Energy & Climate
- A Power Utility Perspective

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Energy for Brighter Tomorrows

The Challenges Of

ENERGY & CLIMATE CHANGE

Climate change affects business…

Potential direct impacts include:

- Supply disruptions due to flooding, problems accessing water, asset damage leading to brownout and unplanned outages, etc.
- Accelerated ageing due to increased wear and tear, leading to loss of efficiency and reduction of capacity, etc.

Climate change can have direct physical/operational impacts

Climate change affects business…

Potential indirect impacts include:

- Customer satisfaction
- Loss of stakeholder confidence
- Demand growth changes over time
- Need for new management skills
- Opportunities for new products and services
- New policies, regulations and incentives
- Etc.

The Business Case for Aggressive Climate and Energy Action

Source: BSR Blog, Ran Tao, Oct 2016, The Business Case for Aggressive Climate and Energy Action Is like a Gathering Storm

Sooner or later new climate-related policies, regulations and incentives may appear everywhere & therefore affect business

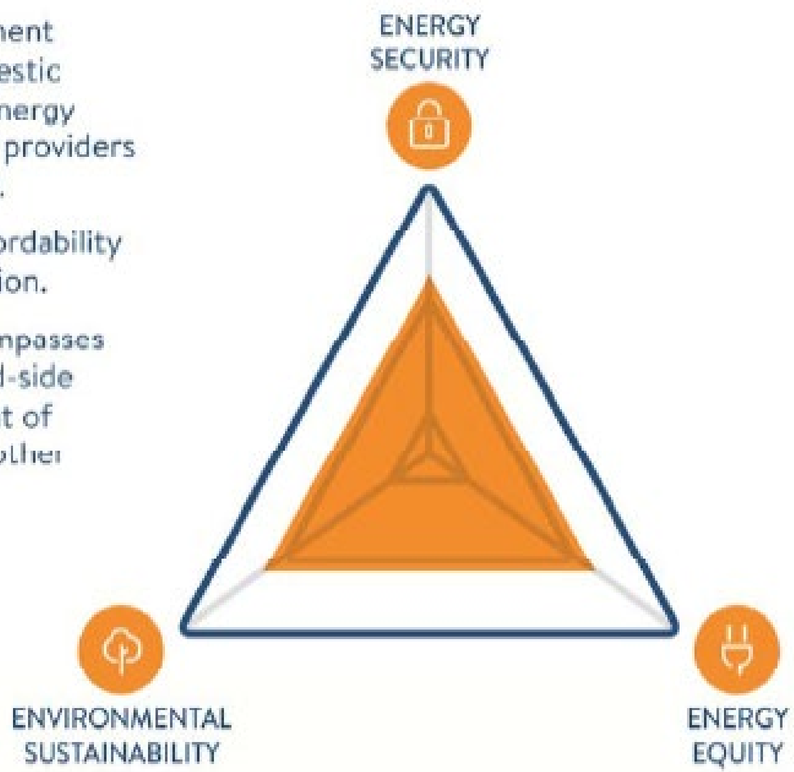
The Energy Trilemma

FIGURE 2: THE THREE DIMENSIONS OF THE ENERGY TRILEMMA

Energy security: Effective management of primary energy supply from domestic and external sources, reliability of energy infrastructure, and ability of energy providers to meet current and future demand.

Energy equity: Accessibility and affordability of energy supply across the population.

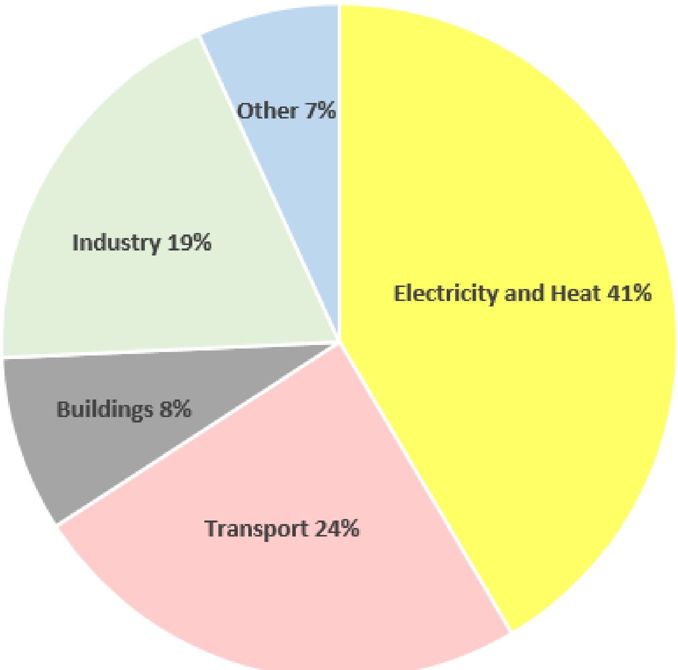
Environmental sustainability: Encompasses achievement of supply- and demand-side energy efficiencies and development of energy supply from renewable and other low-carbon sources.



Source: World Energy Council/Oliver Wyman, 2016

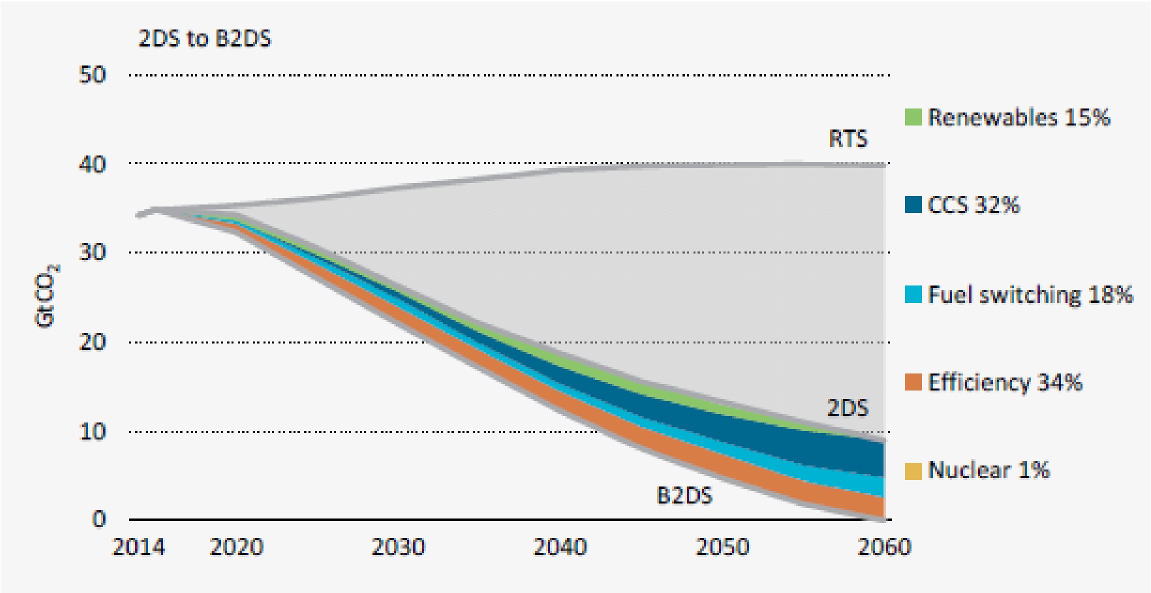
Energy and climate change

Global CO2 Emissions by Sector, 2016



Source: CO2 emissions from fuel combustion 2018 overview, IEA

Global CO2 Emissions Reduction by Technology Area and Scenario

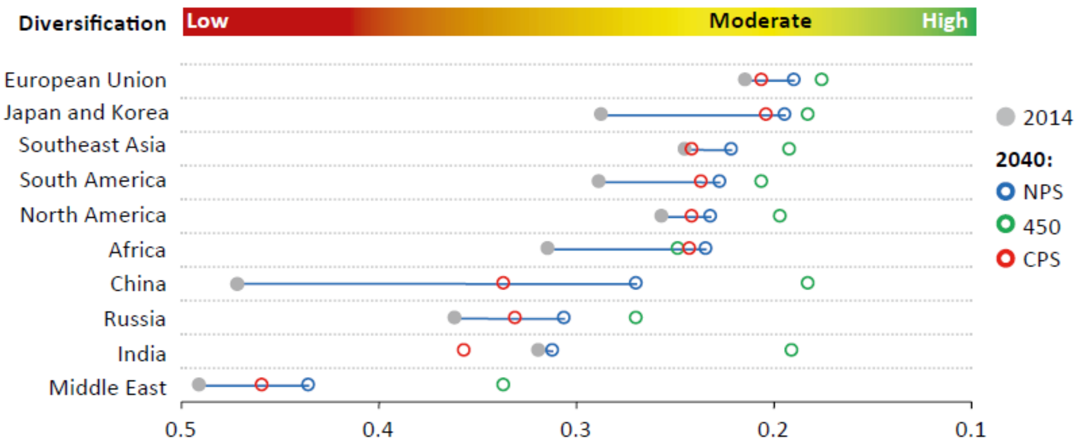


Source: Energy Technology Perspectives 2017, IEA

Power sector has the largest potential for carbon emission reductions...

Different pathways to decarbonising electricity - the future…

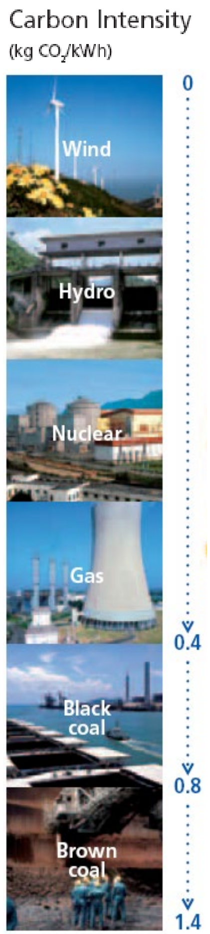
Figure 2.14 ▷ Diversity of the primary energy mix by scenario and selected region



Energy systems almost everywhere shift to a more diverse mix of fuels and technologies in the coming years

Notes: NPS = New Policies Scenario; 450 = 450 Scenario; CPS = Current Policies Scenario. The indicator for diversity is calculated using a Herfindahl-Hirschmann Index, a commonly used tool to measure market concentration in different parts of the economy. The calculations use the share of each fuel in total primary energy demand in each scenario. Lower values indicate a higher degree of diversity in the energy mix.

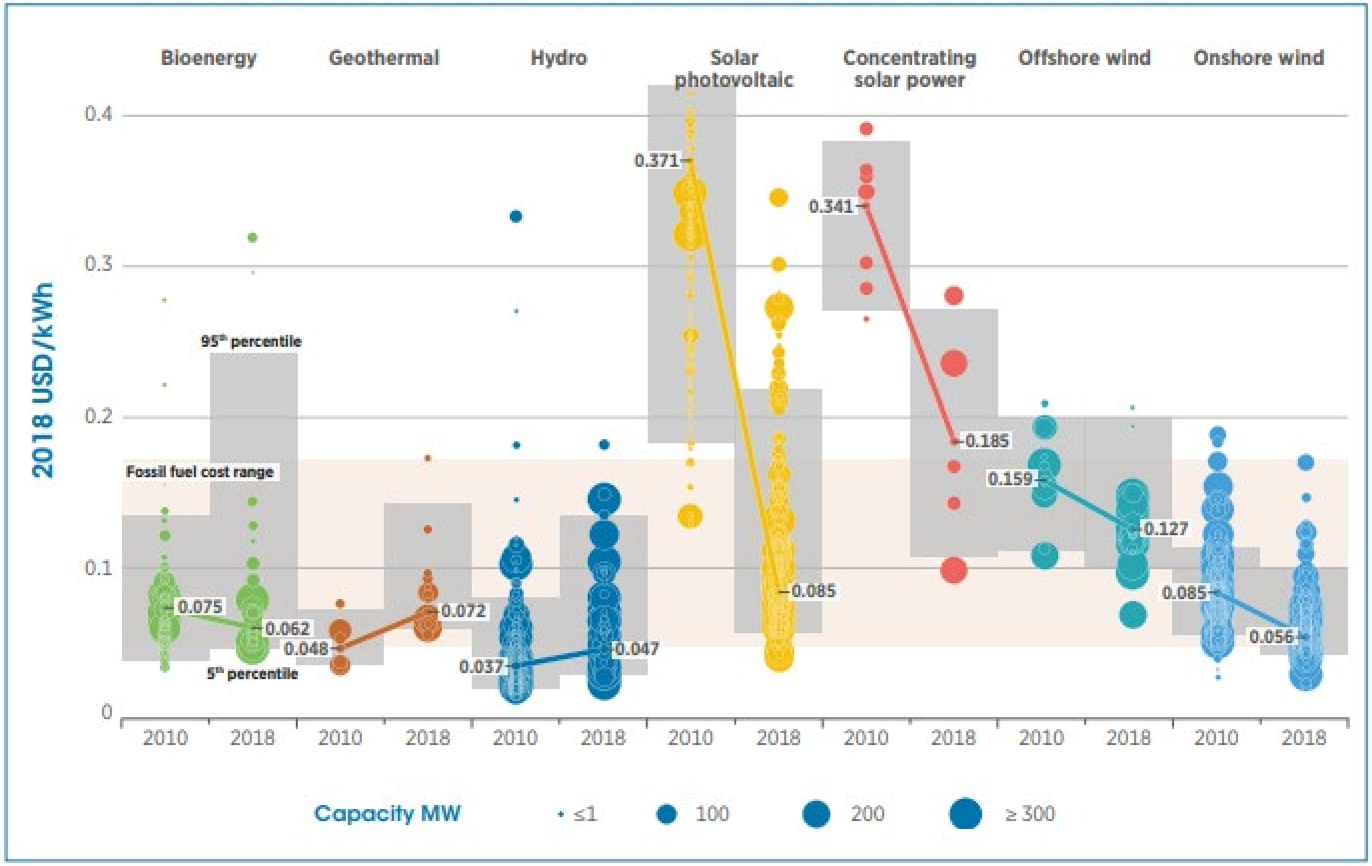
Source: IEA, World Energy Outlook 2016



Although technological advancements can help to advance decarbonisation, different countries and regions will have different policies, economic activities and different reduction pathways…

Projected costs of different technologies

Global LCOE of utility-scale renewable power generation technologies, 2010-2018



Source: Renewable Power Generation Costs in 2018, IRENA, 2019

Overall, cost drivers of the different generating technologies remain both technology-specific and market-specific

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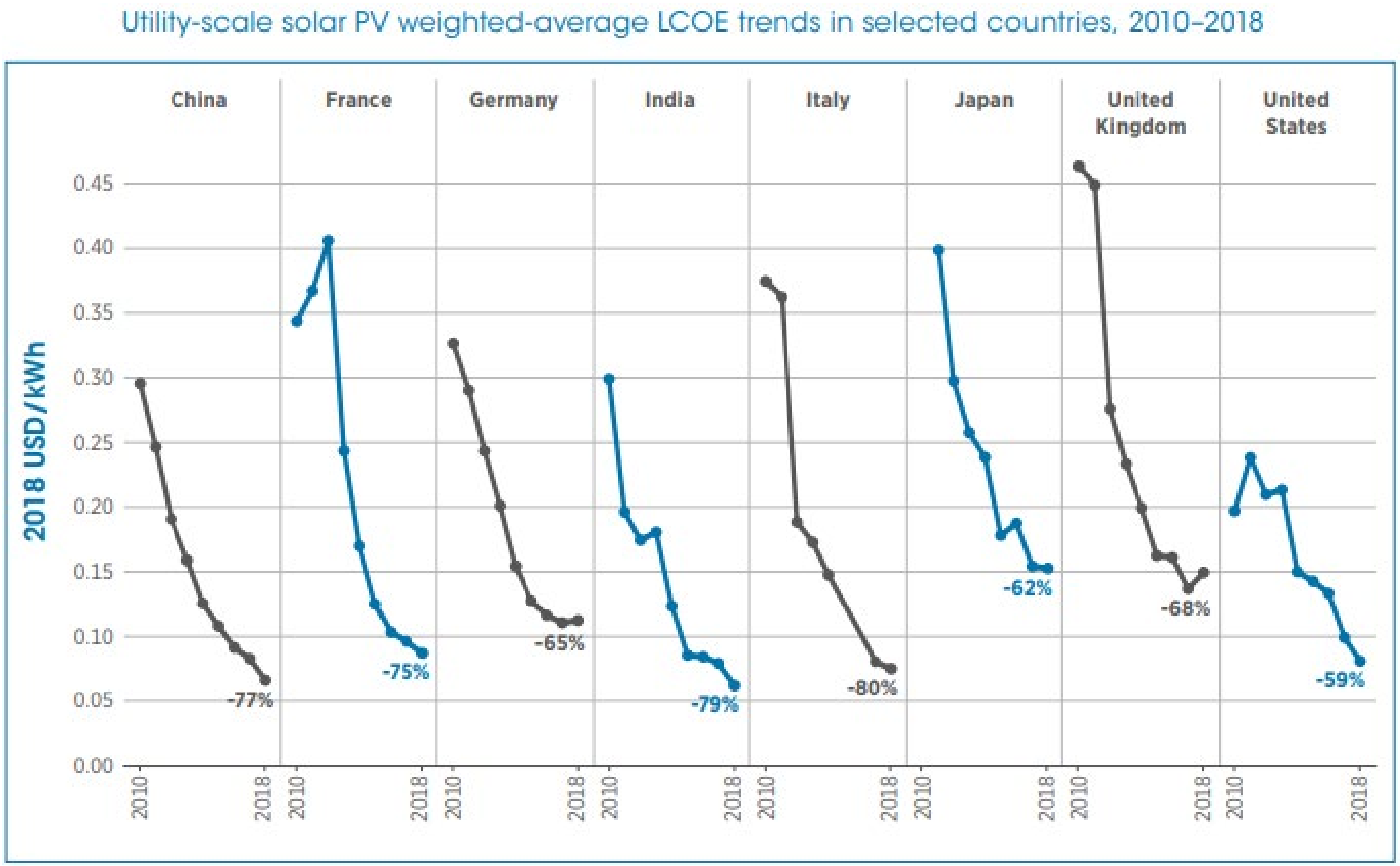
Levelised costs of commercial PV in different markets



Source: Renewable Power Generation Costs in 2018, IRENA, 2019

Overall, cost drivers of the different generating technologies remain both technology-specific and market-specific

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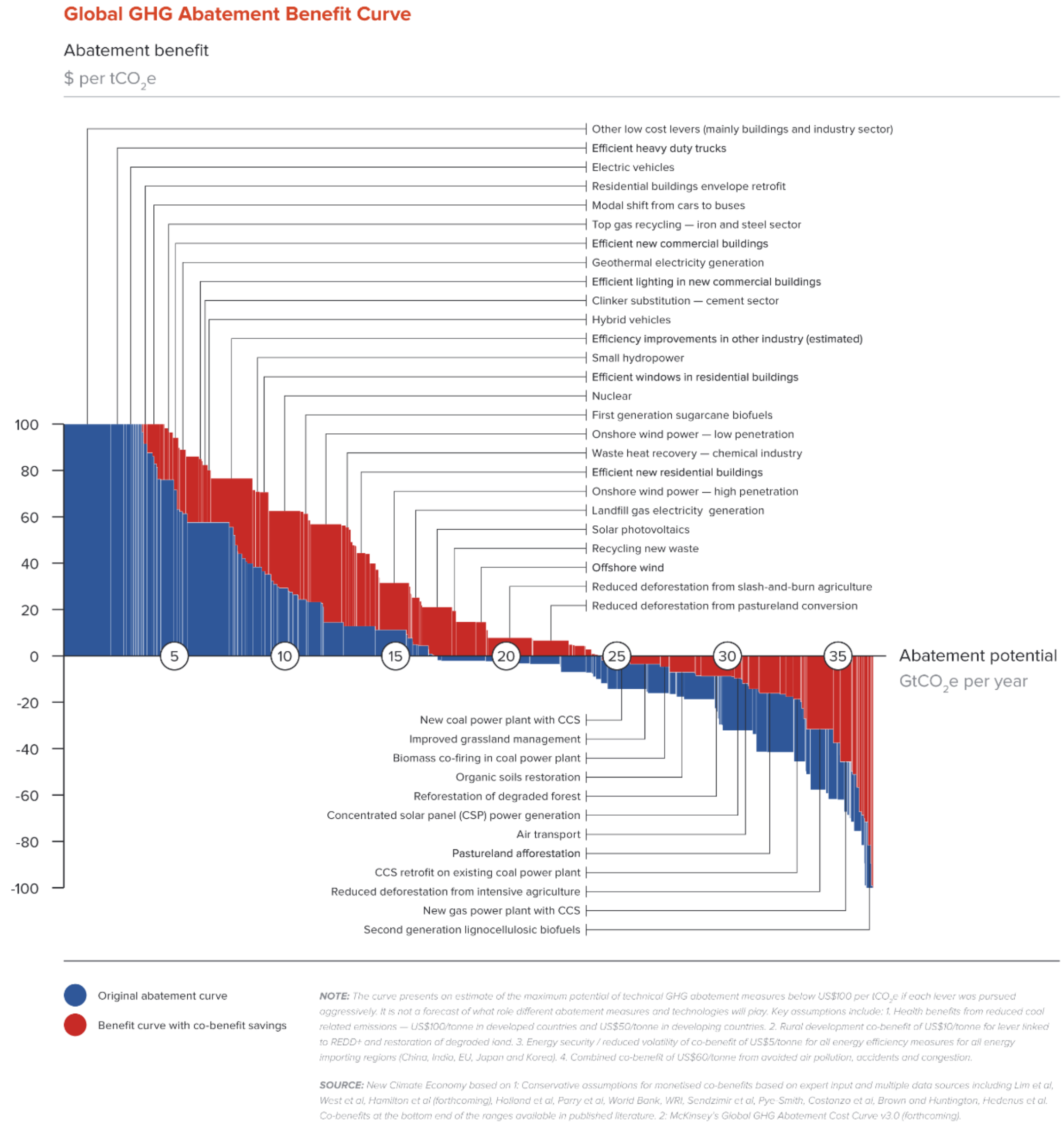
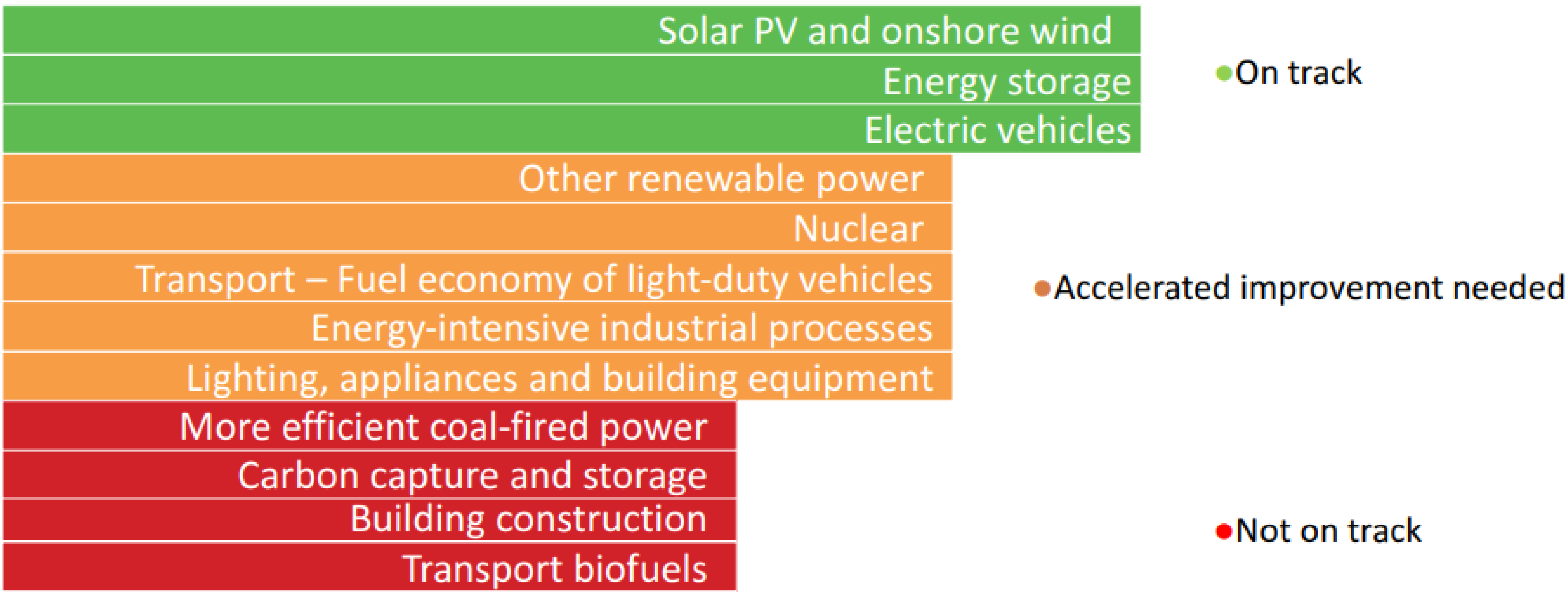
The potential cost of mitigation



Source: The New Climate Economy, The Global Commission on the Economy and Climate, 2014

Need a carbon signal – even as costs come down and/or benefits increase, some larger reductions still not commercially viable today…

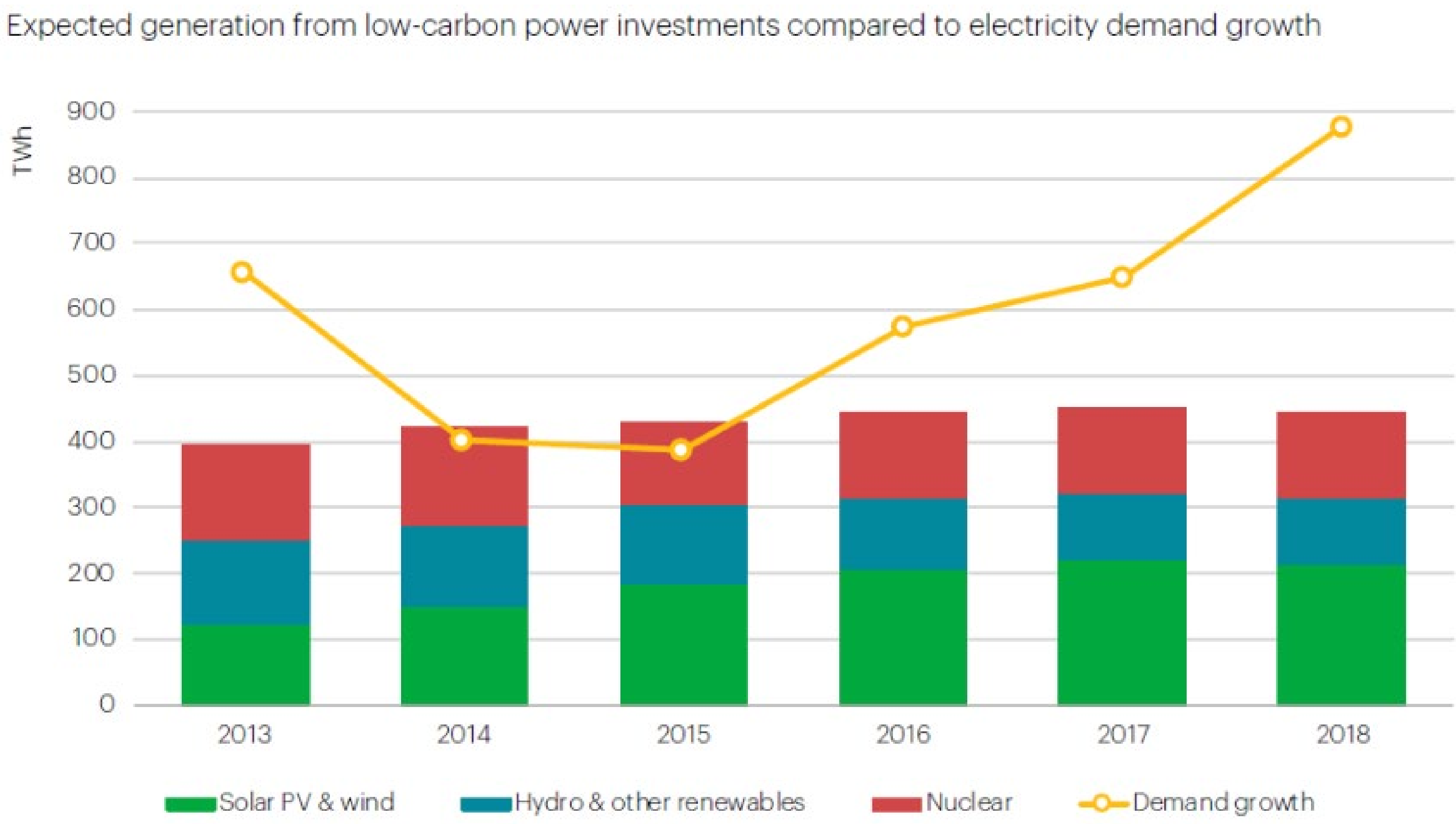
IEA Energy Technology Perspectives 2017: Technology progress



Source: Energy Technology Perspectives 2017 (pp.55-63), IEA

Most technologies are not on track or with limited development, especially coal and CCS… Only three technologies are on track: EV, PV/Wind & Energy Storage

IEA World Energy Investment 2019

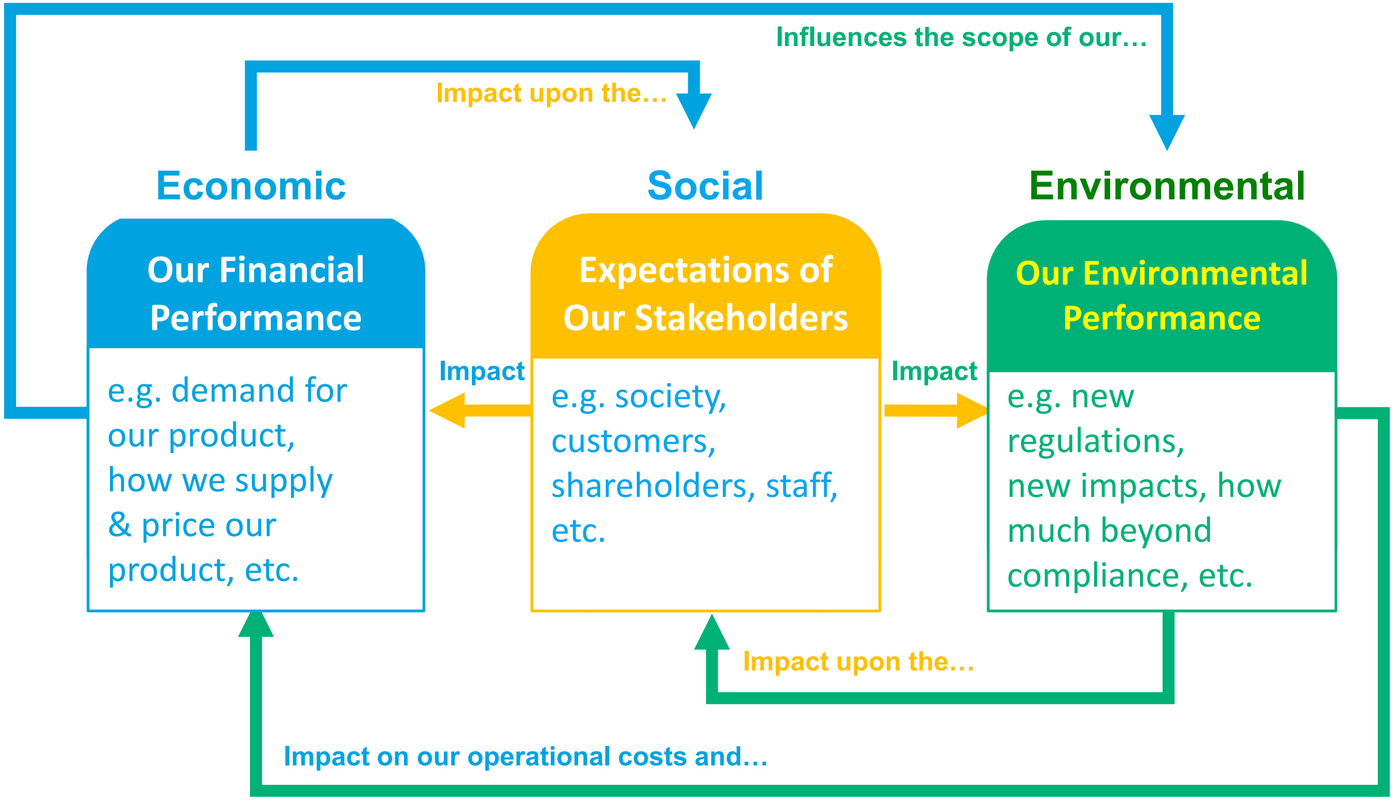


To ensure energy security, enough new supply of lower carbon energy needs to be operational before old coal plants are phased out…

The Challenges Of

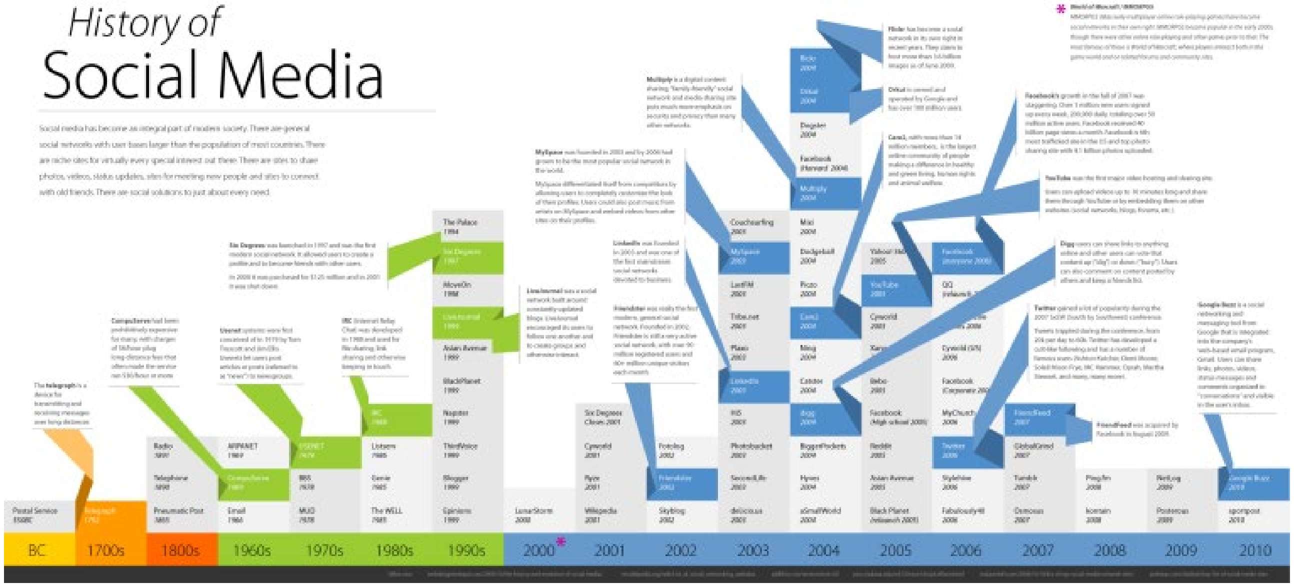
CHANGING STAKEHOLDER EXPECTATIONS

People dictate the changing business landscape



The changing world

- Changes seem to be faster & sometimes bigger than before
- Social expectations changing within generations as well as across generations



The changing business landscape is moving the goal post

As a growing number of people gain access to an increasing amount of information at close to real-time frequencies:

- **Increasing environmental & social awareness** – more public expectations and thus more pressure
- **Increasing regulation** – more stringent policies and regulations
- **Increasing scope** – e.g. additional pollutants and social-related issues
- **Increasing data quantity & quality** – more data and independent verification to decrease uncertainty
- **New impacts** – as we use new technologies, new or unexpected impacts may come to the fore

All result in rising operational costs (& ultimately prices), which business and communities must come to terms with as social and environmental costs become gradually internalised

Moving Towards

A NET ZERO CARBON ENERGY FUTURE…

Ratification of Paris Agreement by countries

United Nations
Climate Change

UNFCCC Google Search

Home | CDM | JI | CC:iNet | TT:Clear

Your location: Home > Paris Agreement

Visit our Newsroom

KEY STEPS

- The Convention
- Kyoto Protocol
- Paris Agreement

NEGOTIATIONS

- Meetings
- Documents & Decisions
- Bodies

FOCUS

- 2018 Talanoa Dialogue Platform
- NDCs
- Pre-2020 Ambition
- Long-term Strategies

- Overview
- Adaptation
- Capacity-building
- Climate Finance
- Mitigation
- Technology

Paris Agreement - Status of Ratification

175

175 Parties have ratified of 197 Parties to the Convention

On 4 November 2016, the Paris Agreement entered into force.
More information

The Paris Agreement entered into force on 4 November 2016, thirty days after the date on which at least 55 Parties to the Convention accounting in total for at least an estimated 55 % of the total global greenhouse gas emissions have deposited their instruments of ratification, acceptance, approval or accession with the Depositary.

The list below contains the latest information concerning dates of signature and receipt of instruments of ratification by the Secretary-General of the United Nations, as Depositary of the Paris Agreement. The dates in the third column are those of the receipt of the instrument of ratification, acceptance (A) or approval (AA).

Authoritative information on the status of the Paris Agreement, including information on signatories to the Agreement, ratification and entry into force, is provided by the Depositary, through the United Nations Treaty Collection website, which can be accessed here, and the Depositary Notifications which are available here.

Background information related to the ratification, acceptance, approval or accession of the Paris Agreement, as well as its entry into force can be found here.

Paris Agreement

Authentic texts of the Paris Agreement

- Arabic (3595 kB)
- Chinese (3131 kB)
- English (4439 kB)
- French (5194 kB)
- Russian (5397 kB)
- Spanish (5234 kB)

First nationally determined contribution

By decision 1/CP.21, paragraph 22, the COP invited Parties to communicate their first nationally determined contribution (NDC) no later than when the Party submits its respective instrument of ratification, acceptance, approval or accession. If a Party has communicated an intended nationally determined contribution (INDC) prior to joining the Agreement, that Party shall be considered to have satisfied this provision unless that Party decides otherwise. Further information be found here.

Source: UNFCCC website, 6 April 2018

Perspectives on COP

COP is good for business

- It sends an international policy signal and the NDCs provide national policy signals stating clearly the intention to ratchet or tighten mechanism
- But there needs to be more detailed implementation plans like China’s NDC and 5-year plans

Science provides the compass

- Setting aspirational long term goals aligned with the limits of the earth tells us where we need to be
- But 1.5° is a less practical measure for business compared to ‘net zero carbon’

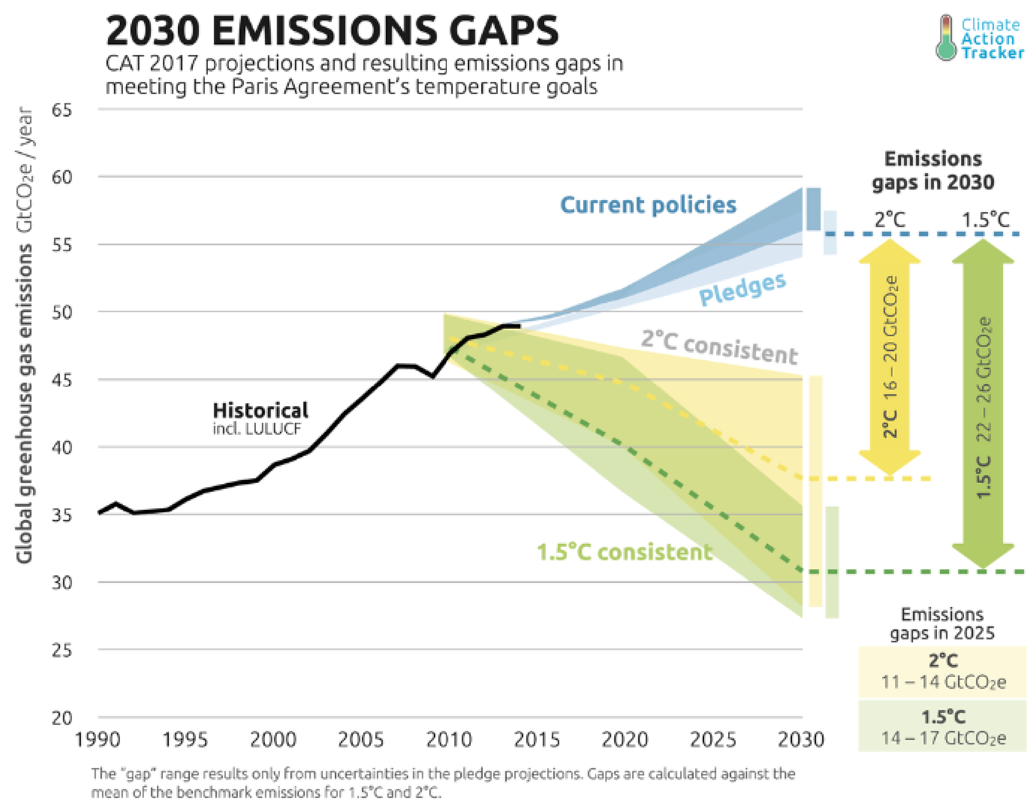
Transparency is key for its success

- The rulebook for measuring, reporting and verification (MRV) will be key to its success
- But this, along with loss and damage, is amongst the most contentious of the negotiation issues

The Climate Action Tracker

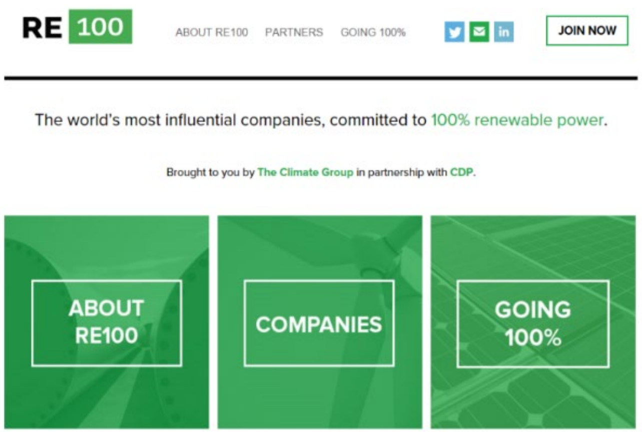
15th November 2017

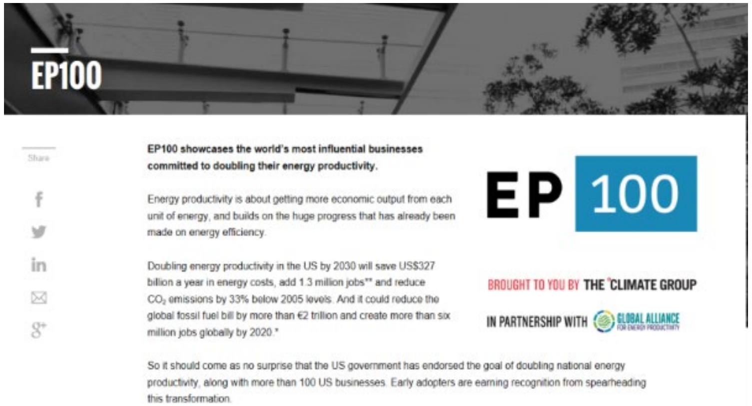
Source: Climate Analytics & Ecofys & NewClimate Institute, http://climateactiontracker.org/global/173/CAT-Emissions-Gaps.html

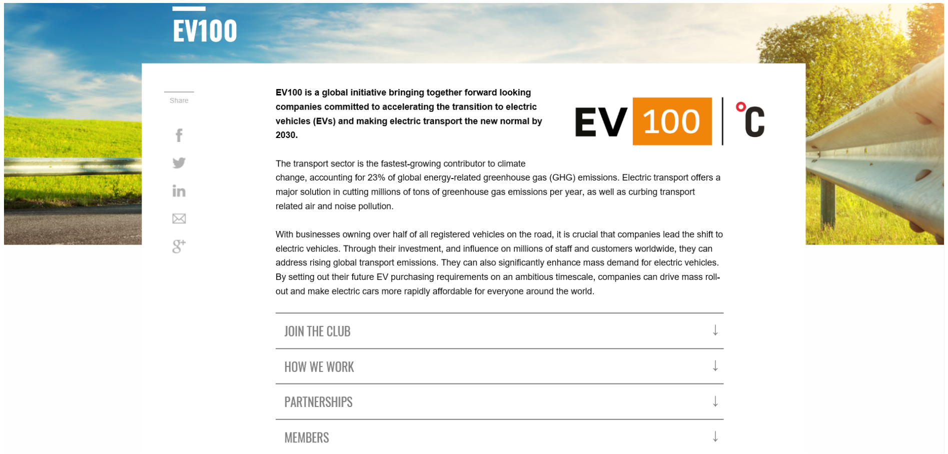


But still a significant gap between the NDC pledges and 2° C and 1.5°C scenarios…

Business is taking action…

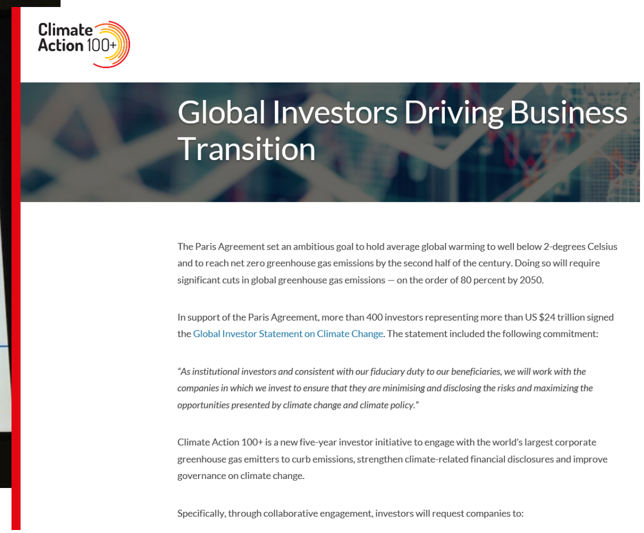






The business sector is already moving…
from supply to demand…

Even the investment sector is moving…



Climate Action 100+

Global Investors Driving Business Transition

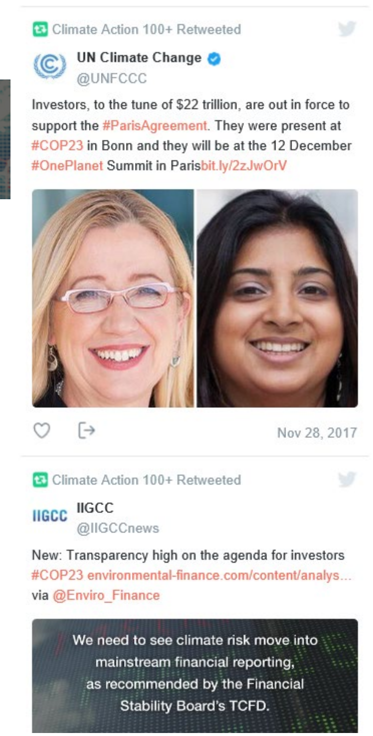
The Paris Agreement set an ambitious goal to hold average global warming to well below 2-degrees Celsius and to reach net zero greenhouse gas emissions by the second half of the century. Doing so will require significant cuts in global greenhouse gas emissions — on the order of 80 percent by 2050.

In support of the Paris Agreement, more than 400 investors representing more than US $24 trillion signed the Global Investor Statement on Climate Change. The statement included the following commitment:

"As institutional investors and consistent with our fiduciary duty to our beneficiaries, we will work with the companies in which we invest to ensure that they are minimising and disclosing the risks and maximizing the opportunities presented by climate change and climate policy."

Climate Action 100+ is a new five-year investor initiative to engage with the world's largest corporate greenhouse gas emitters to curb emissions, strengthen climate-related financial disclosures and improve governance on climate change.

Specifically, through collaborative engagement, investors will request companies to:



From recognising the potential business risk…

to making investment decisions…

Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD)

4 Recommendations with 11 Recommended Disclosures

Governance	Strategy	Risk Management	Metrics and Targets
Disclose the organization's governance around climate-related risks and opportunities.	Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.	Disclose how the organization identifies, assesses, and manages climate-related risks.	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.
Recommended Disclosures	**Recommended Disclosures**	**Recommended Disclosures**	**Recommended Disclosures**
a) Describe the board's oversight of climate-related risks and opportunities.	a) Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term.	a) Describe the organization's processes for identifying and assessing climate-related risks.	a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process.
b) Describe management's role in assessing and managing climate-related risks and opportunities.	b) Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning.	b) Describe the organization's processes for managing climate-related risks.	b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks.
	c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.	c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.	c) Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

Collective efforts across the sectors are needed to deliver a low carbon sustainable future

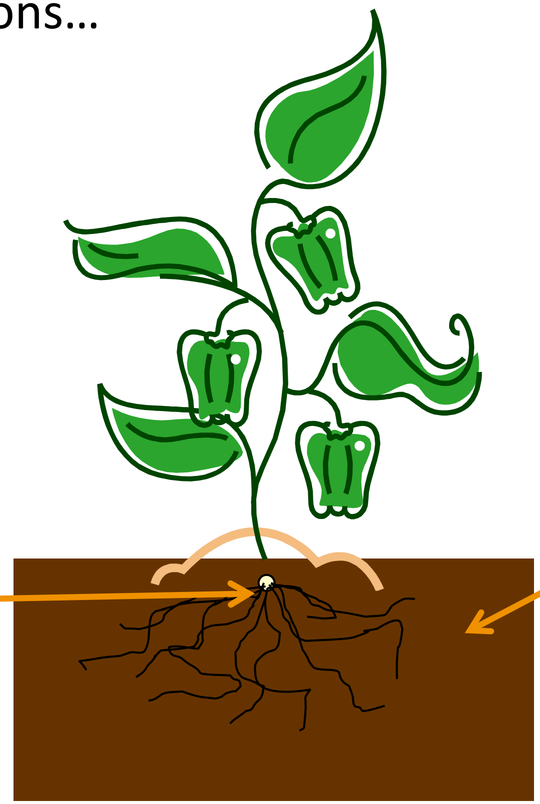
Business & Communities	• To invest and take action • To implement and deliver on the intended low carbon policy objectives
Governments	• To set predictable and long term policies & regulations • To send the right signals to incentivize investment and actions for business and scientific and technological advancements
Scientific community	• To provide the compass and inform policy making • For the direction and performance objectives on how far and how fast we must go

Business and investors can go as far as they can on their own, but some can only go as far and as fast as the rules and market signals enable us to go…

From science to policy…

Politics & stakeholders expectations provides the critical natural elements for growth of regulations…

So the policies & regulations grow…



from international to national & vice versa…

Science & research form the seeds that spawn a growing research community

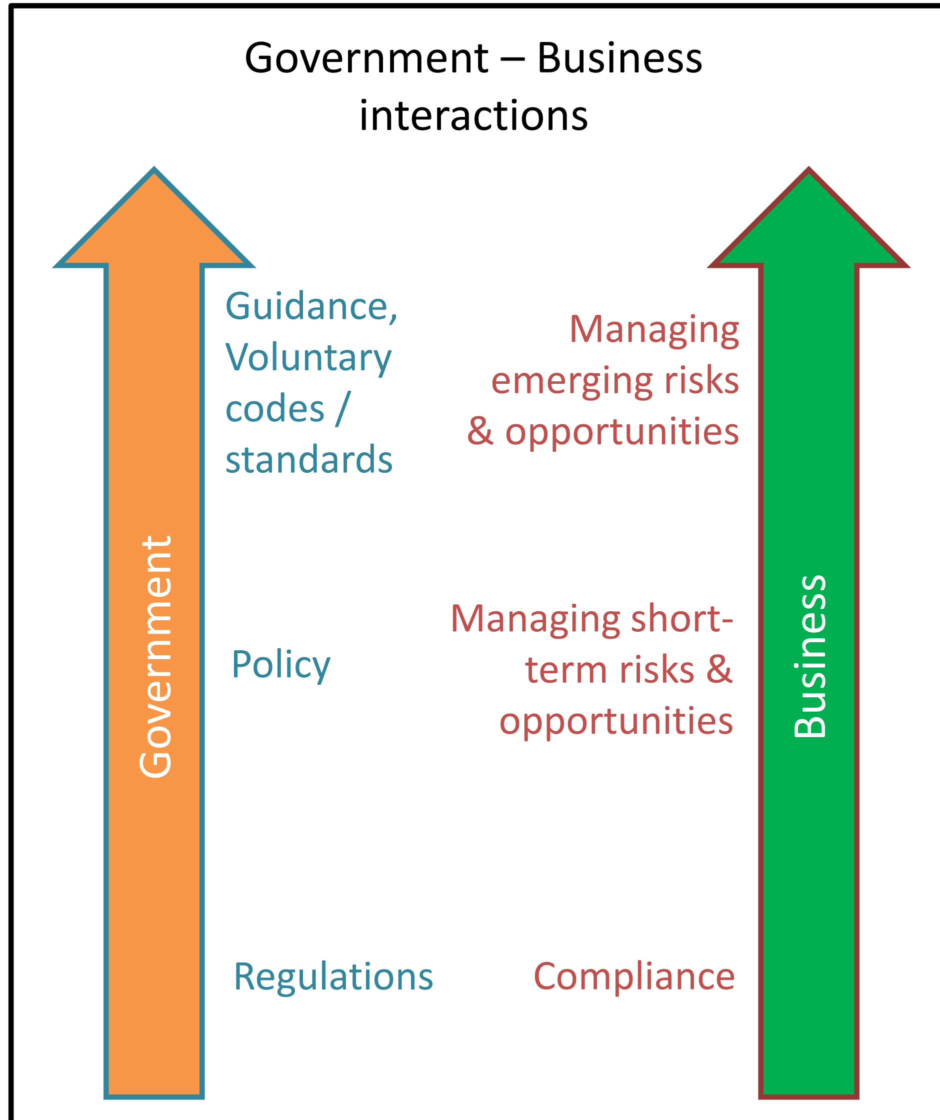
Technology & management practices provides the nutrients for growth in regulations

And policy to business…

Governments set the "rules" for business and society to operate.

Some businesses are more regulated than others – these are the ones that can probably innovate more and faster without the need for policies and regulations.

The most regulated businesses will require more predictable policy and regulatory signals to be able to make changes/transitions to new business models.



Different policy tools for pricing carbon

Implementing a direct carbon price in the economy

	Cap-and-trade system	Carbon tax	Baseline-and-credit approach	Project mechanism
Description	The desired environmental outcome, expressed as a cap, for the sectors covered by the system, is translated into allowances. The only obligation on an emitter operating within the system is to surrender one allowance for each tonne of CO_2 emitted. Allowances are introduced into the economy by the government, with the total number created being limited to the desired outcome. The allowances are transferable through trade and have a value – the carbon price. An offset mechanism may apply.	The government imposes a fixed tax on CO_2 emissions at some point in the economy. This may be at the source of the emissions, or upstream of the actual emissions (e.g. at the point of sale from a coal mine). The level of tax is the carbon price. Like a cap-and-trade system, the carbon tax approach requires measurement, reporting and verification of CO_2 emissions across the sectors covered by the policy.	The government establishes a baseline emission for each sector, typically on a CO_2/unit of production basis. This is also called an intensity based approach. The participants earn credits by exceeding the baseline, or surrender credits if they fall short. The credits are tradable and can be banked, as in the cap-and-trade approach. The approach could also be linked with an offset mechanism, as for cap-and-trade.	A project is developed and emissions are compared with a baseline, which may represent best available technology or typical practice for a particular country. For example, if coal is the usual fuel for similar projects, then this would be used to calculate the baseline. If the project emission reductions are better than the baseline, credits are issued. These credits are tradable, and may be bought directly by governments, or used as compliance instruments in cap-and-trade systems.
Operation	It delivers a specific environmental outcome through the overall cap, in theory at the lowest overall cost to the economy as participants progressively implement projects from left to right across the abatement curve (figure 1). Allowances are typically auctioned by the government into the market. Early on, as the economy begins adjusting to the carbon pricing mechanism, and sometimes to prevent carbon leakage, the government may allocate some, or all, as free allowances. The system relies on robust measurement, reporting and verification processes at each installation, causing administrative burden, and is more appropriate for large emissions sources.	A tax based approach is strongly favoured by many economists. It is a relatively simple approach to understand and implement, but requires significant analysis, with regards to the setting of the tax level, in order to achieve a specific environmental outcome. This can only come from a clear understanding of the abatement opportunities present in the economy. A disadvantage is that when providing exemptions to prevent carbon leakage, the sector does not perceive the price signal.	Baseline-and-credit requires accurate benchmarking across different sectors. Because of the trade of credits, benchmarks should also represent an equivalent effort when comparing sectors, i.e. y tonnes CO_2/t cement equivalent to x tonnes CO_2/t of steel. If not, sectoral economic distortion results. Importantly, the environmental outcome in terms of absolute emissions is uncertain, as it depends on the level of production. This approach does not generate additional revenues to the government because allowances are not sold.	Like the baseline-and-credit approach, a project mechanism requires a high level of oversight, including baseline determination and measurement, reporting and verification. The mechanism typically requires an assessment panel of some description, such as the Executive Board of the CDM. This may introduce a level of subjective decision-making into the process.
Current examples	• Power and industry sectors in the EU. • Power sector in the US north-east states. • New Zealand economy, but in stages. • In final development for California.	• British Columbia. • Norwegian offshore facilities.	• No direct industrial application. It has been used in the UK prior to the development of the EU-ETS. • The Low Carbon Fuel Standard in California incorporates aspects of baseline-and-credit.	• The Clean Development Mechanism. • Various voluntary carbon reduction schemes (e.g. airline offset programs), use project mechanisms as a source of credits. • REDD+ payments for improved management of forests in developing countries, (e.g. Indonesia, Ghana).

Implementing an indirect carbon price in the economy

	Alternative energy standards	Emissions performance standards	Efficiency standards	Social commitments
Description	A national or sector based standard is established by government dictating the percentage of sources of energy in the mix, as a means of reducing fossil fuel use. There is an implicit carbon price, but calculating this by basing it on substitution costs may result in an overestimation, as governments typically have other objectives as well (e.g. security of supply).	A sector or facility standard is established by government setting a limit on the emissions per unit of production; for example, grams CO_2 per kWh of electricity produced. The approach provides a clear implied carbon price, which can be calculated from the standard itself, in combination with market energy prices.	Efficiency standards are set by government, often at a micro economic level, e.g. on energy consumption of equipment such as air-conditioning units, the CO_2 emissions per km on vehicles, or in the design of new buildings. The approach is performance based, and deriving an underlying carbon price can be complex, since it depends on the actual use of the product (e.g. hours of operation or mileage).	Many companies, and some national and global sectors, have pledged to reduce CO_2 emissions on a voluntary basis. Such a commitment introduces an implicit carbon price for the entity making the offer, though the calculation of the price may be very difficult to determine.
Operation	The approach requires a mechanism to translate the high level target into company or facility level compliance. It is usually supported by penalties, but may also include tradable compliance certificates.	It is in operation in both the EU and California in the vehicle fuel pool. Compliance is at supplier level and is supported with tradable certificates (see "Baseline-and-credit").	The approach may require considerable data collection, but can be tailored to a given sector. It promotes the importance of saving energy with business entities, and is used extensively in some countries.	This requires a high degree of voluntary reporting, and transparency of this reporting, so that observers can determine the effectiveness and value of the contribution.
Current examples	• EU Renewable Energy Directive. • US Bio-energy mandates for transport.	• Proposed Canadian moratorium on new unabated coal fired power stations. • California Low Carbon Fuel Standard.	• "Top-Runner Standard" in Japan. • Energy Saving Act of 1979 in Japan. • CO_2 regulations for cars in the EU.	• Shell target 1990-2010, Unilever target 2012. • Japanese industry implements the "Keidanren Voluntary Action Plan" in line with national Kyoto obligations.

CLP Group’s

CLIMATE VISION 2050

CLP Group

Established in Hong Kong in 1901 & listed on the Stock Exchange of Hong Kong

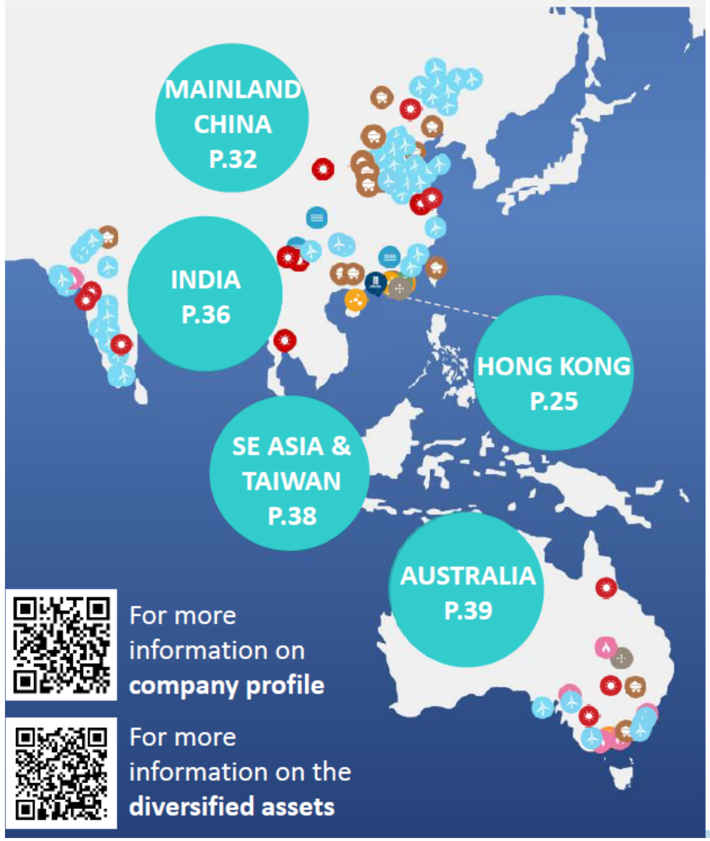
- S&P [A]; Moody's [A2]
- Dow Jones Sustainability Index (DJSI) Asia Pacific and DJSI Asia Pacific 40 [69]
- Hang Seng Corporate Sustainability Index [AA-]
- CDP Climate Score [B]

As at 31 Dec 2018

Assets diversified by activities, geography and technology

Revenue in 2018
HK$92bn
(about US$12bn)

Market Capitalisation
over HK$224bn
(~US$29bn as at 31 Dec 18)



Over **7,600** employees

over **5.1 million** customer accounts

2.6 million in Hong Kong

2.6 million in Australia

Over **15,800** km transmission lines

Generation capacity # more than **23,700 MW**

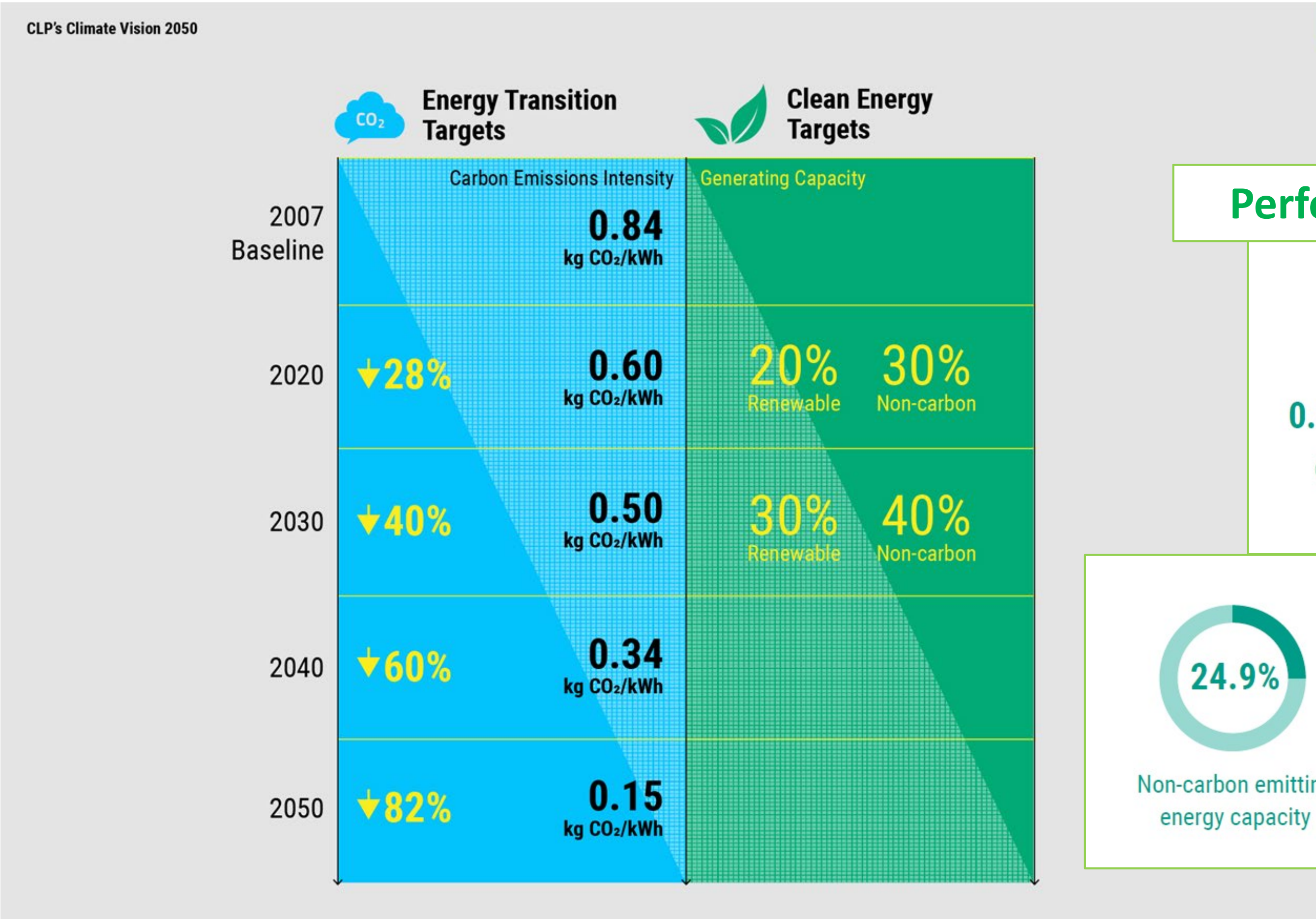
- Coal 51% — 11,997 MW
- Gas 21% — 5,084 MW
- Nuclear 11% — 2,685 MW
- Wind 8% — 1,982 MW
- Solar 2% — 558 MW
- Hydro 2% — 489 MW
- Others e.g. oil 910 MW 4%

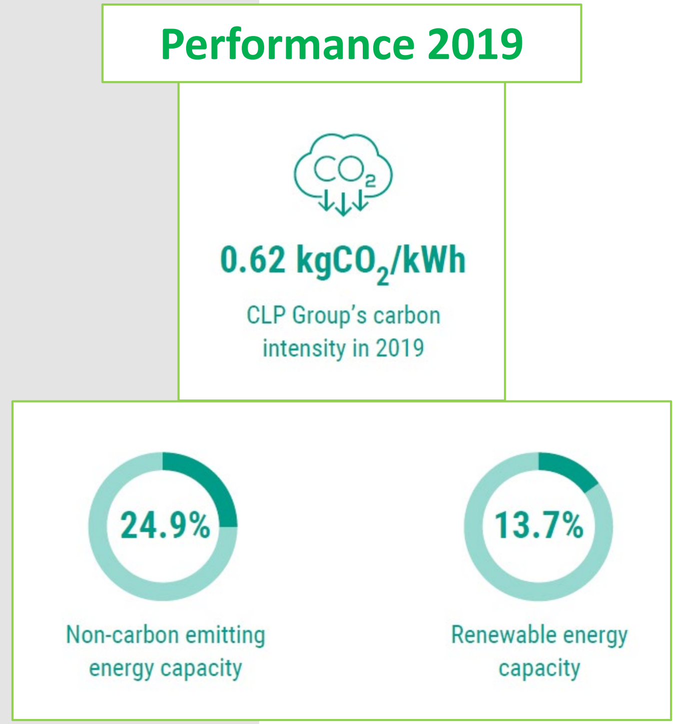
Renewables 13% 3,029 MW

including long-term capacity and energy purchase arrangements

As at 31 Dec 2018

Climate Vision 2050 (updated 2017)

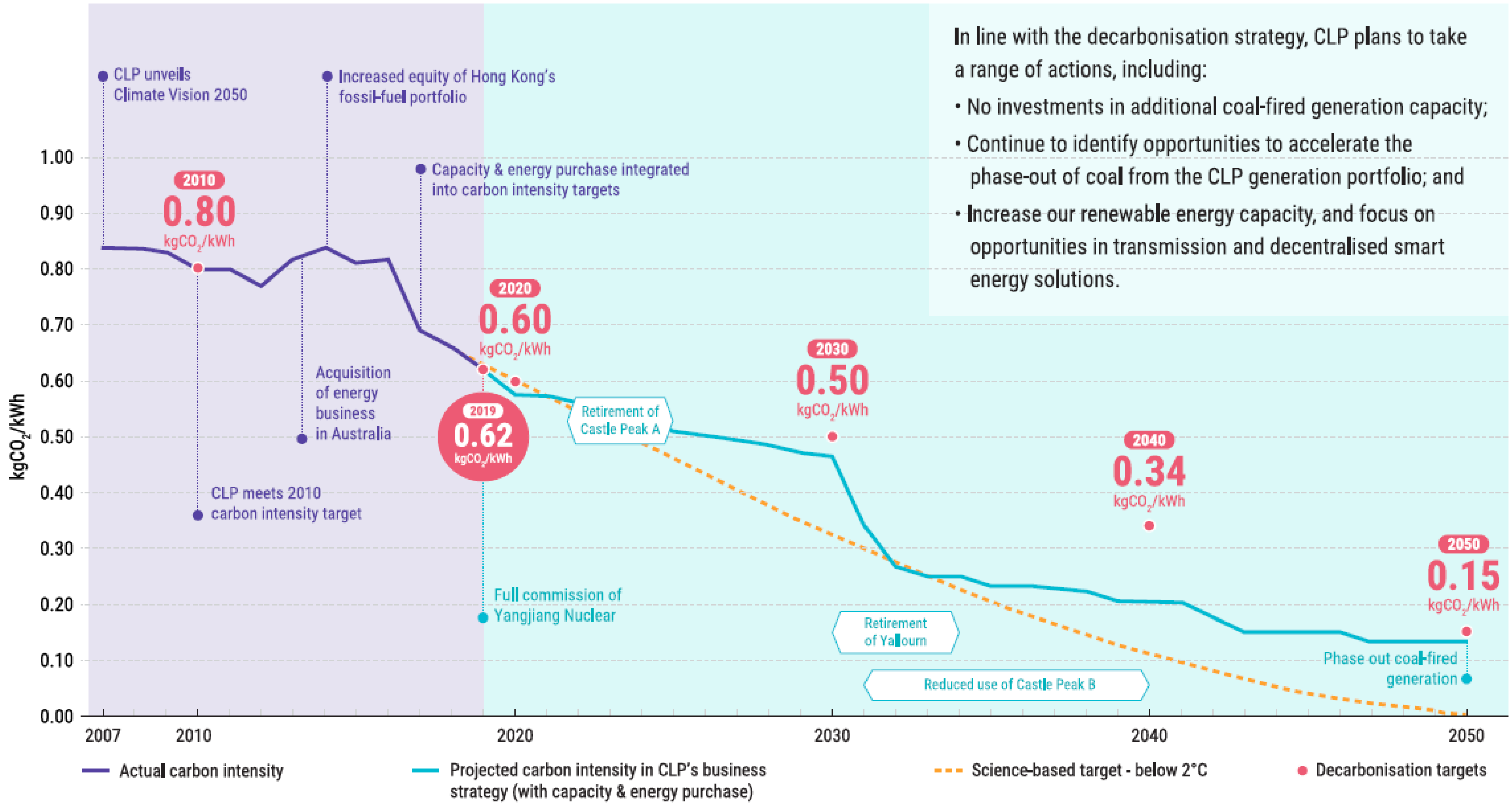




We are committed to meeting our targets, but technologies are not progressing as fast as we need for a 2 degree world…

Climate Vision 2050 performance (2019)

CLP Group's carbon intensity



In line with the decarbonisation strategy, CLP plans to take a range of actions, including:

- No investments in additional coal-fired generation capacity;
- Continue to identify opportunities to accelerate the phase-out of coal from the CLP generation portfolio; and
- Increase our renewable energy capacity, and focus on opportunities in transmission and decentralised smart energy solutions.

Note: The plant retirement timeframes are indicative only.

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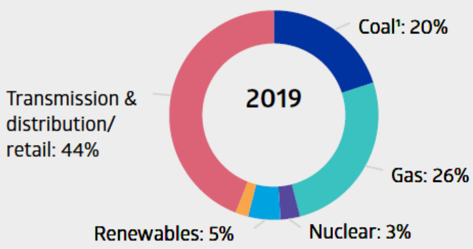
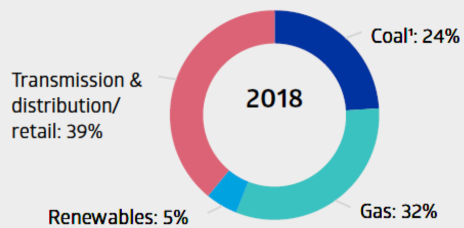
Climate change asset risk (2019)

Capital investments (on accrual basis) incurred by asset type

Capital investments into non-carbon generation assets represented 8% of Group capital investments in 2019, supplemented by 44% from transmission & distribution and retail related activity.

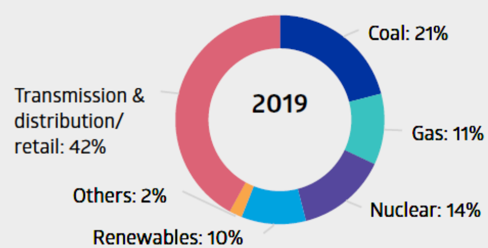


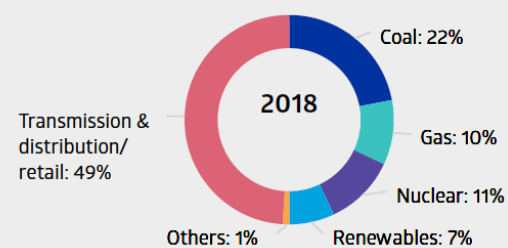


1 Capital investments in coal assets include upgrades and efficiency improvements only.

Operating earnings (before unallocated expenses) by asset type

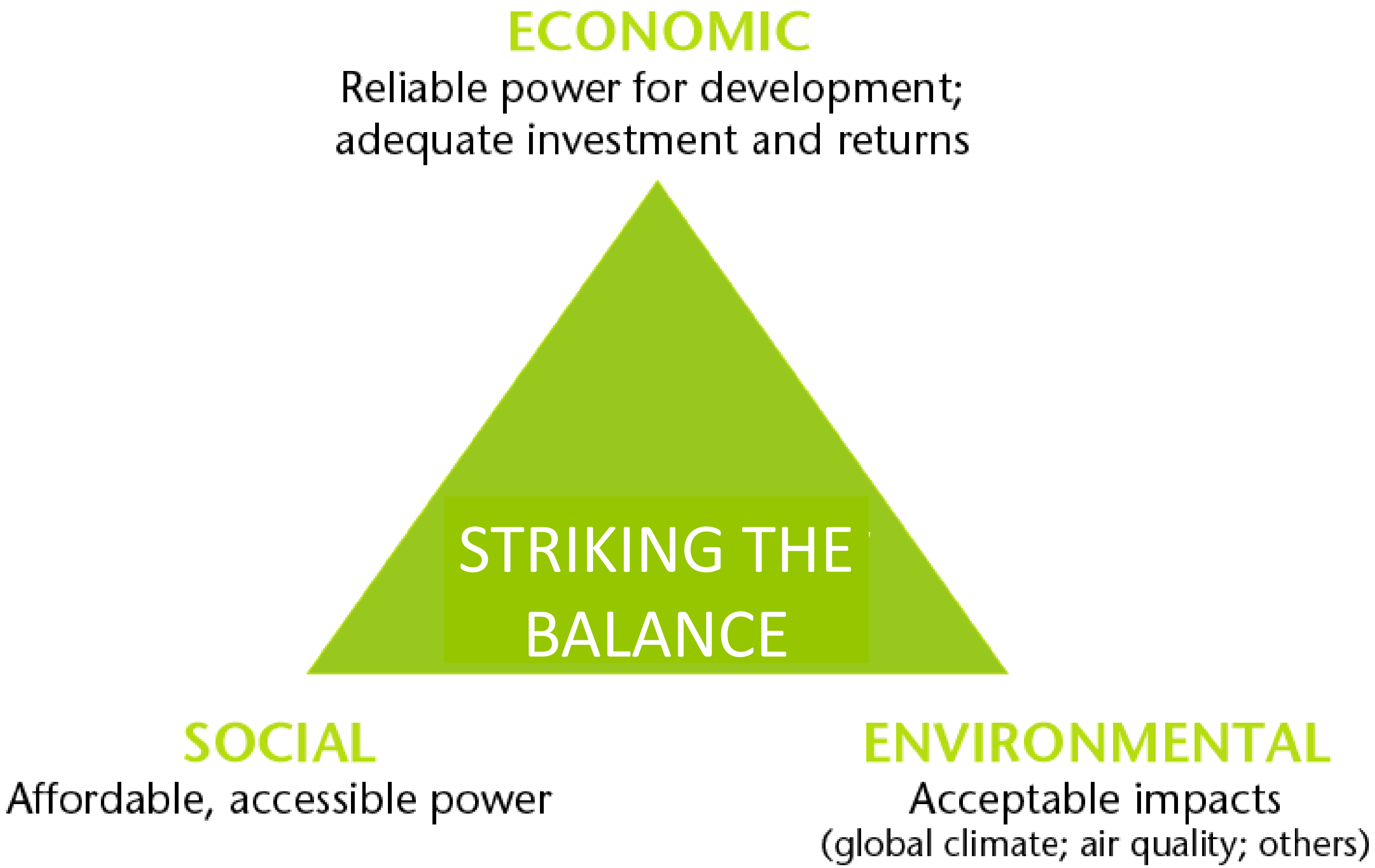
Operating earnings from non-carbon generation assets represented 24% of Group operating earnings in 2019, supplemented by 42% of operating earnings from transmission & distribution and retail related activity.





THANK YOU

Powering Asia responsibly



How to provide the energy necessary for social and economic development, yet avoid serious environmental impacts…

Our Manifesto on
Air Quality & Climate Change (2004)

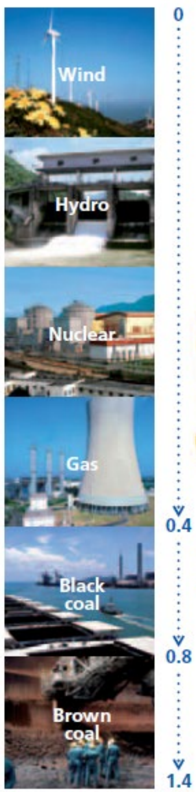
CLP sets out an action plan in Our Manifesto on Air Quality and Climate Change

- Hong Kong Air Quality
  - reducing emissions from coal-fired plant
  - bringing in LNG
  - promoting energy conservation
- Group Renewable Energy
  - 5% of Group equity generating capacity by 2010

CLP Group's Climate Vision 2050 (2007)

The Carbon Intensity of CLP's Generating Portfolio

CLP Plant | Carbon Intensity ($kg\ CO_2/kWh$)



Carbon Intensity 2007

0.84 $kg\ CO_2/kWh$

Climate Vision 2050

0.2 $kg\ CO_2/kWh$

Reducing our emissions intensity by 75% demands a new business approach.

FRIDAY, DECEMBER 7, 2007

Herald INTERNATIONAL Tribune

PUBLISHED BY The New York Times

iht.com

Asia utility plans major emissions cuts

CLP ready to invest in clean alternatives

By Keith Bradsher

HONG KONG: CLP, one of the largest power utilities in Asia, plans to commit itself to sharply reduce its emissions of carbon dioxide, the main global warming gas, for every kilowatt-hour of electricity it generates.

The company on Friday will announce plans to reduce its emissions per kilowatt-hour by 4.8 percent over the next three years and by 76 percent by 2050. To do so, CLP will step up its investments in nuclear power, natural gas, renewable energy, efficiency gains and so-called clean coal technologies.

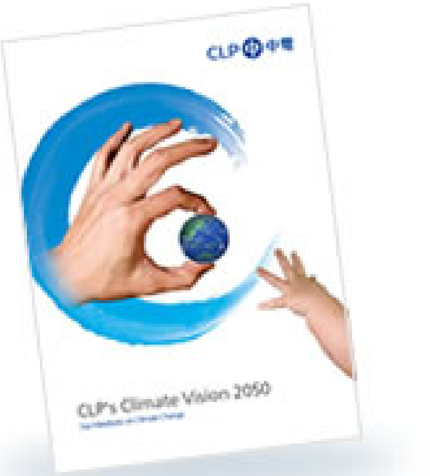
Timed to coincide with the climate change negotiations now under way in Bali, the CLP announcement would be the latest step by the global power industry to address emissions of global warming gases.

CLP's decision is especially noteworthy, energy experts said, because it is one of the few such steps by a power company active in developing countries. These countries are not subject to the emissions caps set by the Kyoto Protocol, but they are coming under tremendous pressure from the United States and the European Union to agree in the Bali talks to begin discussing binding limits as well.

"We believe that if everyone takes an approach like this, the magnitude of global warming may be limited to approximately 2 degrees Celsius to 3 degrees Celsius, so that the most catastrophic effects of climate change may be warded off," said Andrew Brandler, chief executive of CLP, according to an advance copy of his statement. He was describing a range of 3.6 degrees to 5.4 degrees Fahrenheit. A United Nations panel of scientists warned last month that even global warming on this scale could cause a rapid rise in sea levels from the melting of ice sheets and the extinction of many species.

POWER, Continued on Page 16

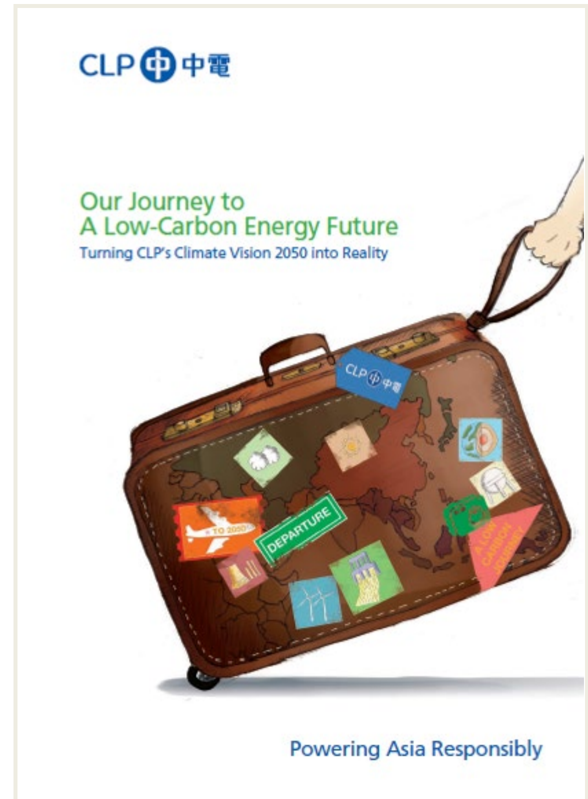
U.S. refuses to shift emissions stance at Bali talks. Page 3



By 2010	The CO_2 intensity of our generating portfolio will be reduced to 0.8kg CO_2/kWh or better
By 2020	The CO_2 intensity of our generating portfolio will be reduced to 0.7kg CO_2/kWh or better; and 20% of our generating capacity will be non-carbon emitting (including nuclear, large hydro, and more than 5% of other renewables)
By 2035	The CO_2 intensity of our generating portfolio will be reduced to 0.45kg CO_2/kWh or better

Our Climate Vision 2050

Our Journey To A Low Carbon Energy Future (2010)



Financing the energy transition

- New instruments to help redirect financial flows towards lower carbon generation
  – from coal to gas (Energy Transition bonds)
  – to new energy sources like biomass, hydro, etc. (New Energy bonds)
  – to pure renewables like wind and solar (Green bonds)

https://www.clpgroup.com/en/investors-information/quick-facts

CLP issues its first green bond (2015)

- Financing in India is challenging…
- This green bond achieves the objectives of
  - accessing long term funds at competitive rates for CLP;
  - helping to keep its interest cost in check as the interest remains fixed over the term of the bond (unlike bank borrowing); and
  - being an attractive long term investment opportunity for the investors.

CLP will use the bond proceeds from this issuance to fund the expenditure of new projects in the renewable energy space, thereby supporting its growth plans in India.

CLP Carbon Credit online sales platform