

- Annual clean energy investment **has risen much faster** than investment in fossil fuels.
- The recovery from the Covid-19 pandemic and the response to the global energy crisis **have provided a major boost** to global clean energy investment.
- **For every $1 spent on fossil fuels, $1.7 is now spent on clean energy**. Five years ago, this ratio was 1:1 (IEA, 2023a)

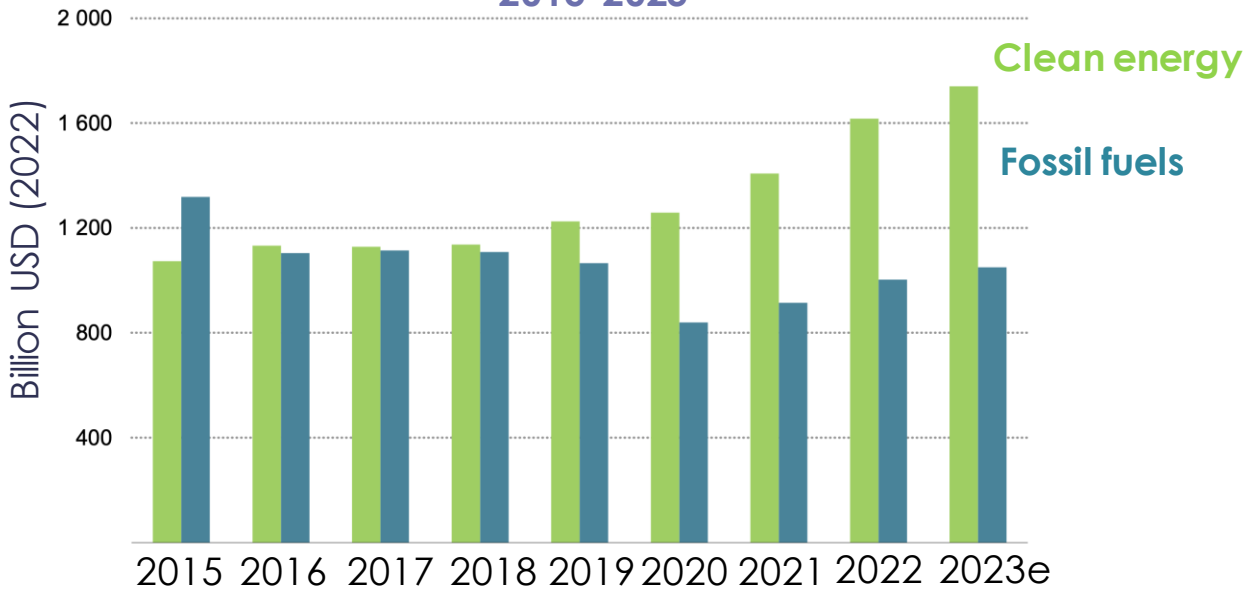


For 20 years the IEA forecast linear growth of solar deployment. For 20 years solar has been growing exponentially.

Source: RMI (2023b).

- In the period since 2015, most of the deployment of solar power globally **has been in China**.
- In 2022, solar power capacity added in China was **40% of the global total.** Over 200GW being added each year (compare UK total capacity of all forms of 80GW) (IRENA, 2023a).

Global energy investment in clean energy and in fossil fuels, 2015-2023



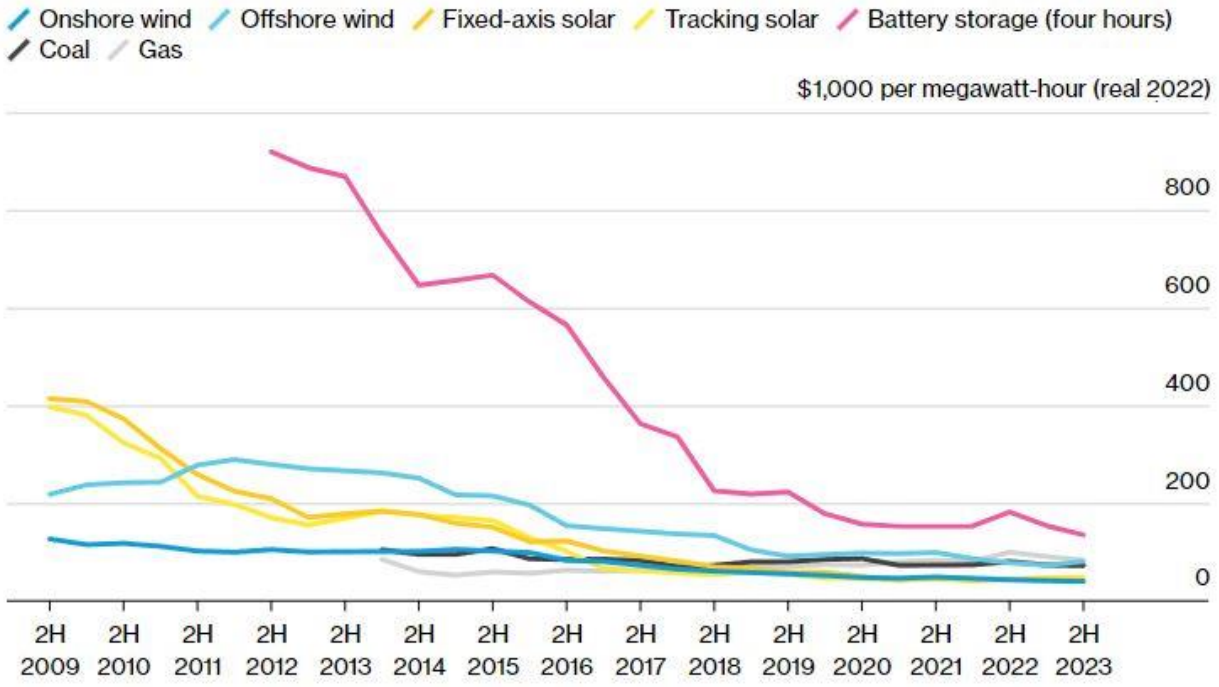
Source: IEA (2023a)

1 Clean is cheaper than the dirty for electricity. But cost of capital is a barrier in EMDEs

Solar and wind power achieved cost competitiveness with fossil fuels.

- In 2022 the worldwide average cost of electricity from solar PV reached $0.049/kWh - **almost one-third lower than the most economical global fossil fuel alternative;** for onshore wind was $0.033/kWh - **nearly half the price of the least expensive fossil fuel-fired option in the same year** (IRENA, 2023b).
- **"Round the clock"** renewables (including storage) already competitive with fossil fuels, **providing capital costs are manageable**. Costs of generation and storage continue to fall. And better grids reduce storage needed (Bloomberg, 2023; IRENA, 2023b).
- Solar cheaper than fossil fuel electricity **in Africa if capital cost is 7-10%, but not if it is 20%** (see Energy Transition/Systemiq).
- **Cost of capital for utility-scale solar PV projects in EMDEs outside China is more than twice that in advanced economies**.

Global levelized cost of electricity (LCOE) benchmarks, 2H 2023



Source: BloombergNEF
Note: The LCOE is the long-term breakeven price a power project needs to recoup all costs and meet the required rate of return. The global benchmarks are capacity-weighted averages using the latest country estimates. Offshore wind includes offshore transmission costs. Coal- and gas-fired power include carbon pricing where policies are already active. LCOEs do not include subsidies or tax credits. LCOEs shown by financing date.

BloombergNEF

Source: Bloomberg (2023a)

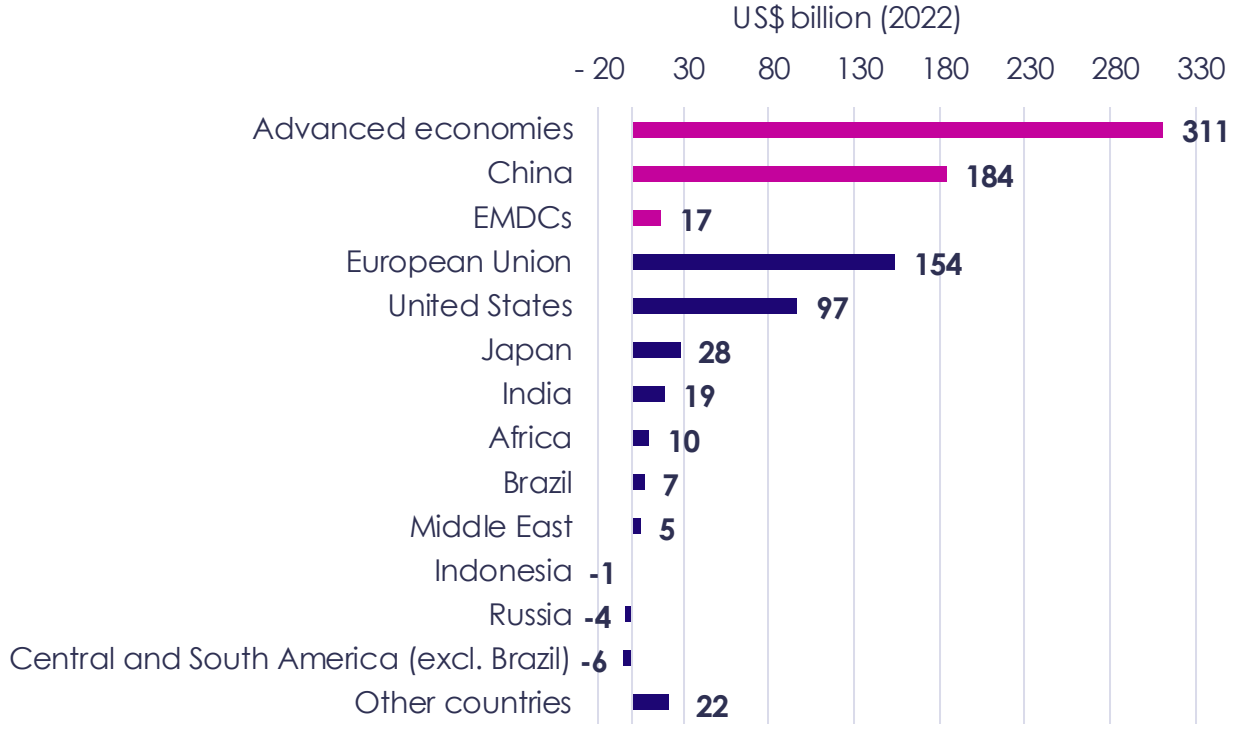
1

Clean energy investment is lagging in EMDEs

Clean energy investment is rising globally but remains disproportionately low in EMDEs other than China, due to policy, financial, and capital cost barriers. These regions have a high clean energy potential and growing energy needs, but fossil fuel investments still predominate.

- Global clean energy investment rose by 40% between 2020-2023. Almost **90% of the increase in clean energy investment since 2021 was in advanced economies and in China,** despite **EMDEs being home to 2/3 of the world's population and 1/3 of global GDP** (IEA, 2023b).
- Challenges that impede investment in EMDEs (other than China) include **unclear policy frameworks and market design, financially-strained utilities, implementation costs and difficulties, a high cost of capital, and push-back from vested interests** (IEA, 2023a).
- There are **notable bright spots**: India continues to see robust investment in solar energy, and clean energy deployment is increasing steadily in Brazil.
- The current trajectory of clean energy investment is a long way from what is needed to meet growing energy needs in a sustainable way. In EMDEs (other than China), investments in fossil fuel production and fossil fuel-based generation ($442 billion in 2023) **still largely outstrip the amount going into clean energy** ($250 billion in 2023) (IEA, 2023a).

Increase in annual clean energy investment, 2019 - 2023



Notes: 1) Advanced economies include countries in the OECD regional grouping and Bulgaria, Croatia, Cyprus, Malta and Romania. EMDCs include all other countries (including the selected regions/countries also presented on the graph such as Africa, Brazil, India, etc.) other than China.
2) Clean energy includes investment in clean energy supply (renewables, electricity networks, and other supply) and end-use (energy efficiency and other end use).

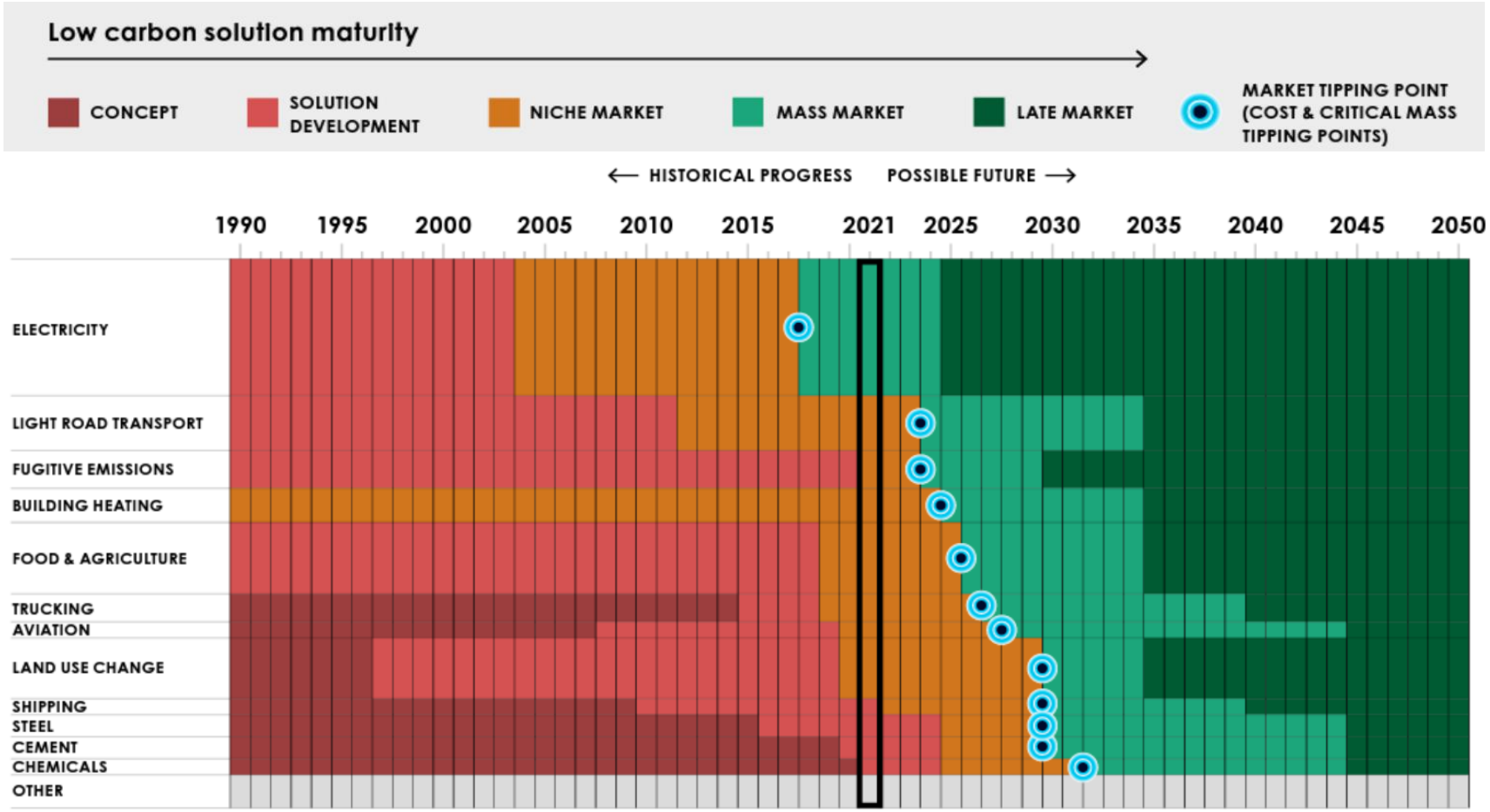
Source: IEA (2023a)

1 Technological tipping points and breakthroughs

In the next seven years, tipping points for crucial low-carbon solutions in sectors representing 90% of emissions likely to be met, making them competitive in key markets (clean cheaper than dirty) (Systemiq, 2021b). Major opportunities for governments and private sector to commit to and invest profitability in this transformation. Design for and try to anticipate learning. Requires large step-up in investment (private and public), supportive policies, and collaboration (private and public).

- **Significant tipping points already occurred**: LCOE for solar and wind below new coal and gas in 2018. This led solar and wind to account for more than 75% of total new capacity additions globally in 2021.
- **Others expected to be reached within a few years**.
- **Unsubsidised Battery Electric Vehicles (BEVs) expected to reach purchase price parity with ICE by 2025–26 in major regions (BloombergNEF, 2023b).**
  - Green ammonia projected to be economically viable within the next decade. Implications for fertilisers and sea transport.
  - Green hydrogen also taking off, with policies and major projects expanding rapidly around the world (Systemiq, 2023). Green steel and aviation.

Tipping points by sector – historical progress and indicative future timeline



Notes: Tipping points exist when a set of conditions are reached that allow new technologies or practices to out-compete incumbents. After a tipping point is crossed, reinforcing feedback loops take hold that drive self-reinforcing progress, so that greater deployment of the solution encourages even faster deployment. **Source:** Systemiq (2021b)

The driving forces of a new growth story:

2 Increasing returns to scale in new technologies

Remarkable cost reductions in last dozen years - part scale, part network/systems, part discovery/innovation. On back of modest policy and broad sense of direction. Change can be still faster with stronger policy.

Cost of renewables: down by a factor of around 10. Scale a major influence.

Network/scale effects. AI management of systems.

Electric vehicles. Set-up costs, charging infrastructure. Learning-by-doing and mutual learning. Stronger with scale.

New materials. Discovery costs imply scale effects.

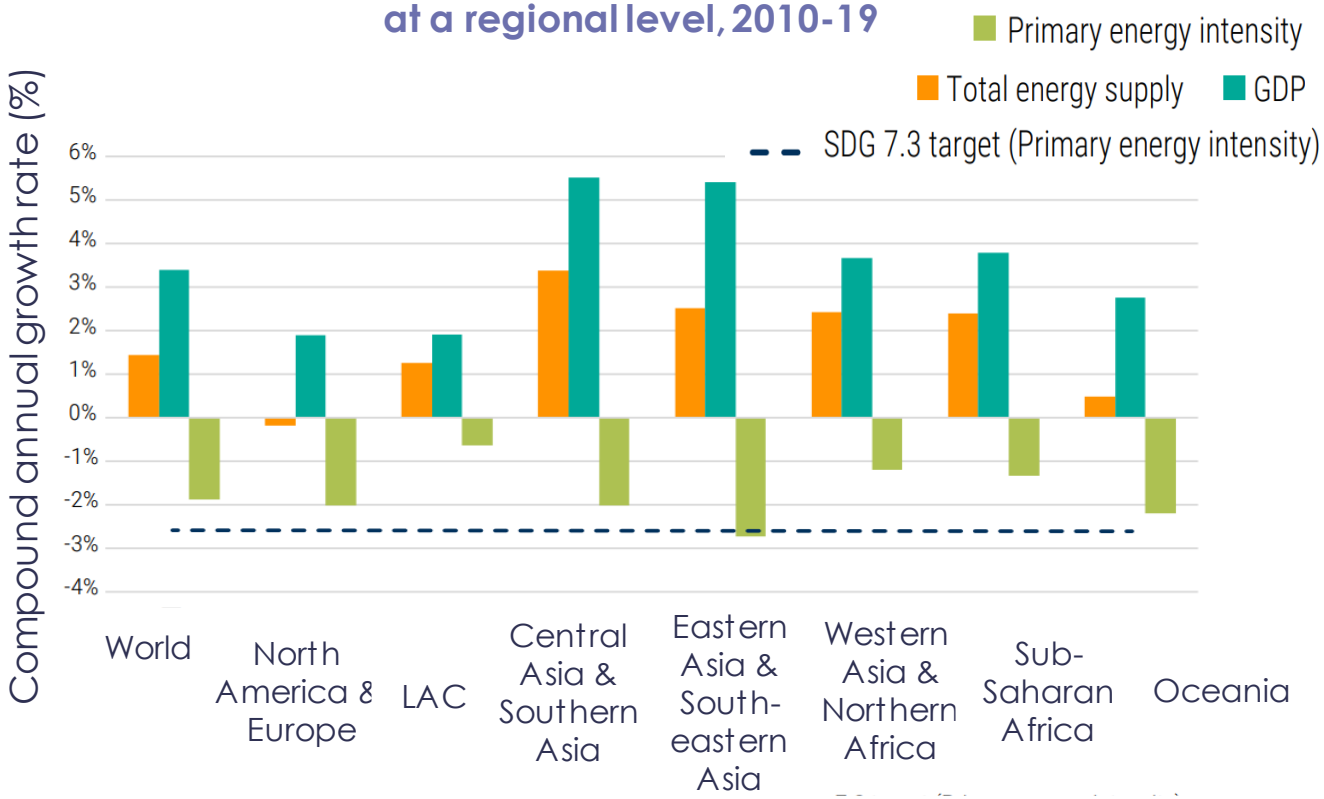
- In India, public procurement on scale brought down the **costs of highly-efficient LED bulbs by 85% in four years**; expected to repeat the same success with **electric buses** (Anadon et al., 2022).
- Strong increasing returns to scale in new technologies and in discoveries - set-up costs, learning by doing, mutual learning all associated with scale.
- Scale a major factor in the rapidly falling costs of production of solar panels, wind turbines, and batteries.
- Further returns to scale embodied in critical networks (electricity grids, broadband, public transport, or recycling and reuse facilities). Increasing returns part of logic of networks.
- Some physical increasing returns effects. Cost of turbines linear in materials (circumference) but capacity rises as the second power (area). **Electricity generated goes up as third power of wind speed – build big and high**.
- **Potential in AI in examining whole set of opportunities and managing systems**.

The driving forces of a new growth story:
3 Improved resource efficiency (I)

Greater efficiency in resource use means higher productivity. COP28, November 2023, committed to doubling rate of change of efficiency from 2% p.a. to 4% p.a. : the extra 2% would reduce energy use by more than 20% in 9 years.

- Since the start of global energy crisis (2022), more than 75% of governments had introduced new energy efficiency policies or had made existing ones stronger (IEA, 2023c).
- In the period 2011-2020, the average annual rate at which global energy intensity improved (1.7%); was double that of the previous decade (0.8%) (IEA, 2023c). Energy intensity is energy per unit of output.

Growth rate of total energy supply, GDP and primary energy intensity at a regional level, 2010-19



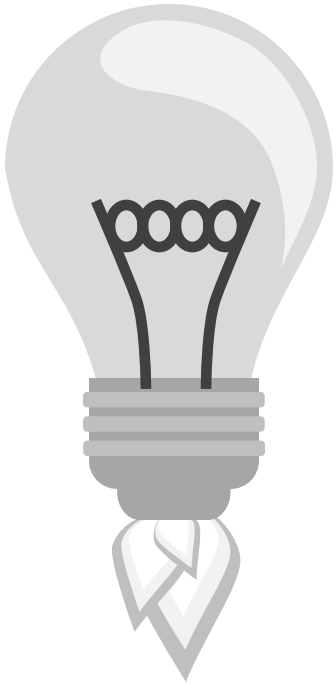
Source: IEA, IRENA, UNSD, World Bank, WHO (2023).

The driving forces of a new growth story:
3 Improved resource efficiency (II)

Enhancing resource efficiencies and adopting circular economy principles could significantly reduce CO2 emissions and waste. Improved resource productivity can decouple economic growth from material consumption.

Exploiting potential resource efficiencies could **reduce CO2 emissions by 40%** globally from four major sectors (plastics, steel, aluminium and cement) (ETC, 2018).

Among the G20, on average, **resource productivity grew by about 40% between 2000 and 2017**, contributing to a relative decoupling between GDP and material consumption (OECD, 2021).



Unnecessary **waste** can be immense across food, raw materials, energy, and beyond. **Real potential resource savings in the circular economy**, in which "waste" becomes an input into production (Ellen MacArthur Foundation, 2019; Pauliuk et al., 2021).

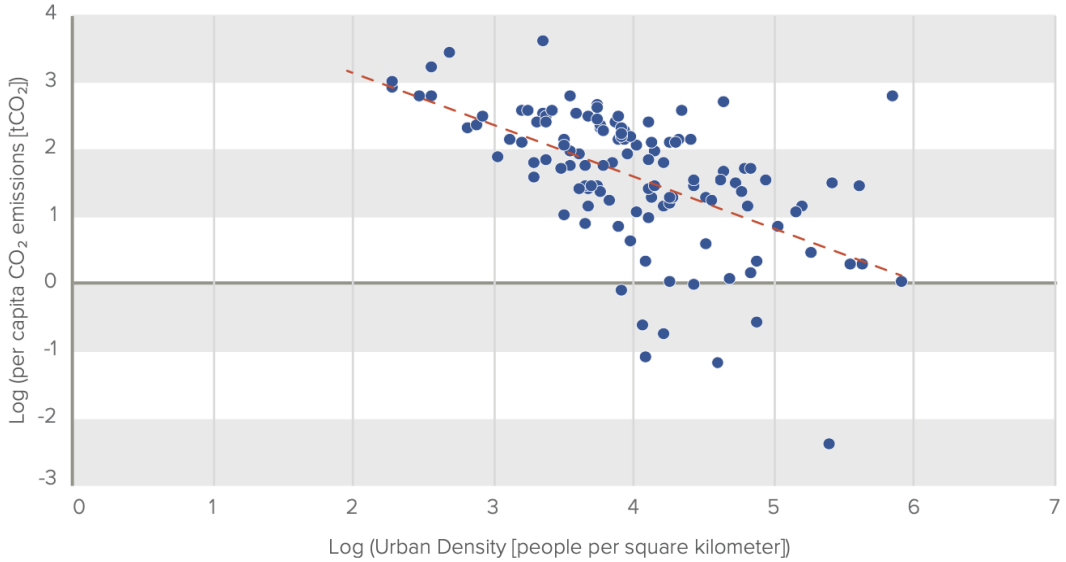
High returns from investments in "integrative design" (e.g., Lovins, 2018), where a whole house, process, or system is designed for efficiency (heating, water flows, lighting, construction).

The driving forces of a new growth story:
4 Stronger system productivity

Designs and standards can help drive systemic change (e.g. city zoning for pedestrians/cyclists, managing waste, circular economy). Digital management and AI have great potential. Huge possibilities from use of IT and AI for efficiency, integration, congestion and system management. E.g.: advanced forecasting and control in electricity market to accommodate variable electricity and flexible demand; better modelling of transport demand and planning of new infrastructure.

- **Energy, cities, land, transport and water systems can all become more productive** through improvements to how each operates as a system and how these systems interact.
- Larger, more integrated, better managed electricity grids will produce and use power more efficiently and bring in lower cost, less polluting sources. **Integrate across space and time**. Reduces storage requirements.
- **Crucial role of system design and management.**
  - **Land use** (very destructive across the world; soil depletion, poisoned rivers, deforestation)
  - **Cities** (congested and polluted)
  - **Transport, energy** (poorly integrated and polluting)
  - **Water** (wasteful and polluting)
  - **Oceans** (overheated, plastics, acidification)
- More compact, connected, and coordinated cities are worth up to **US$17 trillion in economic savings** to 2050 and could **reduce infrastructure capital requirements** by over US$3 trillion between 2015 and 2030 (NCE, 2018). Densification is also more **carbon efficient and resilient** to climate change and disasters (NCE, 2018).

The relationship between population density and per capita carbon emissions in urban areas



Note: A Pearson's correlation on a dataset of 127 cities found that r=-0.3383, with p<0.05. Source: Coalition for Urban Transitions.

Source: New Climate Economy (NCE) (2018).

The driving forces of a new growth story:

5 Increase in share of investment

Investment is at the core of the new growth story. See section 3 below.
If well executed, this increment in investment will have high returns in terms of productivity and will foster and embody innovation. Full of opportunity. Remember Harrod-Domar: g = s/v where s is investment rate and v is ICOR.

This is a big challenge, but **it is feasible**:

Investment rates and growth rates have been declining in both advanced and emerging market and developing economies since the global financial crisis and for most part had not recovered to the levels of 2000.

The world has seen in last one or two decades a **macro position with global planned investment too small in relation to planned saving**; low real interest rates and low productivity growth.

There has been a **persistent gap in global infrastructure spending** in both developed and developing economies that has been estimated at $15 trillion between 2016 and 2040 (Global Infrastructure Hub, 2017).

There are **significant opportunities for scaling up sustainable investments** to accelerate the transition to a low-carbon and climate-resilient economy and restore natural capital (these are examined and quantified in Stern, 2021). Productivity includes savings on future fossil fuels. India spent 4% of GDP on fossil-fuel imports in 2021 (The Economist, 2022).

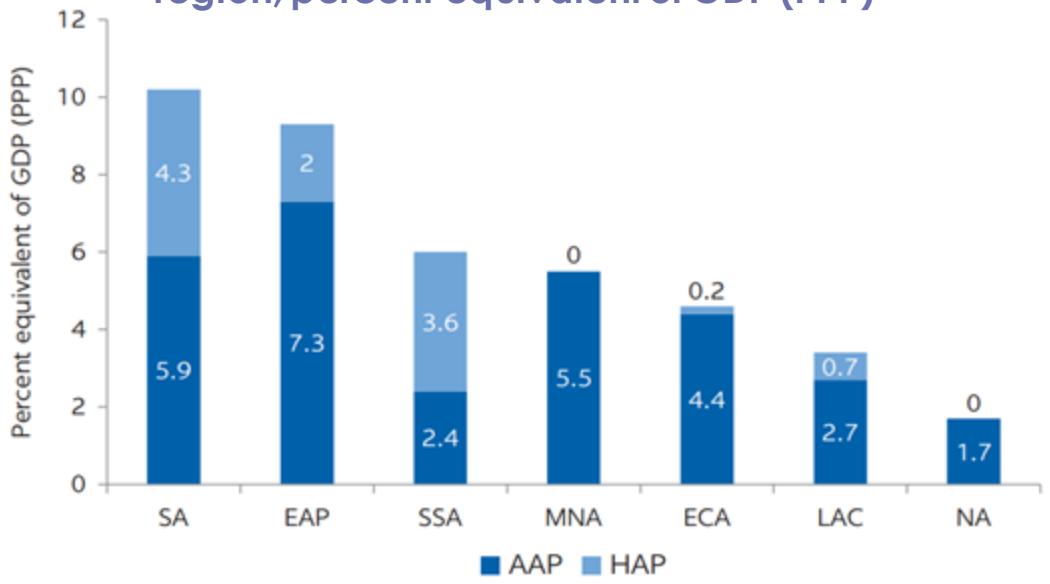
The driving forces of a new growth story:

6 Improved health

Reducing fossil-fuel combustion will reduce impacts of air (and other) pollution on health, increase productivity, and reduce the associated burden on the economy.

- **10%–20% of annual global deaths are linked to air pollution**. Much (not all) associated with burning fossil fuels. Also from polluting and wasteful agricultural and construction methods. On top of that, great damage to health, including cardiovascular disease, respiratory illness, and cancer (IHME, 2020; Vohra et al., 2021).
- Large **health costs associated with pollution**, the global annual health cost of mortality and morbidity caused by exposure to PM2.5 in 2019 estimated at **6% of GDP** (World Bank, 2021).
- Some of the actions to cut emissions, such as greater **cycling and walking**, can also improve health and productivity.
- **Children particularly affected** (breathe more rapidly) with major costs for the future (RCPCH, 2023).

Cost of health damage from PM2.5 exposure in 2019 by region, percent equivalent of GDP (PPP)



Source: World Bank (2022b)

Note: EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and Caribbean; MNA = Middle East and North Africa, NA = North America; SA = South Asia; SSA = Sub-Saharan Africa. Numbers may not add up due to rounding.
AAP = ambient air pollution
HAP = household air pollution

Delivering this growth will not be easy and will require purposive and effective policy, collaboration and leadership

Delivery requires strong (mostly private) investment, innovation and structural/systemic change; must be actively fostered and created. Expectations central to private (and public) investments. Criticality of clear and credible polices, institutions and strategies.

Tackle sectoral challenges and drive innovation

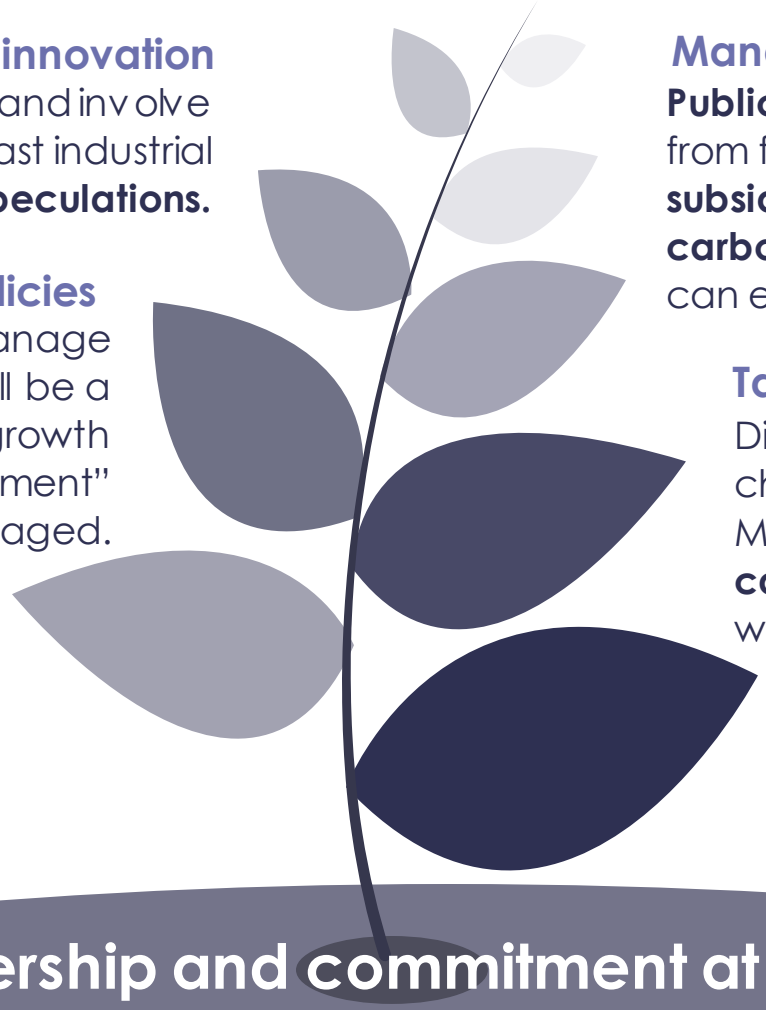
Some sectors will be **hard-to-abate** and involve greater costs. Innovation critical. As in past industrial revolutions there will be **failures** and **speculations.**

Implement macro policies

Good **macro policies** are necessary to manage increase in investment demand. But will be a **supply response** and history of East Asia growth has shown that "macro with high investment" can be managed.

Evolve the role of the state

Return to these issues later in this Lecture.



Manage public finances

Public finances will need management as revenue from fossil fuel taxation declines. Can **reduce toxic subsidies, tax vehicle use**, and, in transition, impose a **carbon tax**. Advances in digital information and of AI can enhance public revenues.

Tackle economic dislocations

Dislocation of consumers and workers will be challenging issues. **Invest in people and places**. Manage time paths of costs and prices. And **cost of capital**, particularly for poorer people. **Vested interests** will push back.

Work closely with the private sector

To manage implementation, reduce adjustment costs and bureaucracy, give confidence in revenue.

Leadership and commitment at the core

Structure

- The basics of the new growth story
- **Climate action, development and poverty reduction**
- Investment and innovation
- The analytics of the new growth story
- Policies and institutions
- The role of the state

Development, adaptation and mitigation: climate action can drive development and reduce poverty

The six driving forces for growth, associated with mitigation, together with clear pay-offs to investing in resilience, i.e. adaptation, tell us that climate action can drive development.

- **Good adaptation is always good development.** It makes no sense to build infrastructure and houses or to pursue agriculture activities whilst ignoring the changes that are occurring and will occur. Extra security lowers cost of capital and fosters investment, particularly in SMEs and poorer households (Global Commission on Adaptation, 2019).
- In much of the economy, **adaptation, mitigation and development are interwoven**. For example: mangroves; restoring degraded land; SRI rice; public transport; decentralised solar… Such investments foster development, reduce emissions and promote resilience. Similarly energy and resource efficiency.

Mangroves: provide barriers to storm surges; capture carbon; foster fisheries, (and tigers and tourism).

Restoring degraded land (including peat): gives greater resilience; captures carbon in soil; increases income.

SRI rice: more robust to difficult weather; does not flood fields and releases less methane; saves water and energy.

Public transport: provides protection for livelihoods of poorer people; reduces emissions; enhances opportunity.

Decentralised solar: less dependent on fragile grid; reduces use of fossil fuels/wood; increases opportunities, particularly for SMEs and women.

- Recognition of need for climate action on both mitigation and adaptation, and opportunities therein, is already creating potential and enthusiasm **for increasing investment and finance in EMDEs** from private sector and MDBs.
- Whilst all good adaptation fosters development, some **adaptation makes limited contribution to mitigation**, for example, in some cases, flood defenses. And some **adaptation may be difficult to finance**, as a private entity may have limited ability to capture revenue returns.

Inaction on climate change obstructs development and poverty reduction

Poorer people are already suffering from a changing climate. Inaction on climate will stall or reverse development and will increase poverty.

Health

- x **Income loss** from work disruptions (e.g. agricultural workers in EMDEs) and uninsured medical costs.
- x **Increased malnutrition** from impaired crop yield and water scarcity.
- x **Greater exposure to air pollution** from fossil fuel combustion in EMDEs vs advanced economies. Children especially vulnerable.
- x Spread of **water and insect borne diseases**.

Physical damage

- x **Poorer households live in more vulnerable areas** (flood plains, etc.).
- x Poorer households **take longer to recover** from a disaster and thus face greater long-term impacts on their economic and physical well-being.
- x Natural disasters **push upwards of 26 million people** into extreme poverty every year (Hallegatte et al., 2017). **Women often last to leave or escape**.

Food systems

- x **Reduced agricultural incomes** from crop and livestock losses.
- x **High and volatile food prices** disproportionately impact people in poverty who spend a larger income share on food.

Migration and conflict

- x Intensification of drought by climate change increased **armed conflict and migration in West Asia and North Africa** (Abel et al., 2019). **Women especially vulnerable.**
- x In **Syria**, climate change induced drought led to **mass migration** from rural to urban areas, which contributed to the causes of **civil war** (Kelley et al., 2015).

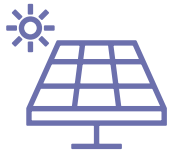
«Climate v development» : misguided arguments and alleged trade-offs

Concern 1: In an efficient world, introducing an additional criterion (here, the future state of the climate) must involve reduction on some other dimension, here growth and poverty reduction.	This position is not a sound basis for analysing a world that has many important inefficiencies. **Well-designed climate action can and should overcome market failures** and crucial inefficiencies. And the challenge of climate change provides extra motivation for overcoming these failures (Stern and Stiglitz, 2023).
Concern 2: Development needs energy, and energy needs fossil fuels, and thus development must involve increased GHG emissions.	Development generally needs energy but **energy does not need fossil fuels**. Indeed, zero or low-carbon sources are now cheaper than fossil fuels in many sectors and geographies.
Concern 3: Using resources for climate action will reduce those going to growth which would have reduced poverty and increased resilience.	Well-designed climate action works largely through fostering **investment and innovation which drive growth**, job creation and resilience.
Concern 4: Climate action involves a whole range of policies around pricing, technologies, and phasing out of fossil fuel extraction which could increase costs and reduce opportunities for poor people.	Well-designed policies can overcome such effects. For example, **reducing (inefficient, often toxic) subsidies releases resources** more than sufficient to compensate the poorest (WB, 2023e). Similarly, for use of revenue from carbon pricing. Decentralised solar can empower **smaller businesses and women working from home**. Increasingly the clean is cheaper than the dirty.

The narrative and analyses around growth and climate must change

Action for the new path requires convincing narrative, leadership, and sound analyses. It is the only realistic option. Not acting is unrealistic, neglecting danger, and irresponsible. Importance of where the communication comes from. Religious and cultural leaders, medical profession, universities may be more trusted than governments.

Why has climate action been too slow when science has become more worrying and technology has become more promising?



The **misconception** that climate action requires a **trade-off with economic development and growth** has been damaging to political will and decision-making.

Climate action involves a strategic choice for a new form of development, growth and poverty reduction: sustainable, resilient and inclusive. But that new development requires investment which requires **available and affordable finance**. International financial support has been weak and trust from EMDEs in developed countries has been eroded. The **management of dislocation** and changes in relative prices, requires purposive and credible policy. A political willingness to "take on" **vested interests** may be lacking (and corruption can play a role).

Many economic assessments fail to capture the **full range of benefits**, not only for output but for broader aspects of development. And often many such assessments **severely undervalue** the lives and livelihoods of today's **young people and future generations**.

A persuasive case should focus on the positive arguments: new investment drives a new and attractive form of growth. It should also deal directly with the (mistaken) argument that there is an inevitable trade-off. And recognise that **continuing dirty growth is not a realistic or sensible option**: it is destructive, dangerous, and unsustainable.

Structure

- The basics of the new growth story
- Climate action, development and poverty reduction
- **Investment and innovation**
- The analytics of the new growth story
- Policies and institutions
- The role of the state

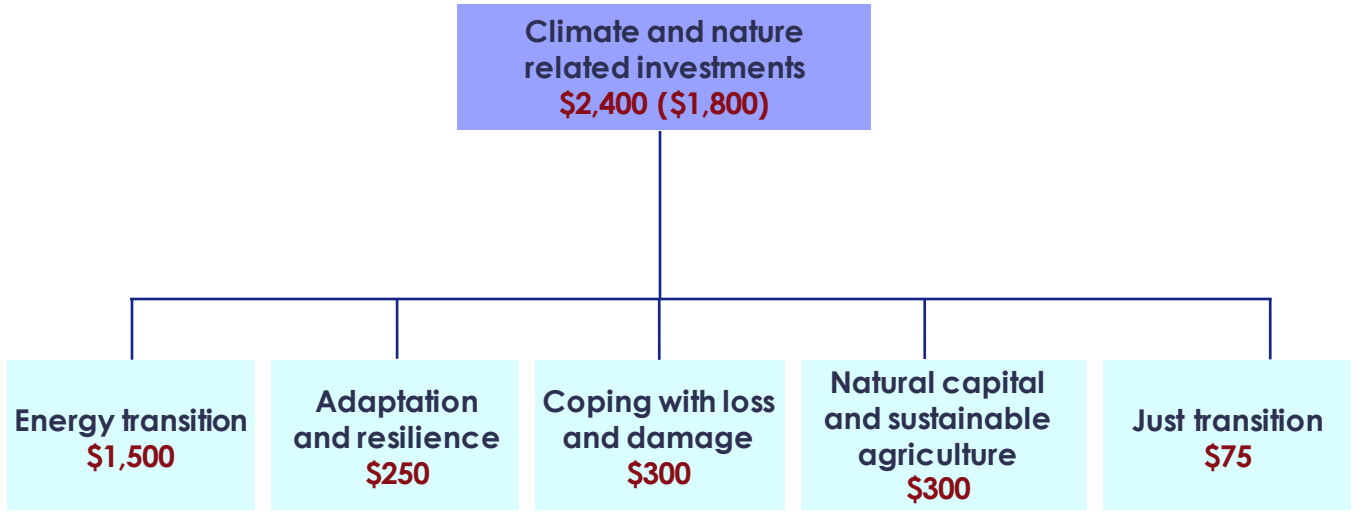
A big push in investment is needed, especially in EMDEs

These investments are required for delivery on the Paris targets (which are nested within the SDGs). They are not "aspirational" but deductive from targets i.e. what is necessary for their achievement (Bhattacharya et al., 2022). Invest in the new, innovative, and clean to enable reduction of old, outdated and dirty.

- The reason we are off-track for achieving the Paris targets, and the climate crisis is so severe, is that **investment in the clean and new has been far too low**. Off-track for SDGs more generally.
- For delivery on Paris, global investment needs to be **increased and sustained** above pre-pandemic levels by at least 4 trillion p.a. by 2030 and beyond for the augmentation and transformation of all forms of capital. More in some countries, less in others. And change in composition. See Stern et al. (2021).
- EMDEs will account for **a big majority of new physical capital** in the coming three decades, and drive a global doubling of infrastructure in the next 15-20 years. Human and natural capital also central.
- The majority of investment will be in the **private sector**, but **public investment** will have to play a key role, particularly for complementary sustainable infrastructure (e.g. some public transport and grids).

Clean energy investment "replaces" to some extent dirty investment, which would otherwise have taken place. However, **all the $2.4 trillion will have to be financed**.

Investment / Spending Requirements for Climate and Nature ($ billion per year by 2030 in EMDEs (other than China)



Source: Bhattacharya et al. (2023)

Investment must increase by several points of GDP in EMDEs (other than China)

The scale of the investments needed in EMDEs for climate and SDGs over the next five years and beyond will require a debt, macroeconomic, and financing strategy that tackles festering debt difficulties, especially those of poor and vulnerable countries, and leads to a major expansion and revamp of both domestic and international finance, public and private. Criticality of conditions for investment. Return to these issues later in Lecture 3.

Investment/spending needs per year for sustainable development and climate action for EMDEs (other than China):

Estimate	2019 US$ billion	2019 % GDP	2030 US$ billion	2030 % GDP	Increase (2030 minus 2019)[1] US$ billion	Increase (2030 minus 2019)[1] % GDP
SDG-related investment[2]	2,385	11.3%	5,400	18.2%	3,000	6.9%
Of which climate and related investments[3]	550	2.4%	2,400	7.2%	1,800	4.8%

Notes:
1. Increase is defined as difference between estimated investment needs in 2030 and current baseline of investment in 2019. It is not increment relative to some counterfactual - note that clean investment "replaces" dirty to some extent. 2030 figures in "round numbers". Last two columns are differences between relevant preceding columns.
2. Human capital, sustainable infrastructure (including on the energy transition), adaptation and resilience, AFOLU.
3. Energy transition, adaptation and resilience, AFOLU.

Source: Bhattacharya et al. (2022)

Electrification will be at the core of the investment challenge

Clean electricity is the backbone of the transition to net zero and will provide more than 60% of the energy consumed in 2050, a substantial increase from 20% today. The electricity system will need to grow by 3-5 times globally. Wind and solar will need dramatic growth to cover 75-90% of power generation –up from 10%, with annual installations growing 5-7 times by 2030 (ETC, 2023).

Even high temperature industrial energy uses would be able to come from electricity.

- Driven by technological progress and declining costs of wind and solar power, established heavy industries, engineering companies and startups are all actively investing in electrified innovations to generate the high temperatures needed in industrial processes (The Economist, 2024). This is key for decarbonisation, as industrial sectors are responsible for over 30% of global GHG emissions (World Economic Forum, 2023).

"The decarbonisation of energy-intensive industries can only be achieved through electrification"

Dr. Martin Brudermüller, Chairman of the Board of Executive Directors of BASF SE (February 15th, The Economist, 2024)

The Core Investment Challenge

Increase electricity capacity

Assuring that additions are zero carbon

Special challenges in decarbonisation of agriculture: investing and innovating

Agriculture, a major GHG emitter, must adapt to and mitigate climate impacts through policy reform, land restoration, innovation incentives, and the strategic use of AI, combining emission reduction with food security and equitable transitions.

Agriculture must **adapt and build resilience** against the already visible and increasing impacts of climate change.

The sector is responsible for **22% of global GHG** emissions, directly and indirectly through land use change (IPCC, 2023). Mitigation of **methane gas is fundamental** given its strong influence on temperatures in the short term.

Agriculture **lags behind other sectors in terms of climate commitments and actions**, e.g.:

- As of mid-2022, only 16 OECD and major emerging economies had set agriculture-specific emissions targets (OECD, 2022).
- Agriculture is generally **exempt from mitigation policies (e.g. carbon pricing or equivalent regulatory measures)** with only a few countries using targeted subsidies to encourage emission reduction.
- Most agricultural policy support **does not incentivise innovation or align with climate goals,** often raising GHG emissions instead.

Unlocking the potential to reduce emissions will involve:

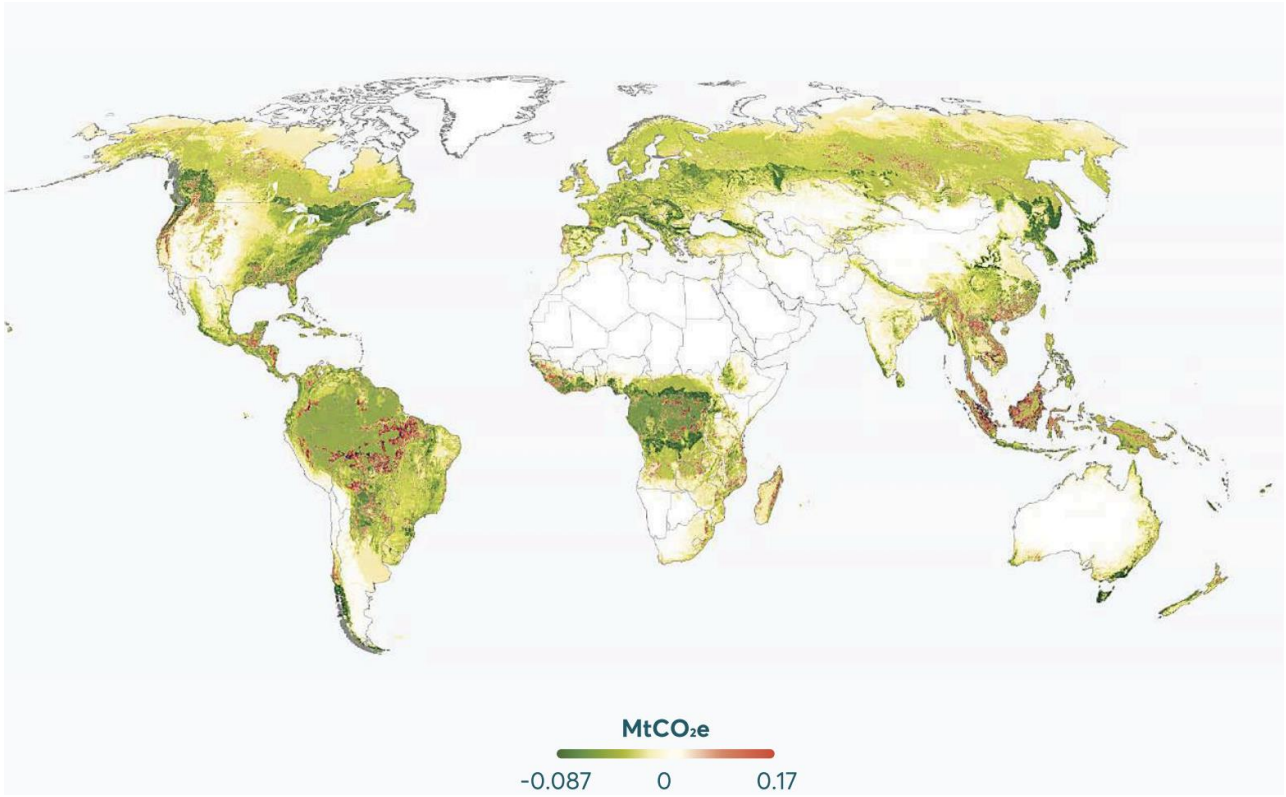
- ✓ **Restoring degraded land**, especially peatlands.
- ✓ **Reorienting agricultural support** and employing **pricing instruments** to curtail emissions and **stimulate innovation** and the uptake of lower-emission technologies and practices. Removal of **toxic subsidies** (WB, 2023e).
- ✓ Approach transformations for adaptation and mitigation from a **food systems perspective.** Reduce **food waste. Low-meat diet** can free up land. Provide appropriate incentives for **regenerative agriculture** and provision of ecosystem services.
- ✓ Recent **AI breakthroughs can accelerate decarbonisation of agriculture** – e.g. improving pesticide, insecticide, and fertiliser use by applying the most suitable treatment precisely when and where it is needed (Agrahari et al., 2021; Coulibaly et al., 2022).
- ✓ But some policies to reduce emissions may create perceived **trade-offs with food security for consumers and livelihoods for producers**. E.g. Recent protest of EU farmers. As elsewhere, managing a **just transition** is crucial (Lectures 2 and 3).

Investing in forests

Forests play a critical role in carbon sequestration, but high deforestation rates threaten their capacity to act as carbon sinks. Effective strategies to halt deforestation are needed, such as improved monitoring, community empowerment, and engaging the private sector.

- Forests are the largest terrestrial sink – globally, their **net removal of carbon is equivalent to 5.7 GtCO2 a year (45% of CO2 sequestration from the land sink)** (FOLU, 2021; Harris et al., 2021).
- However, emissions from deforestation are high, **reaching around 7GtCO2 on average over the 2013–2022 period**, highlighting the strong potential of halting deforestation for emissions reductions (Friedlingstein et al., 2023).
- Forests, such as the Amazon or Russia's boreal forests, are exposed to tipping points and Earth system feedback loops which **could see them turn into net sources of carbon**. This is already happening across the tropical belt.
- Methods to **halt deforestation** include:
  - Effective monitoring and enforcement (including using satellite imagery, drones, and ground patrols).
  - Empowering local communities and Indigenous Peoples through legal rights to land and resources.
  - High-quality VCMs.
  - Promoting alternative incomes and productivity in land near forests.
  - Private sector engagement and supply chain initiatives.
  - International cooperation and partnerships.

Net annual fluxes in forest-related GHGs



Source: FOLU (2021) based on Harris et al. (2021)

Great potential of AI

AI can bring to the transition: pace; understanding and guidance of behaviour; systems change and management; acceleration of technology discovery and innovation; lower capital requirements; strengthened resilience and adaptation.

- Extraordinary advances in **green new technologies and AI** are occurring simultaneously.
- AI likely to accelerate **green technology, accelerating tipping points and the deployment of breakthrough technologies** (fusion, quantum chemistry, alternative protein design, materials…).

Great potential of AI/ML: has arrived at critical time for climate

Complex systems management (cities, energy, transport, agriculture, water)	**Energy** ➢ Manage predictability in the grid and improve system productivity from today's standby generators. ➢ Advanced forecasting, scheduling and control in electricity market to accommodate variable electricity and flexible demand (across space and time). ➢ DeepMind suggest that this could increase the economic value of wind energy by 20% by reducing reliance on battery storage. **Transport** ➢ Better modelling of demand and planning of new infrastructure. For example, could discourage sprawl and reduce congestion. ➢ Better monitor traffic in existing systems through automated computer vision. ➢ Development of autonomous vehicles. ➢ Development of shared mobility services. **Agriculture** ➢ Visual recognition with AI to distinguish between cultivated plants and weeds allows reduction in herbicides and fertilisers. ➢ In developing countries, smart phones to guide small farmers on planting times in relation to potential weather and best destinations for selling their output.
Behaviours	➢ Identify patterns, and hence improve prediction of, individual and collective behaviour. Could promote actions that help reduce emissions (e.g. Ant Forest programme by Alipay).
Discovery	➢ E.g. more than 2 million theoretical crystal structures recently identified by Google DeepMind (more than 45 times the number of such structures identified before then). Potential for those new materials to generate significant progress from renewable energy to energy storage to semiconductors. ➢ Clean technologies absorb more spillovers from AI and ICT than dirty technologies (Andres et al., 2022).
Climate systems analysis and modelling	➢ Barriers in accelerating climate action include size and complexity of the datasets, models and scenarios (e.g. many physical models not able to account for catastrophic changes and tipping points). ➢ AI can revolutionise the capacity to gather and interpret large and complex datasets and can accelerate computationally expensive physical simulations.
Risk assessments of investments in EMDEs	➢ Information asymmetry prevents investors from offering affordable finance to projects in emerging markets. ➢ AI can help by aggregating different data sources on realised projects risk and use them to provide more accurate predictions on project risk.
Impacts, adaptation and resilience	➢ Help in identifying and assessing some of climate risks (e.g. track biodiversity loss). ➢ Hazard forecasting and help with designing resilience. ➢ Improving climate disaster alert systems, help humans better respond to extreme weather events (storms, wildfires and floods).

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The analytical challenges and agenda: transition and rapid structural, systemic and technological change

Analysis and modelling should be directed towards understanding and constructing policy for the transition and associated rapid, structural, systemic, and technological change. Will need full range of economics and social sciences and strong focus on dynamics, interactions and radical change.

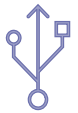
Action on climate change will involve **radical changes in key systems**, including cities, land, transport and energy. Creates job opportunities. Strong multipliers through the economy. Powerful effects on health and well-being.

In the next seven years, **tipping points** for crucial low-carbon solutions in sectors representing 90% of emissions will likely have been met, making them competitive in key markets (clean cheaper than dirty) (Systemiq, 2021b).

On all of these drivers and their interactions, **AI and digitisation** can have powerful, enabling, and reinforcing effects (Stern and Romani, 2023) in managing systems and systemic change and fostering new technology.

Large and pervasive co-benefits, including resource efficiency, livable cities, reduced air pollution (currently kills 5 -10 million p.a. worldwide), and fruitful and robust ecosystems.

However structural and technological change at this scale and speed will involve **dislocations and difficulties** particularly for poorer people. Managing these will require **strong policy and significant expenditure; a just transition**. If managed badly can delay or derail the transition.

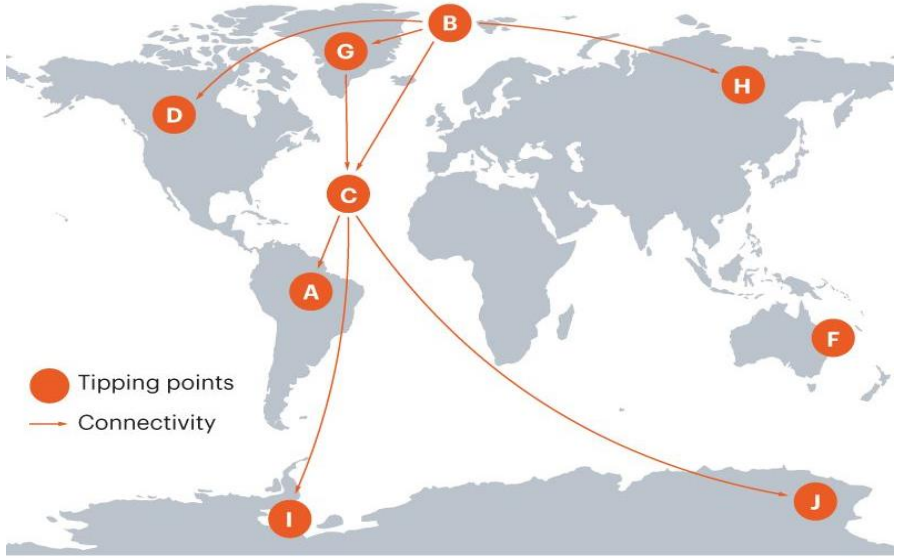


Current economic analyses tend to underestimate: the potential future risks of climate change; the pace at which costs of action are falling; and the wider benefits of a transition to low-carbon growth

Given these fundamental flaws, IAMs are dangerous if used as benchmarks for the assessment of climate risk in economic, financial or other systems. Further, they do not address the core issues and fundamental analytics of necessary structural and systemic change-see below. One focus of these models has been on calculating carbon prices in terms of future damage but results are so sensitive to underlying specification and parameters as to be of little use.

Current economic analyses and IAMs fall short in three main areas when considering the economics of climate change:

1. They fail to incorporate many of **the largest risks**, including the potential effects from crossing climate thresholds or 'tipping points'.
2. They struggle to account for the **dynamic benefits of innovation, learning and feedback loops** that promote institutional and behavioural change, discovery and economies of scale, as well as the "co-benefits", such as reduced air pollution. Underestimate pace and potential of technological change.
3. They often apply **high discount rates** to future scenarios, implicitly assuming that the lives of people in the future are much less valuable, or less important, than those today, and/or that future generations will be much richer, ignoring the immense real risks from unmanaged climate change to living standards.



A. Amazon rainforest
Frequent droughts

B. Arctic sea ice
Reduction in area

C. Atlantic circulation
In slowdown since 1950s

D. Boreal forest
Fires and pests changing

F. Coral reefs
Large-scale die-offs

G. Greenland ice sheet
Ice loss accelerating

H. Permafrost
Thawing

I. West Antarctic ice sheet
Ice loss accelerating

J. Wilkes Basin,
East Antarctica
Ice loss accelerating

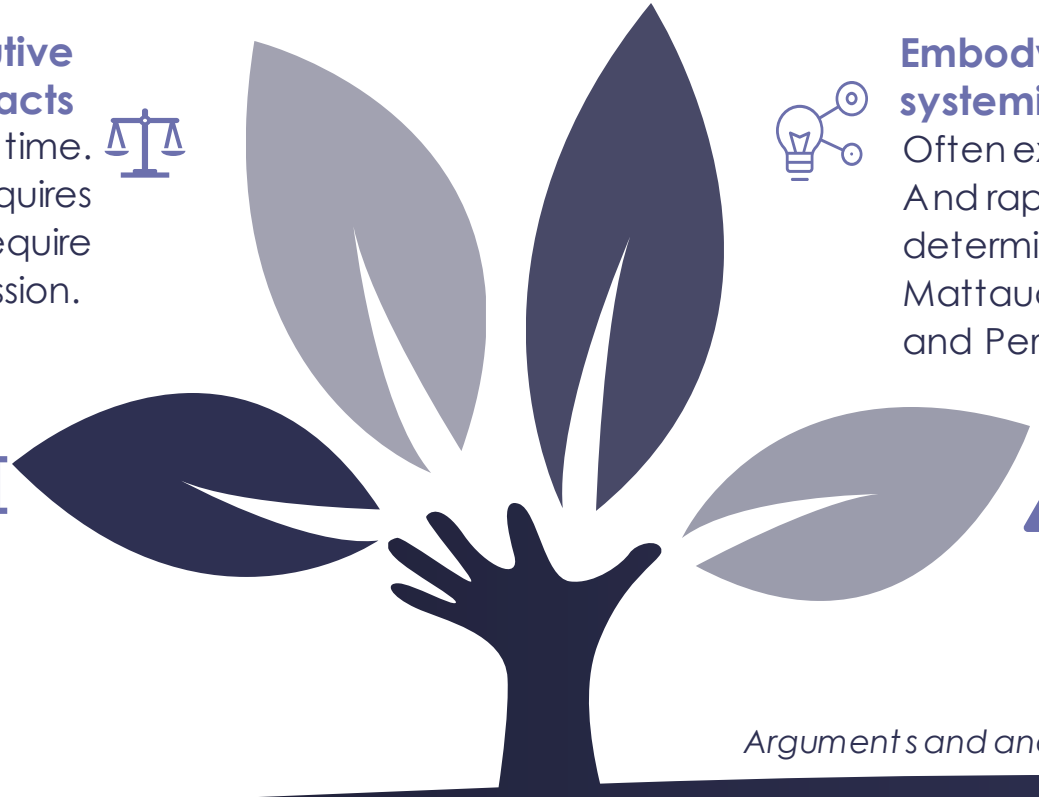
Source: Lenton et al. (2019).

We must have an economics that can handle both extreme risk and fundamental structural and technological change

Much of the standard economic modelling of climate change, including via Integrated Assessment Models (IAMs), does not embody basic methodological essentials. Their aggregation, structure and specifications make them silent on crucial issues concerning structural, systemic and technological transformation. These models do not grapple with the core questions. Misleading on what they do include and misleading on what they do not.

Take into account distributive impacts
Both at a moment in time and over time. Assessment of differential impacts requires value judgements, and these require explicit analysis and discussion.

Recognise that many key markets have critically important failures (beyond that of the GHG externality) and crucial markets are absent
There are limits on the government's ability to fully "correct" these market failures, but much can be done.



Embody rapid technical and systemic change
Often exhibiting increasing returns to scale. And rapid changes in (endogenously determined) beliefs and preferences (see e.g. Mattauch, Hepburn and Stern, 2018; Besley and Persson, 2020).

Take into account extreme risk
Including possible large-scale and unforeseeable consequences.

Arguments and analytics are set out in Stern, Stiglitz, Taylor (2022).

Economic analyses of climate change must change

Understanding and guiding economy-wide fundamental, structural and rapid change will require a collection of analytical perspectives

These analyses must be rigorous and are not easy. No one model or set of models can deliver the understanding needed. Will need a mix of analyses, perspectives and models. And judgement in combining them. A rich, urgent and crucial research agenda. But must research and act at same time.

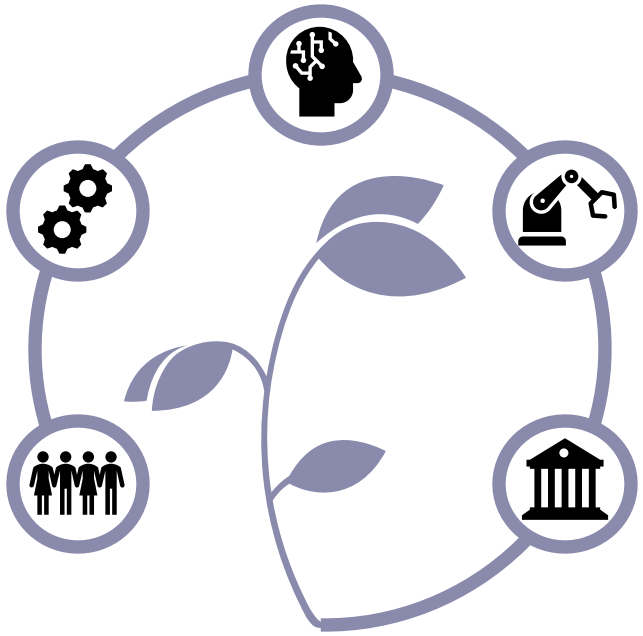
Do not attempt one "all-encompassing model". Will need many models, perspectives and approaches. And **judgement and wisdom** in how to combine them.

Will need to examine different elements in complex overall system and how they can change, and how they combine. **Key questions** are the following:

What is the **role of AI**?

What is the potential for **change in five key systems**: cities, energy, transport, land/biome; water? How do they interact? What are key instruments to foster change?

How do the **economics, politics, and society change and how do these interact and influence further change?**



How can **technologies change**? How can changes be fostered? What are the priorities?

How can **institutional structures and policies influence change** and be built?

Structure

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Investment, expectations, credibility

Create a strong investment climate and sense of direction. Vacillation and inconsistency undermine investment.

Because investment is at the core, so too are expectations. How they are formed is a crucial issue. They can and should be shaped by public action and discussion, including by the key public policy and financial institutions which set strategic and policy direction.

Government-induced policy risk is a major deterrent to investment. Vacillation and inconsistency, sometimes, for perceived short-term political gain, undermine confidence.

Clear, credible signals can draw through both investment and innovation by reducing perceived risk and giving greater confidence in revenue streams. For example, feed-in tariffs and confidence in operations of power companies.

Be '**predictably flexible**'. For example, can set feed-in tariffs, but also set out criteria to govern future change (such as diffusion of technologies, changing cost structures, etc).

Analogous to central banks describing possible outlooks and potential future influences on policy.

Importance of **investment climate** to foster confidence in returns, ability to get things done, solve problems, raise finance. And clear overall strategic direction.

"Country/sector platforms" jointly constructed with private sector, civil society, and (where relevant) MDBs.

Policies and institutions to tackle climate change can help overcome key market failures that limit growth and transition

It is a serious mistake to assert that this complex and dynamic problem of change can be tackled just with a carbon price, important though that is. A whole range of instruments are necessary. For example, standards can give clarity, enhance confidence, avoid waste, help generate economies of scale and accelerate dynamics. Consistency and credibility are crucial for all policies; confidence is crucial to investment.

Different market failures point to the use of **different instruments**, but the collection should be mutually reinforcing.

Market Failure	Description	Policy Options
Greenhouse gases (GHGs)	Negative externality because of the damage that emissions inflict on others.	Carbon tax/ cap-and-trade/ regulation of GHG emissions (standards). Do not subsidise the toxic.
Research, development and deployment (R,D&D)	Supporting research, innovation and dissemination.	Tax breaks, support for demonstration/deployment, publicly funded research. Coherent standards to focus research and innovation.
Imperfection in risk/capital markets	Imperfect information and assessment of risks; understanding of new projects/technologies.	Risk sharing/reduction through guarantees, long-term contracts; convening power of development banks for co-financing; transparency (e.g. TCFD).
Networks	Coordination of multiple supporting networks and systems.	Investment in infrastructure to support integration of new technologies in electricity grids, public transport, broadband, recycling. Management of grids. Planning of cities.
Information	Lack of awareness of technologies, actions or support, or product content.	Labelling and information requirements on cars, domestic appliances, products more generally; awareness of options.
Co-benefits	Consideration of benefits beyond market rewards.	Valuing ecosystems and biodiversity, recognising impacts on health.

- **Key futures markets** (e.g. technologies and carbon prices) **are absent**. **Expectations are central.**
- **Can and should work to align incentive structures and social priorities and values. They interact** (see Mattauch, Hepburn and Stern, 2018).

Public policy and the public finances: public economics as if time matters

The necessary analytics and public economics must draw on the whole of economics: from economic history/geography, political economy, and international relations to technical elements of economics of industry and public economics. And the social sciences more generally. Keeping transition, pace, time, and structural systemic change at centre stage.

Time is of the essence and the whole path of transition determines the total sum of emissions and climate change. Real urgency.

Much of public economics involves **static comparison of equilibria** with and without a policy shift. Must go beyond these largely static formulations (Stern, 2018). **Dynamics of change** at centre stage. Possible disequilibrium.

Can increase revenue, improve efficiency, and reduce damage by removing **toxic subsidies** (World Bank, 2023e). Transition will be politically sensitive.

Much of macro debt dynamics looks at **debt stocks but not environment and capital stocks**. Must examine together.

Examine carefully dislocations and act for a **just transition.**

Whilst most investment for the transition will be **private, a significant amount will be public** (Bhattacharya et al., 2022). Public/private ratio varies over time.

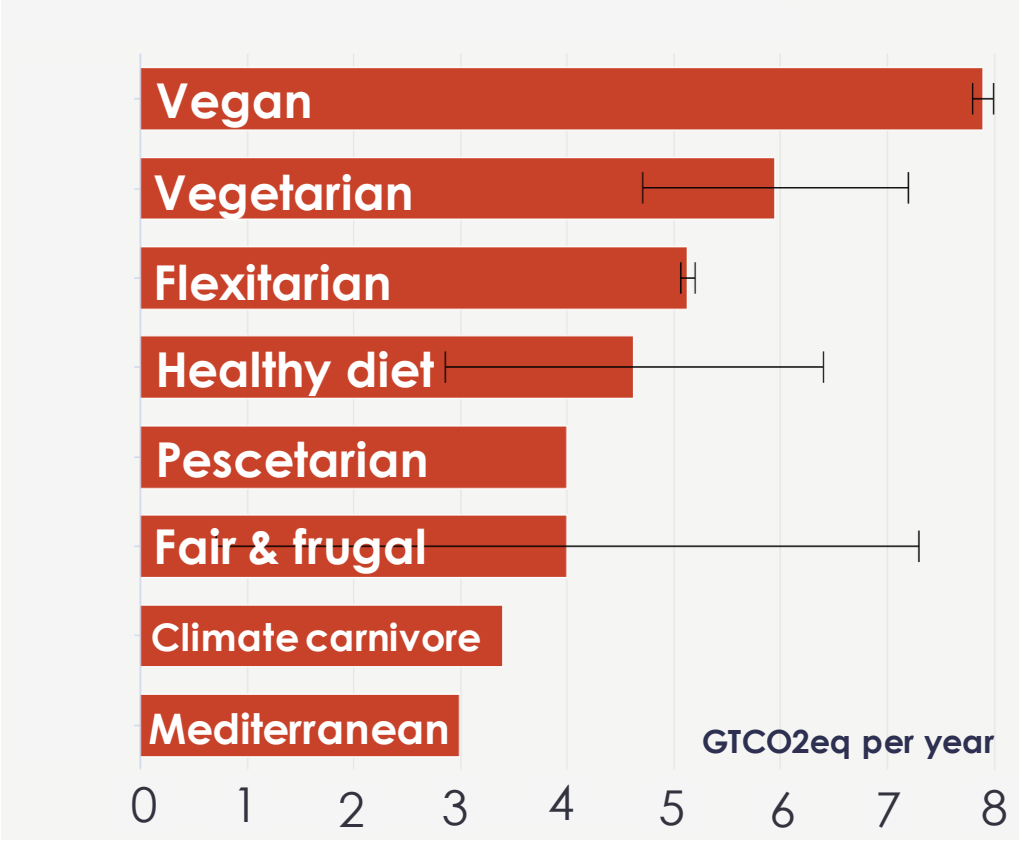
Borrowing for sound public investment is fiscally responsible. Delay is fiscally, economically and environmentally irresponsible (Zenghelis et al., 2024).

Behaviour changes

Behaviour changes are central to the transition, especially in key sectors (energy, travel, buildings, diet, waste) and in richer communities where energy intensive lifestyles are the norm.

- In road transport, behaviour changes such as driving conduct and restricting use of conventional vehicles in large cities can **cut CO2 emissions from road transport by 15% in 2030** (IEA, 2021a).
- Diet changes will also be crucial as the **entire system of food production**, including farming machinery, fertilisers and transportation, **contributes 35% of all global emissions** (Xu et al., 2021).
- The climate impact of **plant-based foods** is typically 10 to 50 times smaller than that of animal products (Poore et al., 2018).
- Uses of **heating, cooling, lighting** in many cases can be managed much more efficiently.
- **Recycling, re-using**. Household and commercial recycling has the potential to reduce carbon emissions by the equivalent of 10.4-11.2GtCO2e emissions between 2020-2050 (Project DrawDown: https://drawdown.org/solutions/recycling).
- See e.g. **LiFE (lifestyle for the environment)** an initiative of PM Modi and core to India's 2023 G20 Presidency.
- See e.g. Behavioural Insights Team on "**Can we nudge to net zero?**". Many interesting ideas on travel, heating, what we eat. Examples include removal of car parking facilities, proximity of recycling bins, listing vegetarian at top of the menu, default options on pension plans…

Global GHG saving potential for each year by 2050 under different diets (compared to BAU in 2050)



Note: Error bars show the spread of results from different studies. Data without error bars are from one study only. Adapted from IPCC (2018) by Carbon Brief.

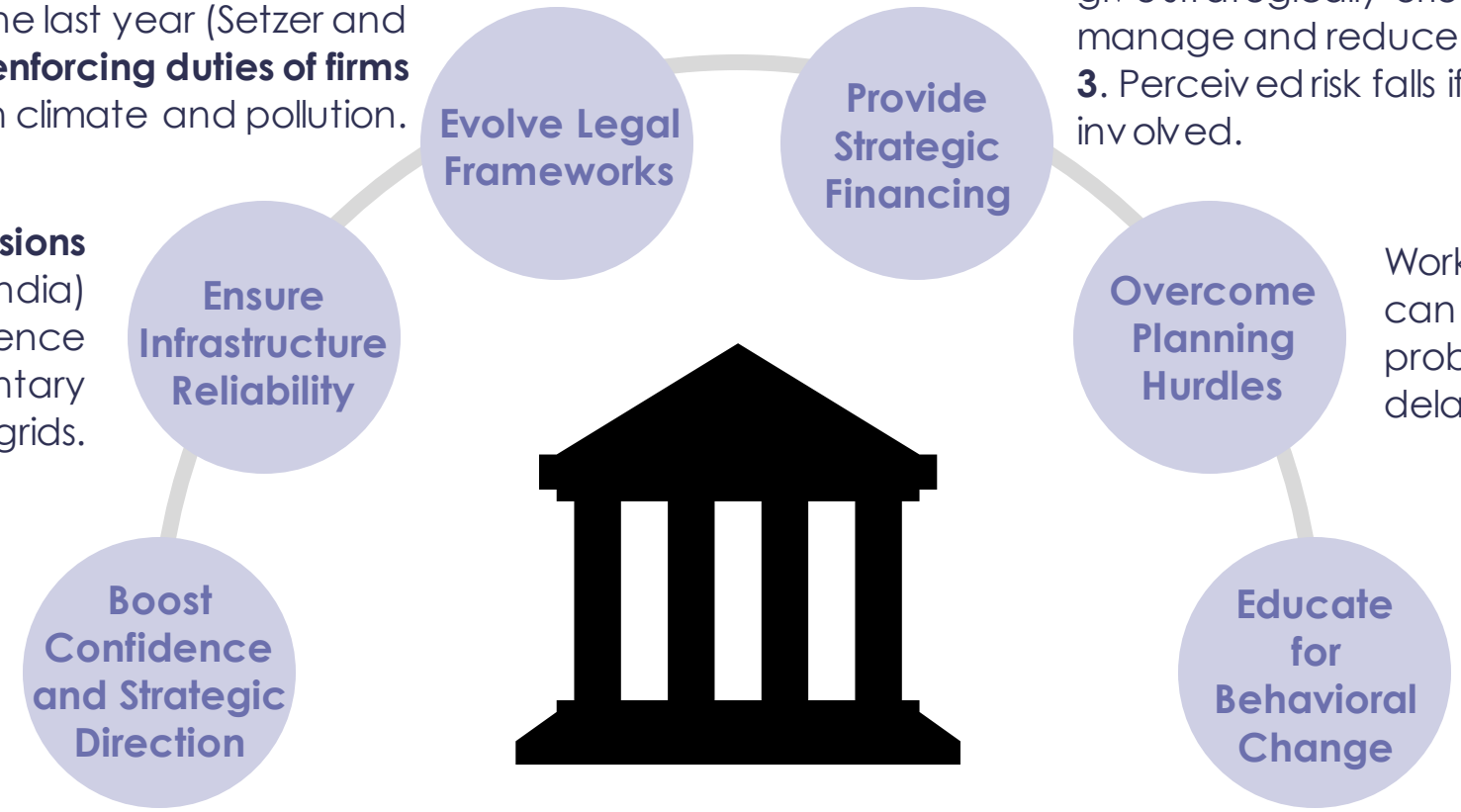
Institutions and legal structures

Institutions and legal frameworks are pivotal in driving climate action, providing strategic direction, facilitating investment, and managing risks.

Legal systems and obligations becoming increasingly important – with 2,341 cases recorded by the Sabin Center's climate change litigation databases, 190 filed in the last year (Setzer and Higham, 2023). **Courts are enforcing duties of firms and governments** to act on climate and pollution.

Infrastructure commissions (examples UK, Australia, India) can provide greater confidence in future complementary structures, such as grids.

Institutions can help **give confidence and strategic direction; e.g. climate change legislation** and Climate Change Committee in UK.



Development finance institutions, such as National Infrastructure Bank in the UK or BNDES in Brazil, can give strategically-oriented finance and help manage and reduce risks. **Also MDBs, see lecture 3**. Perceived risk falls if these institutions are involved.

Workings **of planning structures** can inhibit action. Major problems with permitting delays.

Education and public discussion around responsibilities shape behaviours, including on waste, travel, recycling/re-using, responsibilities, etc.

Fostering a just transition: societal responsibilities and political obstacles

A 'just transition' is about more than managing a zero-carbon transition narrowly defined. It will be necessary for other simultaneous changes in economic structures: shift to services, labour-saving technologies, globalisation… all have to be managed together. The global financial crisis, COVID, and inequality have made the problems of trust and perceived injustice more severe.

This is a **whole economy transformation rapid and everywhere**, involving changing key systems: energy, cities, transport, land use, water.

Strong role for public discussion of **community responsibilities and individual values** in driving and managing these processes.

Fundamental structural change involves dislocation of work, changing relative prices, new standards/regulations. **Management of dislocation** is central to equity and to successful action and political feasibility.

Build-in assistance in **adjusting to changing prices and standards/regulations**. Time to adjust. Help in managing and responding to new standards. Affordable and available finance, e.g. for insulation or heat pumps, and help with practicalities. Poorer people have **higher cost of capital**: provide affordable finance.

Important examples in **changing agricultural systems**. Vital to change from destructive agriculture but also politically sensitive.

A **just transition**. Political economy and ethics. Some jobs will disappear; others will change radically. Some locations may be particularly affected. Challenge is to manage change so that all have a chance of benefitting from the transition. Much of this will involve **investment in people and places**. And in some cases, direct income support.

Injustice can be understood as a denial or damage to the right to development. That right does not however mean a right to stasis or no change, or a right to pollute. But it does mean **taking part in decisions, assistance with change, and serio us attention to enabling new opportunities.**

How the zero-carbon transition is managed will be pivotal to building the political and societal will for strong, sustainable action

Important examples in agriculture, mining, steel making, replacing gas boilers, phasing out ICE vehicles…All different and vary across countries but all need support in managing change. Participation in shaping policy by those affected is part of just transition.

Enabling a 'Just Transition'

"Leave no-one behind"

Life-long learning	Support local skills and investment	Re-locate public sector services	Social protection measures	Cost and availability of capital to poorer households
Offer education and training to support life-long learning	Support new skills and entrepreneurship through finance. Collaboration between local government, universities, business	Locate public services/activities in affected areas to boost local economies (shift government employment hubs)	Boost social protection measures for the most vulnerable members of society (cash transfers, welfare support, housing subsidies…)	Much of the transition embodies investments by households. Poorer households face a higher cost of capital

Structure

- The basics of the new growth story
- Climate action, development and poverty reduction
- Investment and innovation
- The analytics of the new growth story
- Policies and institutions
- **The role of the state**

Role of the state: past errors and confusions; driving change

The era of market fundamentalism reduced the state's role, leading to challenges in sustainability and inequality. Today's crises call for a reassessment of the state's critical function in driving change, fostering sustainable development, and tackling market failures.

The 1980s and 1990s brought **market fundamentalism** and hostility to a major role of the state. In part a reaction to the "big society", social protection, government provision, and "liberal values" of previous two or three decades in US/Europe and to experience of planning in some EMDEs.

The simplistic version of this fundamentalism was: **get government out of the way; trust only in markets; let investment and economic activity fall where they may**. Whilst some productivity improvements flowed, its dogmatic application was reckless and untenable. Even more so now. Dogmatism is not rigour or sound economics.

It was founded also on strong, narrow and pessimistic view of the behaviour of individuals and firms. Namely these operate only in terms of a narrow, self-centred and, usually short-term, self-interest.
Minimal role for community and values.

- It brought some progress in entrepreneurship, and creativity but also brought intensification of the **problems of sustainability, the environment, and inequality**.
- Fostering sustainability and the rapid structural and systemic change necessary requires a view on the economy as a whole. The issues include not only market failures but also the structures shaping investment and innovation; and the functioning of key systems, including cities, land, energy, and transport. **Strong implications for the role of the state**.
- There are also real potential **government failures** that should influence approaches to public action. Deep and real dangers in all-encompassing and powerful (possibly malevolent and corrupt) state. Many examples, including former Soviet Union. But so too deep dangers in **market fundamentalism**. The crises we face require new reflection and considerations.

Role of the state: crises and rights

The state's role in tackling global crises involves coordinating urgent, systemic actions. That function is beyond individual or corporate capacities. Akin to the state's expanded functions during wars and pandemics. That function involves combining/balancing entrepreneurship and personal freedoms with collective good and intergenerational rights. Global crises require coordination across nations.

Thinking through the **new role of the state** requires **an understanding** of the severity of current challenges and crises and of **critical necessary and urgent actions to manage or avoid disasters and catastrophes**.

Actions of individuals and firms cannot by themselves offer the approaches to **systemic and rapid change** that the global crises require. They will be crucial to the implementation and driving of change but **communities and nations will have to decide on direction and shape of changes**.

Some analogies to **war-time and pandemics** where the role of the state is transformed.

The response to crises cannot be full-on central planning or Gosplan; individual action, **entrepreneurship, and creativity are critical** and we will learn and change along the way.

Issues of **rights and liberties** will be central; rights of individuals to live own lives and make choices, whilst respecting rights of others; rights of future generations.

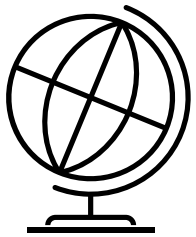
Role of the state: global public goods (GPGs)

Global collaboration is essential in combating climate change. Requires shared efforts in emission reduction, finance, and technology to align national actions with global climate objectives; as embodied in the Paris Agreement. Similarly other global challenges and GPGs.

Climate change is associated with a public good (or bad) which is **inherently global**. The trapping of heat in the greenhouse effect is determined by the **sum total of concentrations** of GHGs in the atmosphere wherever the GHGs originate.

The effect of a kilogramme of GHG from Johannesburg is the same as that from New York. Cannot separate out national activities from the emissions of GHGs: intertwined. **Supply of the GPGs not a separate action**. It concerns how economy functions and what investments are made.

There is an incentive to **free-ride** on the actions of others to cut emissions. By getting together as a world in international discussion and agreement it is **possible to act together**.



Understanding of the nature and severity of the risk is crucial. This is the nation state voluntarily taking an international responsibility and goals and pursuing those goals at home, as well as collaborating on, e.g., finance, technology, and trade. **Striking that nation states and individuals do recognise broader responsibilities**.

Shared discourse and analysis is crucial, e.g., via IPCC and UNFCCC.

Much easier to find agreement on **national action for the world as a whole** if national objectives such as growth, development, and poverty reduction align with the global. Hence importance of argument that this is the growth story of the 21st century.
The **Paris Agreement** was fostered by the beginnings of that understanding.

A **fractious world** makes collaboration more difficult. But **collaboration around shared risk and a goal can help with collaboration elsewhere.**

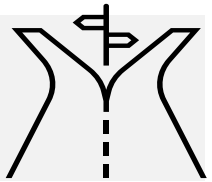
Role of the state: institutions and behaviours

Institutions are key to driving investment and delivering an inclusive transition to a sustainable economy. But they must remain flexible to adapt to market complexities and support an effective combination of public initiatives and private innovation. Their structure influences behaviours and values. Importance of a strategic, coherent and open approach across all levels of governance. And to public discourse and social science agenda.

Institutions, particularly through their influence on conditions for investment and its foundations, and for enabling participation and inclusion, will be central to a strong and effective transition.

- The understanding and actions for building the new growth story, sustainable, resilient and inclusive, **provide clear examples of an active state,** but where investment, behaviours, and **actions are largely driven by the private sector, households, and communities**. Public action to foster individual and community creativity, and vice versa.
- **Institutional structures** (including law, education, local government, nature of public discourse, religious institutions,…) will profoundly influence **behaviour**.
- Mutual understanding on **values, objectives, and metrics** will come through institutions, discussions, and understanding of responsible behaviour. In turn these interactions and processes influence behaviour.

- The canvas is **local, national and international**.
- The international aspects are taken up in Lecture 3.
- **A new agenda for public discourse and for the social sciences**.



But **beware "institutional fundamentalism"** with narrowly focused inflexible institutions. **All institutions should recognise the magnitude and nature of the risks** and necessary transformations. Remember **James Meade** and second best; a market failure in one market distorts market prices across the whole economy.

AI will **influence** both behaviour and institutions: for better or worse.

Summary of Lecture 1

Looking back

In the past 70 years, advances in **human welfare and economic output have been remarkable and unprecedented**, albeit with persistent regional disparities. **The structure of the world economy has been transformed**; now multi-polar. **Severe climate, biodiversity, and environment stresses** have emerged from weight of output and dirty, wasteful and destructive processes.

A world redrawn

A series of crises, the transformation of the world economy, and the recognition of the **unsustainability of our economic methods and models**, where gains in well-being are marred by environmental damage and social division, has prompted **a re-evaluation of global objectives**. Sustainability and social cohesion as central issues. In particular, the SDGs and Paris climate agreement of 2015.

Climate and biodiversity crises

Accelerating climate and biodiversity crises demand urgent and fundamental systemic change. Meeting Paris Agreement targets crucial to avoiding severe impacts of warming and further damage to biodiversity. Need for **integrated and economy-wide and rapid action on mitigation, adaptation and sustainable development** in all countries.

The ethics, the economics and the politics

The underlying ethics point to an approach to sustainable development founded in **human rights and intergenerational justice,** based on the right to development, itself embodied in a notion of common humanity. Rejection of discrimination by date of birth. Recognition of role of past historical emissions and injustice. All this goes beyond standard "welfare function" approaches of most economics; but sensible application of standard "consequentialism" points in similar directions for actions. The necessary **transformative change requires public action and decisive political leadership** to navigate the disruption, foster intragenerational equity, and seize the opportunities the transformation presents. The **obstacles lie more in the economics, politics, and society** than in science and technology.

A decisive decade

The decisions of next decades, particularly on infrastructure in EMDEs, will dictate whether we lock in high carbon emissions or transition to **sustainable, resilient, and inclusive development**. **A big push on investment is central to this transformation**, requiring at least $4 trillion p.a. globally by 2030. **A new model of growth and development** is in our hands but action must be swift and strong. Much more attractive than the dirty, destructive paths of the past. A growth story for the 21st century: many opportunities along the way; rewards are great; obstacles and difficulties are real; but failure risks catastrophe.

Implication

Sustainable, resilient and equitable growth requires **integrating natural capital and social equity into economic analyses and actions.** And placing rapid **structural, systemic and technological transformation** at centre stage. As technology advances, we can see that the **major difficulties lie in economics, politics, and society**. International collaborations that foster and finance investments in new clean and robust activities in affordable ways, particularly energy infrastructure and resilience, are essential for transformative change at the pace now required. **Global cooperation and a new multilateralism are crucial**. **Economic analysis, policy, and action** should be oriented to fostering the transformation, realising the new growth opportunities, and underpinning global co-operation. **This is the new agenda for economics and the social sciences**.

Summary of Lecture 2

The new growth story: basics

The 21st century growth story centres on **six mutually reinforcing drivers,** embodying factors which are **mostly missing from standard growth analyses** (economies of scale, rapid innovation, networks, systemic changes, health, and new forms of investment). This transformative agenda requires substantial **investment and innovation**, supported by effective policies, institutions, collaboration, and leadership to foster **rapid, structural, systemic, and technological change and manage dislocation**.

Climate, development and poverty

Climate action intertwines with and supports development and poverty reduction. Well-designed adaptation and mitigation efforts stimulate economic growth, reduce poverty, and build resilience. **Inaction exacerbates poverty and stalls development.**

Investment and innovation

Achieving climate and development goals requires **substantial investment** in clean technologies, **with a focus on EMDEs and infrastructure**. Requires innovative and strong strategies in electrification of energy, transformation of cities and transport, recasting agriculture, and reviving forests. Strong **AI potential** to advance discovery and diffusion of green technologies and to manage systemic change.

The new growth story: analytics

Existing economic models fall short in capturing the magnitude and nature of climate risks, the dynamics of systemic, structural, and technological change, the full potential of sustainable growth, including health benefits, and the challenges of dislocation. Will require a **collection of analytical perspectives** to guide this complex transformation and careful thought, judgement and wisdom in combining different perspectives into action.

Policies and institutions

Robust policies and supportive institutions are essential for driving investment in climate action. Requires **clear signals** and a **stable investment environment**. Policy must tackle a whole range of market failures in R and D, capital markets, networks, information, and co-benefits such as reduced air pollution – not just the Pigouvian GHG externality. A comprehensive approach, including diverse instruments, such as standards and regulation, effective and responsive public institutions, city design, management of natural capital, and key public investments. **A focus on the dynamics; public economics as if time matters**.

The role of the state

Market fundamentalism has given way to recognising the **state's essential role** in promoting sustainability and tackling inequality. **Government intervention** critical to achieve sustainable growth and development in a world with many key market failures. Structural and systemic change in real time requires clear and purposive strategy. Will have to work closely with private markets and sectors to foster this change. Clarity on **objectives, metrics, strategies and signals. Public participation and co-creation** across stakeholders will be crucial to success.