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

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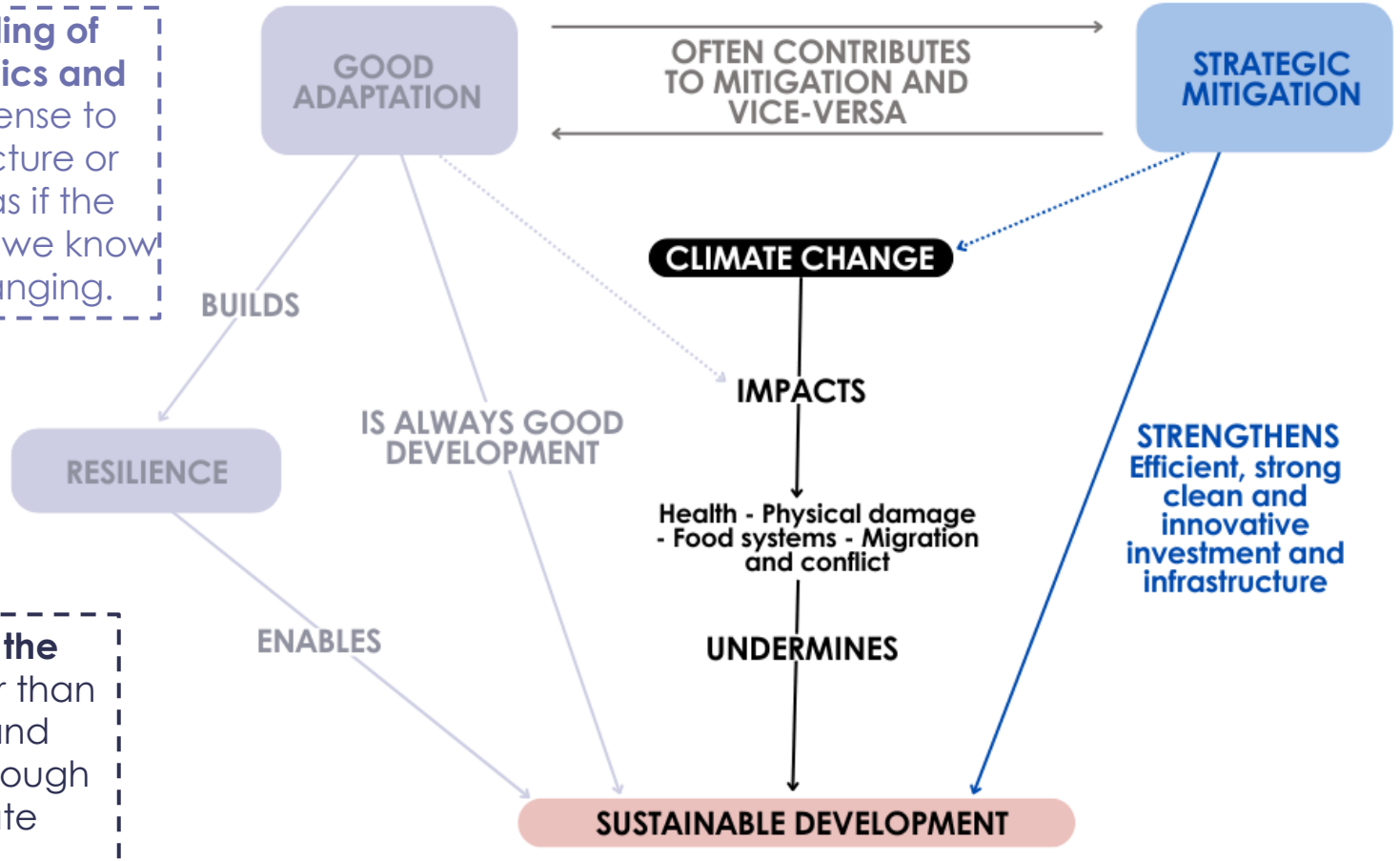
Structure

- **Building and financing a new form of development**
- A new growth story of the 21st century
- China and the new growth story

Building a new form of development

Climate action is at the core of and is a driver of development. If we delay on climate action we disrupt and undermine everything else.

Adaptation and the building of resilience is basic economics and good sense; it makes no sense to build houses and infrastructure or follow cropping patterns as if the climate is unchanged when we know it has changed and is changing.



The investment, innovation, and structural change that can deliver the radical change in economic activities necessary to reduce emissions and protect biodiversity, **can also deliver a much more attractive story of growth and development** than the dirty, destructive growth models of the past.

A stable climate brings the freedom to prosper rather than halting development and hampering well-being through hostile effects of climate change.

Own elaboration drawing on OECD (2023)

We cannot think of climate finance as separate from development finance

Investment / spending requirements for climate and nature ($ billion per year by 2030) in EMDEs (other than China)

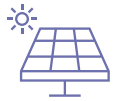
Source: Bhattacharya et al. (2024). Increment from current in parentheses.

Climate and nature related investments
$2,440 ($1,890)

- **Energy transition** $1,600
- **Adaptation and resilience** $250
- **Natural capital and sustainable agriculture** $300
- **Coping with loss and damage** $250
- **Just transition** $40

Clean energy plays a vital role in economic development

E.g. Africa holds 60% of the best solar resources in the world (IEA, 2022) but 40% of its population lacks electricity access (IEA, 2023a).



Development actions are key for adaptation

E.g. Enhancing energy and irrigation systems or improving thermal insulation of buildings.

Natural capital avoids losses that obstruct development

E.g. Mangrove forests provide more than US$80 billion annually in avoided losses from coastal flooding and 24 hours storm or heat wave warnings can reduce damage by 30% (Global Commission on Adaptation, 2019).

Climate hazards impede development through many losses and increased debt

E.g. Since 1970, LDCs have faced climate-related disasters where damages reached up to 30% of their GDP (WMO, 2023).

A just transition is about ensuring sustainable development is inclusive

Economies undergo continuous change and transformation. There is a collective responsibility to manage this transition in an equitable and just manner.

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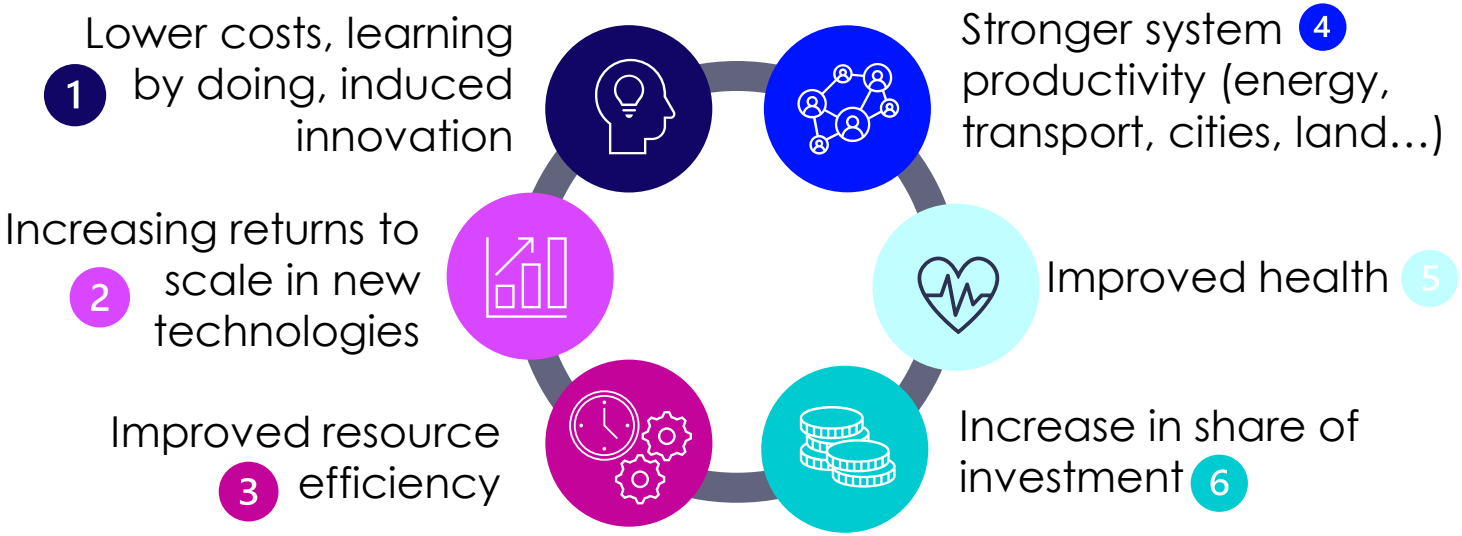
A 21st century growth story

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.

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 and reduce poverty.
~ 10 years	Spur innovation, creativity and growth in the medium term, unleash new waves of innovation and discovery.
~ 20 years	Low-carbon is the only feasible longer-run growth on offer; high carbon growth self-destructs.

Six interwoven mutually reinforcing drivers

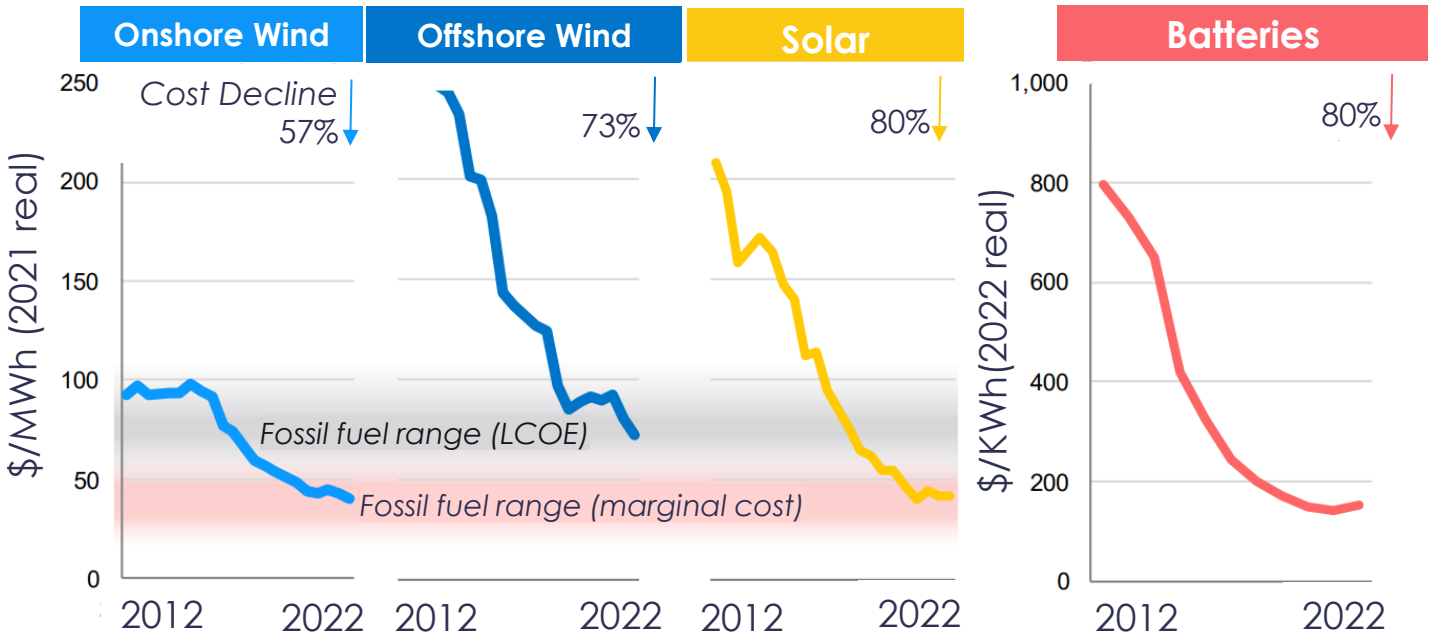


The driving forces of a new growth story:

1 Lower costs, learning by doing, induced innovation

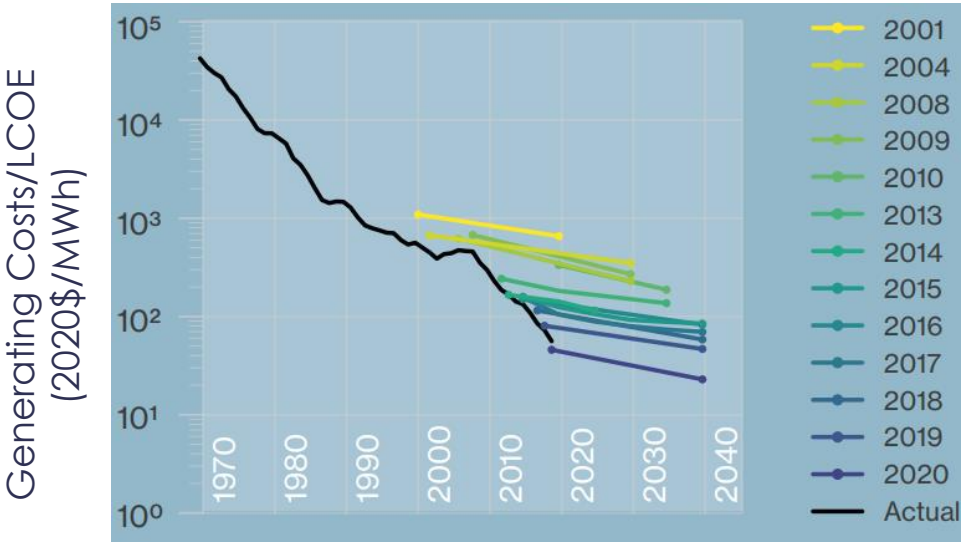
The pace of technology advancement and cost reductions has been rapid and faster than expected. Capital costs for renewables continue to fall much faster than those for conventional technologies. Standard models do not embody the rapid, structural/systemic change, disruptive technological change, and 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 (2023)

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.

- **In 2022 to 2023 alone, cost of solar PV declined by 12%, and between 3-7% for wind** (IRENA, 2024).
- **In 2024, battery storage costs fell by a third** (BNEF, 2025a).

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.

3 Improved resource efficiency

Greater efficiency in resource use means higher productivity. COP28 committed to x2 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.

5 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 associated with fossil fuel burning.

4 Stronger system productivity

Energy, cities, land, transport, water systems can be much more productive through improvements in how each operates and how these systems interact. Cities where we can move and breath are more productive. Digital management and AI have great potential. Huge possibilities from use of IT and AI for efficiency, integration, congestion and system management.

More compact, connected, and coordinated cities are worth up to **$17 trillion in economic savings** to 2050 and could **reduce infrastructure capital requirements** by over $3 trillion between 2015 and 2030 (NCE, 2018). Densification is also more **carbon efficient and resilient** to climate change and disasters (NCE, 2018).

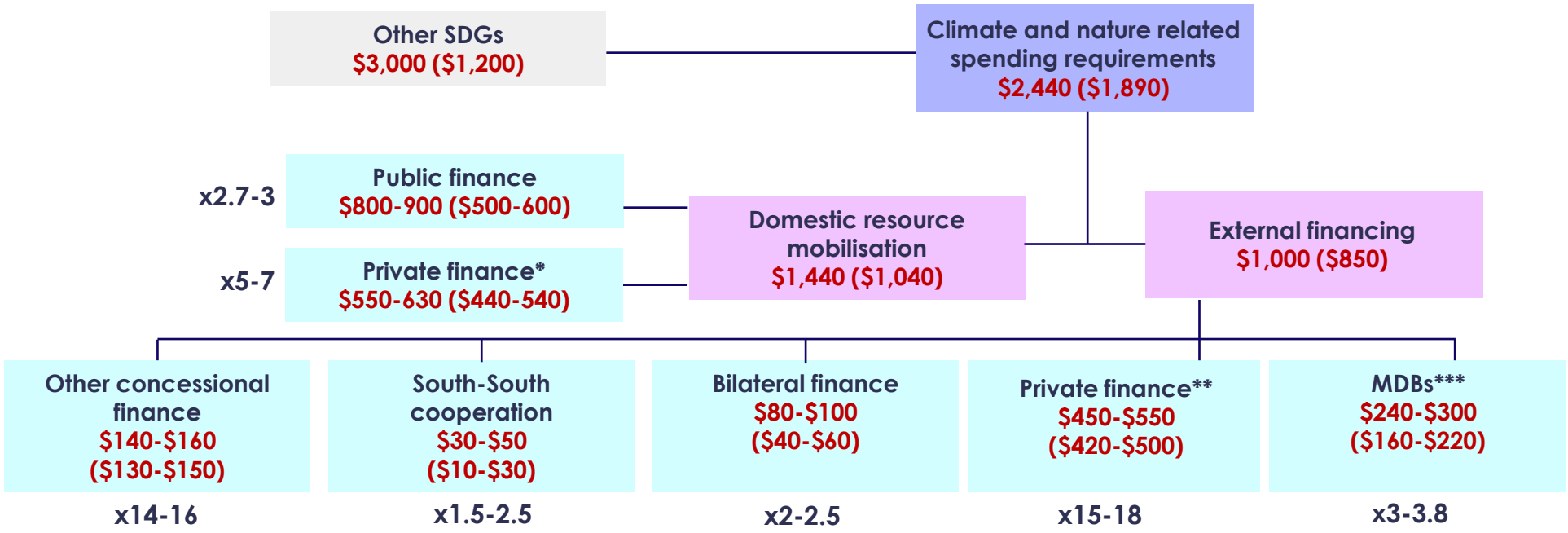
The driving forces of a new growth story:
6 A major increase in investment: an imperative and an opportunity

Investment is at the core of the new growth story. If well executed, this increment in investment will have high returns in terms of productivity and will foster and embody innovation. Full of opportunity but challenging. The four sources (DRM, private, MDBs, concessional) are complementary and mutually supportive. Different activities will need different mix of financing. Private sector is deterred by actual and perceived risk.

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

By managing and reducing risk through appropriate collaborations, particularly involving MDBs, and through guarantees, etc., can bring down cost-of-capital.

Mobilising the necessary financing for EMDEs other than China ($ billion per year by 2030, increment from current in parentheses)



* Includes household savings. ** A significant proportion of this private finance would be directly and indirectly catalysed by MDBs, other development finance institutions and bilateral finance. *** Includes multilateral climate funds.

Source: Bhattacharya et al. (2024). See work of Independent High-Level Expert Group on Climate Finance (Bhattacharya, Songwe, Stern) for COPs 26, 27, 28.

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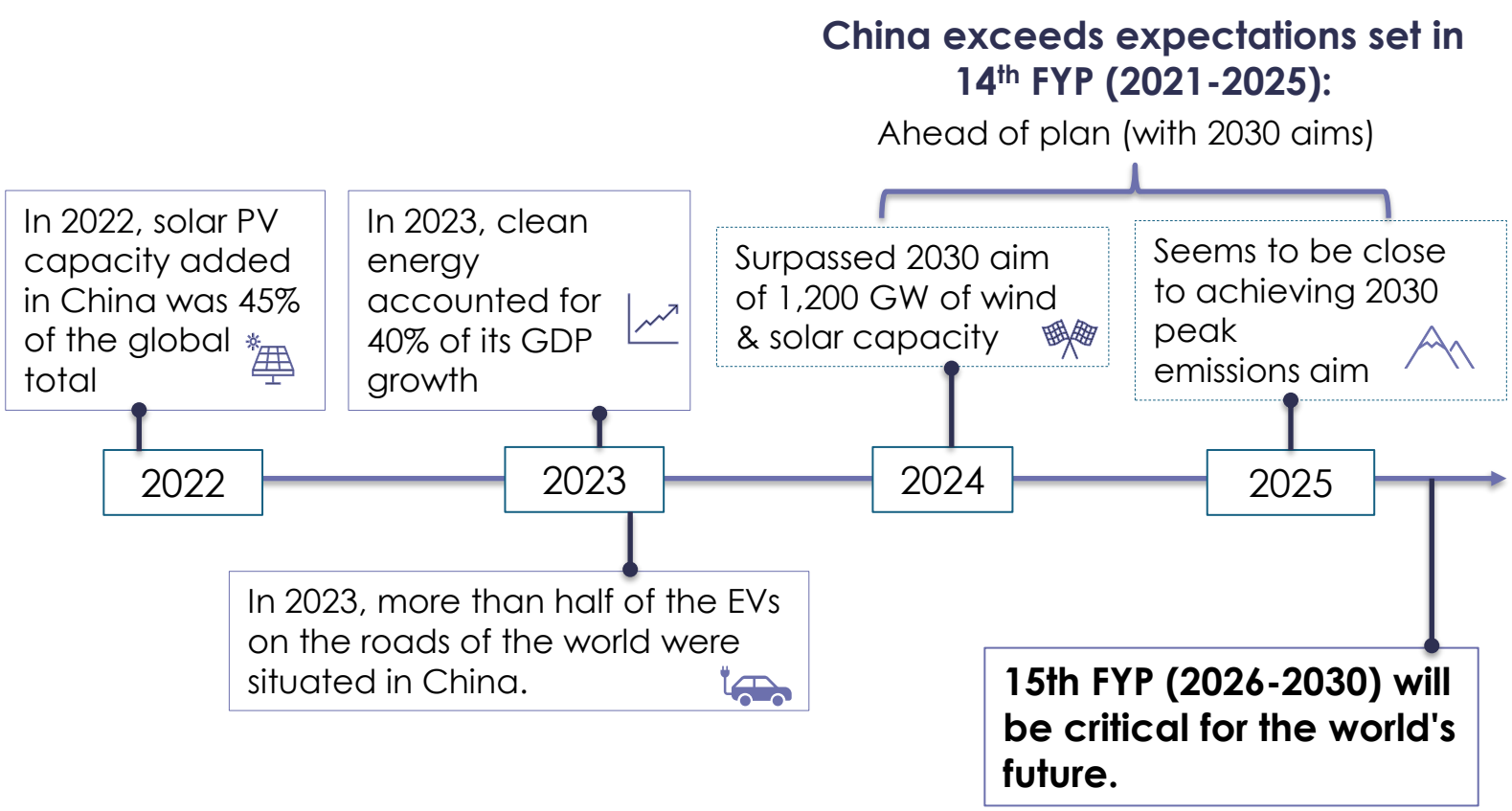
China and the new global growth story

China is embracing a new approach to development under the principle of "harmony between humans and nature." It is exceeding expectations in its energy transition and is in the vanguard in the manufacturing of renewable technologies.



Sources: IRENA (2023), IEA (2024), Carbon Brief (2024), You (2024)

- **China produces solar panels at a cost of around 10 US cents per watt** compared with around 30 US cents per watt elsewhere and costs of around US$2 in the world a decade ago (Swanson & Rappeport, 2024; IEA, 2020).
- **In 2023, China accounted for around 60% of global electric car sales** (IEA, 2023b).
- **>70% of all EV batteries ever produced were made in China** (IEA, 2025).
- **In China, batteries are cheaper than in Europe and North America** by over 30% and 20%, respectively (BNEF, 2024).
    - Declining battery costs in recent years are a major reason why in China **many EVs are now cheaper than ICE vehicles** (IEA, 2025)

China and the developing world

China is at the forefront of clean innovation, implementation, and finance.
These three pillars can together drive growth in the developing world.

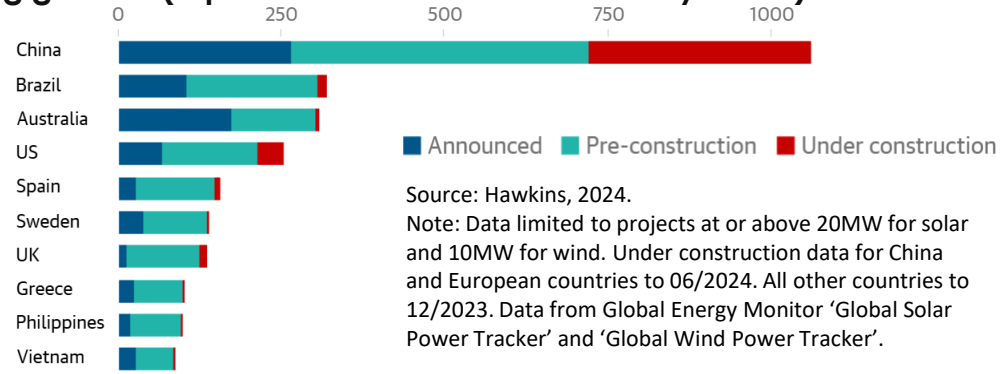
(1) Innovation: China is at the vanguard of (a) renewable tech., (b) storage and grids, (c) e-mobility, (d) green hydrogen and ammonia, (e) AI.

- **ASPI technology tracker:** China led world in **3 of 64 technologies** in 2003-2007 and **57 of 64** in 2019-2023. And note DeepSeek.
- China can provide these technologies at scale to developing world. It is leading the clean energy race: **its total energy transition investment in 2024 was greater than the investments of the US, EU and UK combined** (BNEF, 2025b).
- Between 2021 and 2023, global manufacturing capacity for **solar panels tripled**, mainly due to expansion in China – around **80-85% of manufacturing capacity is based in China** (Ember, 2024). But global installation is behind production capacity. Global deployment forecasts suggest that this decade **>50% of manufacturing capacity will remain unused**. Installations needs to increase to avoid manufacturing capacity contraction. Underutilised solar manufacturing capacity could support the energy transition in the Global South (Ember, 2024). China has more than enough production capacity in PVs to double or triple Africa's total electricity capacity in 2 or 3 years.

(2) Implementation: China can deliver big projects and programmes at a fraction of time at scale.

- These **implementation skills** are of great value for green transitions.
  - E.g. In one decade, China built 25,000 km of high-speed railway (HSR) lines – more than total HSR lines operating in the rest of the world (World Bank, 2019).
  - E.g. All conventional commercial-scale nuclear reactor projects in China's history were completed in less than a decade (Breakthrough Institute, 2024).
- **One third of planned utility-scale solar and wind in China is already under construction** (i.e. site preparation and equipment installation underway), higher than global average (7%) (GEM, 2024).

Solar and wind power projects by status and planned capacity, gigawatts (top ten countries broken down by status)



Source: Hawkins, 2024.
Note: Data limited to projects at or above 20MW for solar and 10MW for wind. Under construction data for China and European countries to 06/2024. All other countries to 12/2023. Data from Global Energy Monitor 'Global Solar Power Tracker' and 'Global Wind Power Tracker'.

(3) Finance: China has and contributes to major development and policy banks.

- China led the development of **new MDBs** – Asian Infrastructure Investment Bank and the New Development Bank.
- One study found that China's development banks lent more than **x2 for public-private infrastructure projects in sub-Saharan Africa than the US, Germany, Japan, and France's development finance institutions combined** between 2007 and 2020 (CGD, 2022).
- Between 2008-2021, the China Development Bank (**CDB**) and Export-Import Bank of China (**CHEXIM**) issued $498 billion in development finance, about **83% as much as the sovereign lending of the World Bank** ($601 billion) (Ray, 2023).
- China is now the **5th largest donor** to the Asian Development Fund (ADF); the **6th largest** in the International Development Association (IDA); and the **12th largest** of the African Development Fund (AfDF) (Hofman et al., 2024).

China and the new international order

China, as the largest and most creative economy in the world, can drive climate action and shape the new development story: a leader in development and internationalism. If US steps back, others step forward.

Leading a major investment in renewables e.g. in Africa. China has low-cost and high-quality. And can help with finance through its own development banks and working with MDBs.

Helping increase role for MDBs beyond the World Bank. Strengthening the MDBs as a group.

Strong support to Brazil's COP30 and South Africa's G20.

Leading in support for the international institutions, in finance, trade, health. Taking a leadership role in those institutions.

Promoting cooperation and inspiring other developing countries: China's example to other developing countries is critically important.
If China can realise "harmony between humans and nature" through embracing a new approach to development, its experience will be a vital driver of a globally sustainable future.

Strengthening multilateral and plurilateral cooperation. Including through BRICS but also with developing world more generally. Special importance of relation with India. And with EU.

References (I)

- Bhattacharya, A., Songwe, V., Soubeyran, E., and Stern, N (2024) Raising ambition and accelerating delivery of climate finance. Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science. Retrieved from https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2024/11/Raising-ambition-and-accelerating-delivery-of-climate-finance_Third-IHLEG-report.pdf
- BNEF (2024, December 10) Lithium-Ion Battery Pack Prices See Largest Drop Since 2017, Falling to $115 per Kilowatt-Hour: BloombergNEF. https://about.bnef.com/blog/lithium-ion-battery-pack-prices-see-largest-drop-since-2017-falling-to-115-per-kilowatt-hour-bloombergnef/
- BNEF (2025a) Global Cost of Renewables to Continue Fallin in 2025 as China Extends Manufacturing Lead.
- BNEF (2025b) Global Investment in the Energy Transition Exceeded $2 Trillion for the First Time in 2024, According to BloombergNEF Report.
- Breakthrough Institute (2024) China's Impressive Rate of Nuclear Construction. https://thebreakthrough.org/issues/energy/chinas-impressive-rate-of-nuclear-construction#:~:text=China's%20recent%20nuclear%20construction%20success,a%20decade%20(Figure%201).
- CGD (2022) New Study: China Lends 2.5x as US, UK, Japan, Germany Combined for Infrastructure in Sub-Saharan Africa
- Carbon Brief (2024) Analysis: Clean energy was top driver of China's economic growth in 2023. https://www.carbonbrief.org/analysis-clean-energy-was-top-driver-of-chinas-economic-growth-in-2023/
- Ember (2024) China's 'spare' solar capacity offers climate and energy access opportunity. https://ember-energy.org/app/uploads/2024/06/Report-Chinas-spare-solar-offers-global-opportunity-1.pdf
- GEM (2024) China continues to lead the world in wind and solar, with twice as much capacity under construction as the rest of the world combined. https://globalenergymonitor.org/wp-content/uploads/2024/07/GEM-China-wind-solar-brief-July2024.pdf
- Global Commission on Adaptation (2019) Adapt now: A global call for leadership on climate resilience. Rotterdam: Washington, DC.
- Hawkins, A. (2024) China building two-thirds of world's wind and solar projects. https://www.theguardian.com/world/article/2024/jul/11/china-building-twice-as-much-wind-and-solar-power-as-rest-of-world-report
- Hofman, B., Srinivas, P.S. (2024) China's Changing Role in Multilateral Development Banks. In: Wang, H.H., Miao, M.L. (eds) Enhancing Global Governance in a Fragmented World. China and Globalization. Springer, Singapore. https://doi.org/10.1007/978-981-97-2558-8_9
- IEA (2022) Africa Energy Outlook 2022, IEA, Paris https://www.iea.org/reports/africa-energy-outlook-2022
- IEA (2020) Evolution of solar PV module cost by data source, 1970-2020. https://www.iea.org/data-and-statistics/charts/evolution-of-solar-pv-module-cost-by-data-source-1970-2020
- IEA (2023a) Financing Clean Energy in Africa, IEA, Paris https://www.iea.org/reports/financing-clean-energy-in-africa

References (II)

- IEA (2023b) Global EV Outlook 2023, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2023
- IEA (2024) Meeting Power System Flexibility Needs in China by 2030: A market-based policy toolkit for the 15th Five-Year Plan.
- IEA (2025, March 5) The battery industry has entered a new phase. https://www.iea.org/commentaries/the-battery-industry-has-entered-a-new-phase
- IRENA (2023) Renewable energy and jobs: Annual review 2023. https://www.irena.org/Digital-Report/Renewable-energy-and-jobs-Annual-review-2023#:~:text=Regarding%20deployment%2C%20China%20added%2086,the%20smaller%20additions%20in%202021.
- IRENA (2024) Renewable Power Generation Costs in 2023. https://www.irena.org/publications/2024/Sep/Renewable-Power-Generation-Costs-in-2023
- Ives, M. C., Righetti, L., Schiele, J., De Meyer, K.,Hubble-Rose, L., Teng, F., Kruitwagen, L., Tillmann-Morris, L., Wang, T., Way,R., and Hepburn, C. (2021) A new perspective on decarbonising the global energy system (Report No. 21-04). SmithSchool of Enterprise and the Environment, University of Oxford. https://www.inet.ox.ac.uk/publications/a-new-perspective-on-decarbonising-the-global-energy-system
- New Climate Economy (2018) Unlocking the Inclusive Growth Story of The 21st Century: Accelerating Climate Action In Urgent Times. https://newclimateeconomy.net/content/unlocking-inclusive-growth-story-21st-century-accelerating-climate-action-urgent-times
- OECD (2023) Scaling up adaptation finance in developing countries: Challenges and opportunities for international providers. Green Finance and Investment. OECD Publishing. https://doi.org/10.1787/b0878862-en
- Ray, R. (2023) Small is Beautiful. A new development era in China's overseas development finance? https://www.bu.edu/gdp/files/2023/01/GCI_PB_017_CODF_EN_FIN.pdf
- RMI (2023) The renewable revolution: It's exponential, global, and this decade. https://rmi.org/wp-content/uploads/dlm_uploads/2023/06/rmi_renewable_revolution.pdf
- Swanson, A., and Rappeport, A. (2024, June 6) U.S. adds tariffs to shield struggling solar industry. The New York Times. Retrieved from https://www.nytimes.com/2024/06/06/business/economy/tariffs-solar-industry-china.html
- World Bank (2019) China's Experience with High Speed Rail Offers Lessons for Other Countries. https://www.worldbank.org/en/news/press-release/2019/07/08/chinas-experience-with-high-speed-rail-offers-lessons-for-other-countries
- WMO (2023) Economic costs of weather-related disasters soars but early warnings save lives
- You, X. (2024, January 19) What does peak emissions mean for China — and the world? Nature. https://www.nature.com/articles/d41586-024-02877-6