FONDAZIONE ENI ENRICO MATTEI

Carbon risk after COP21: a focus on fossil fuels assets' exposure and on the financial sector's strategies.

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Types of climate change related risks

Physical climate risks: arise due to changes in the climate system, including climate change induced natural capital depletion and degradation, resources contamination and changing resources' availability.

Carbon risks: the family of risks associated with the transition to a low-carbon economy:

- **Government regulations** (carbon pricing, disclosure requirements).
- **Energy technology innovation** (due to energy efficiency, disruptive technologies, falling costs, electricity storage) and **market changes**.
- **Evolving social norms** (from divestment campaigns to changing consumer preferences and behavior).
- **Legal challenges** associated with liabilities for financing high carbon activities.

Carbon risk across the investment chain

Carbon risks can be passed-through the chain from physical assets to corporates, financial institutions, governments and civil society.

Operator carbon risk	**Physical assets**: assets that may suffer from unanticipated or premature write downs, devaluations or conversion to liabilities
	Valuation of companies: impairment of physical assets impacts the valuation of companies that own these assets.
	Credit risk: impact on the creditworthyness of counterparties.
Carbon asset risk	**Financial portfolios**: depending on the asset allocation and balance sheet.
	Financial system: systemic risk to financial stability, underexplored but in the agenda of macroprudential authorities.

Physical assets carbon risk will depend on**:**

- Profile of the asset
- IRR and erarning margins required
- Vulnerability to low-carbon technologies competition
- Operator's carbon strategy (diversification, risk management)

The carbon budget

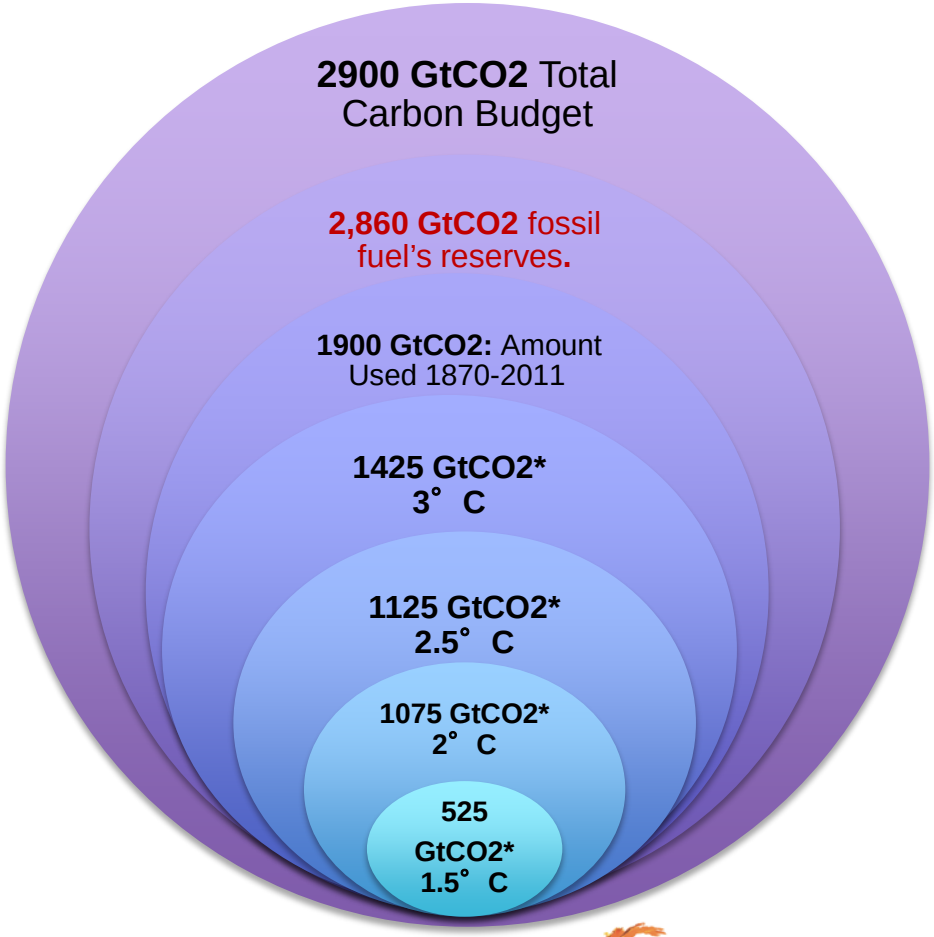
- To meet a 2° C target with 50% probability **35% of oil, 82% of coal and 50% of gas** reserves globally should not be extracted.

Total oil reserves alone are enough for 3° C warming.

- The Middle East holds over half of the unburnable oil globally (260 billions of barrels).
- Canada has the lowest relative utilization of its oil reserves (25%).

Fossil fuel's carbon budget 2013-2049

(*amount required under a 50% probability)



Sources: Ekins (2015), CTI (2013), IPCC (2014).

Carbon budget for listed companies

Top 200 oil, gas and coal mining companies

- Allocated up to **USD 674bn in 2013** for finding and developing more reserves.
  - USD 593billion in oil and gas sector
  - USD 81billion in coal sector.
- Up to **USD 6.74 trillion** in capital for developing unburnable reserves **in the next decade.**
- Spent five times more on seeking new reserves than they are returning capital to shareholders.

Of the 762GtCO2 in reserves owned by listed companies, 65-80% cannot be burnt unmitigated.

The conventional business model of recycling fossil fuel revenues into replacing reserves is no longer valid.

Source: CTI (2013).

The oil reserves' risk debate

90% of proved reserves, base for valuation of publicly traded companies, are expected to be monetized in 10 to 15 years (IHS Herold, 2014).

- By reinvesting the cash in future projects, the risk is simply rolled forward.
- Mostly valid for supermajors. For instance BG Group reserves account for 1/3 of the valuation despite being undeveloped (and unproven). (CTI, 2015a)

"An overwhelming share of the oil and gas reserves held by private companies today will be produced by 2040, even in a 450 Scenario, an indicator that limits the downside risk to their operations and valuation over this period". (IEA, WEO 2015)

- IEA uses large reserves portfolio.
- Such statement is correct only assuming that state oil companies scale back production when coping with falling demand (is this coherent with OPEC?).
- Approach fails to distinguish between types of reserves: oil sands have full life-cycle costs of USD 100 or more, shale oil plays of USD 60-80, while Saudi Arabia below 20 USD. (CTI, 2015a)

Physical assets risk in the oil E&P sector

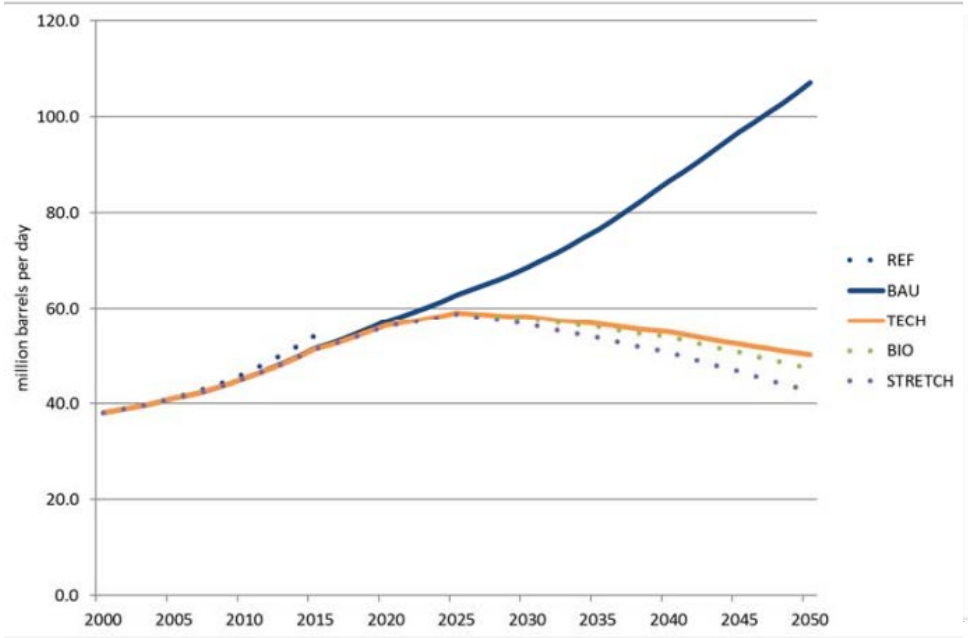
Financial stranding: asset set to deliver a return below a companies' cost of capital (not necessarily balance sheet write-off but destroys shareholder value).

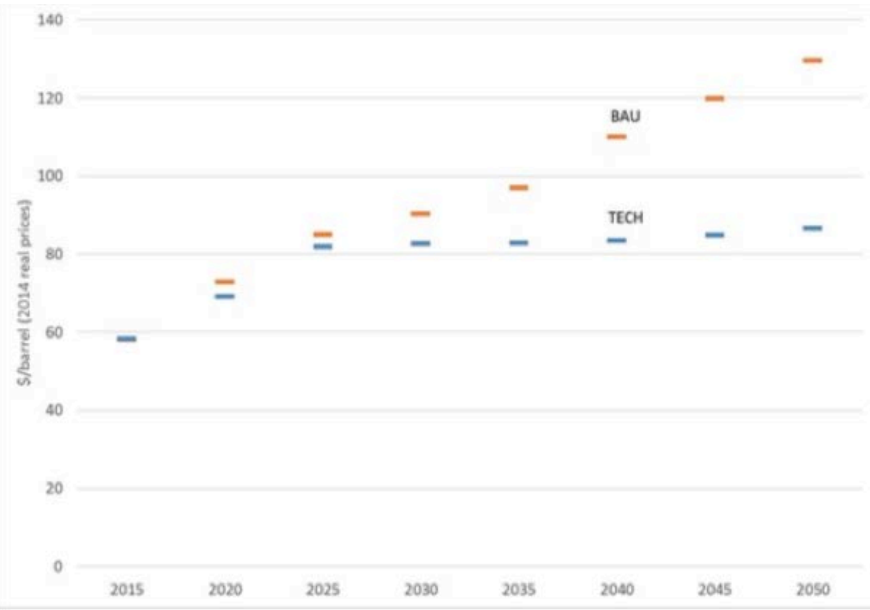
1) Economic restraints driven by oil price decline and cost escalation
   - Global upstream capital spend from 2015 out to 2020 has been reduced by 22% or USD 740 billion.
   - Conventional exploration investment for 2015-2020 is USD 300 billion less than forecasts made in 2014.
2) Impacts on global long-run oil demand by climate risk factors:
   - In IEA's 2° C consistent scenario oil demand peaks in 2020 and declines to 74 mbpd in 2030.
   - **30-45 mbpd gap** between oil major's assumption (demand projected to grow at a 13-26% reaching 100-110 mbpd in 2040).

For 37 biggest oil companies, 40% of the current investment cycle, **USD 1.4 trillions of investment**, could prove economically challenged at oil prices below USD 75/bbl.

Sources: Mackenzie (2016), Citi (2015), IEA (2015)

Effects of a transition to a low carbon transport sector





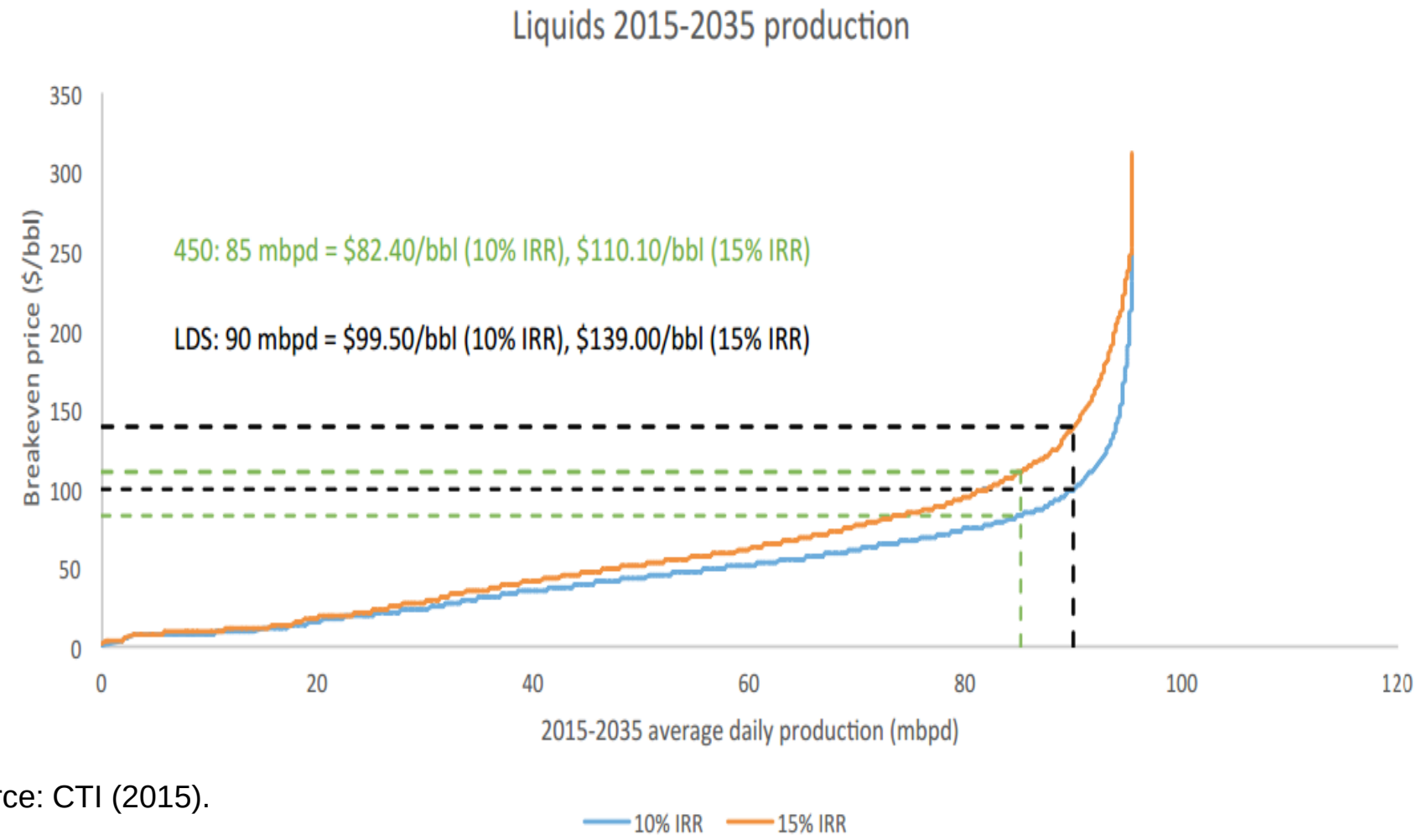
Technology-forcing policies (vehicle efficiency improvements, including aircraft and marine vessels and uptake of new vehicle technologies):

- Annual oil consumption peaks in 2025, and avert a doubling of transportation oil demand up to 2050.
- Oil prices 5% lower in 2030; 24% lower in 2040; and 33% lower in 2050.

Source: Cambridge Econometrics (2016).

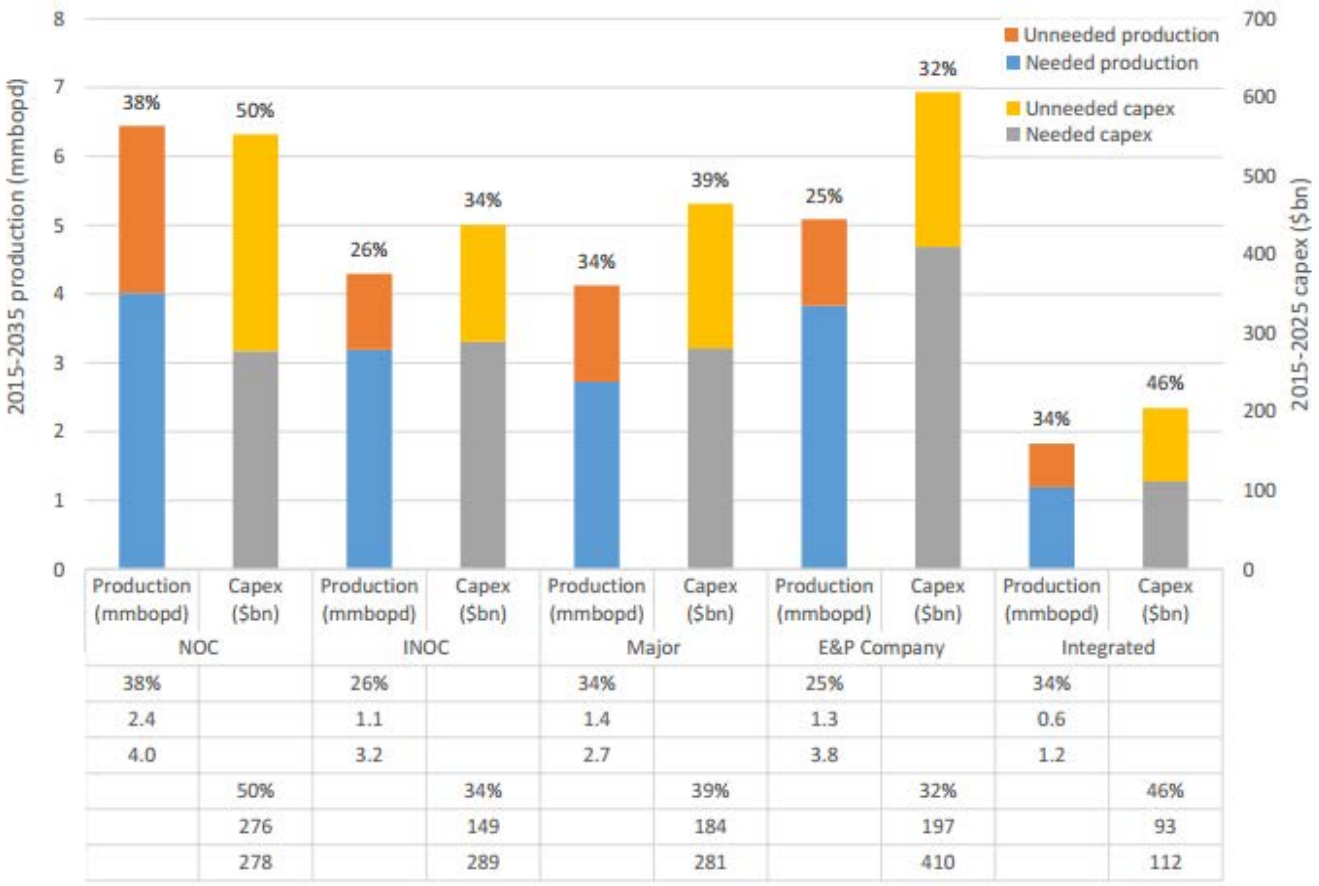
The long-run BAU oil supply curve

CTI bottom-up approach: the curve includes only existing projects plus those that are well-defined but yet-to-be approved.



Source: CTI (2015).

Unneeded production and capex up to 2035



	NOC		INOC		Major		E&P Company		Integrated	
	Production (mmbopd)	Capex ($bn)	Production (mmbopd)	Capex ($bn)	Production (mmbopd)	Capex ($bn)	Production (mmbopd)	Capex ($bn)	Production (mmbopd)	Capex ($bn)
	38%		26%		34%		25%		34%	
	2.4		1.1		1.4		1.3		0.6	
	4.0		3.2		2.7		3.8		1.2	
		50%		34%		39%		32%		46%
		276		149		184		197		93
		278		289		281		410		112

NOCs	Maj.	E&P Comp
Potential unneeded supply all projects (mbopd)		
2,9 **8%**	1, 5 **11%**	1,4 **12%**
Potential unneeded supply new projects only		
2.4 **38%**	1,4 **34%**	1,3 **25%**
Potential unneeded capex, new projects only (USD bn)		
276 **50%**	184 **39%**	197 **32%**

Public production at risk is 2.6 times private's level, while public capex at risk are 1.5 times higher than private's level.

Source: ETA (2015).

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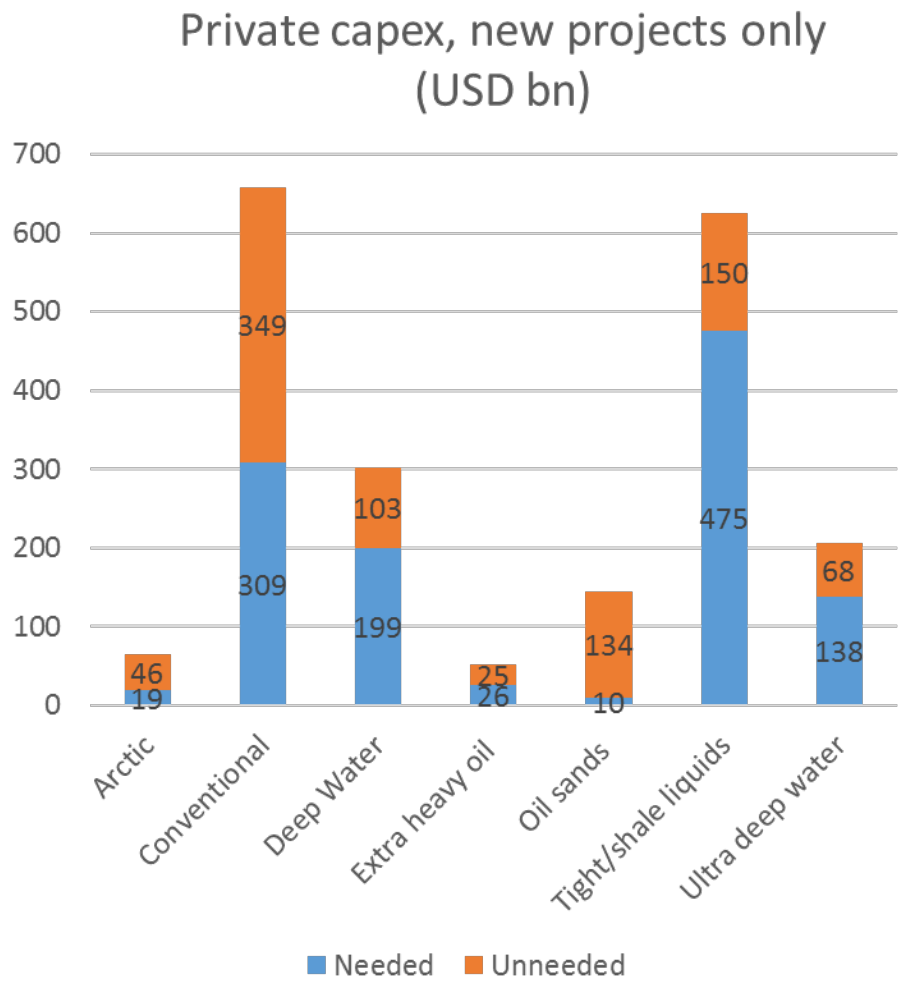
Unneeded capex per oil category

New projects risk allocation	Unneeded capex (all)	Unneeded capex (private)
Arctic	62%	71%
Conventional	51%	53%
DW	34%	34%
UDW	29%	33%
Oil Sands	90%	93%
Shale/thights	24%	24%



Shale/tight production has lower financial risk as:

- Comparatively low capital intensity and short production life time.
- Greater flexibility to respond to demand undershooting expectations or changes in pricing conditions.

Source: CTI (2015).

Absolute vs relative exposure

Medium and small operators with significant exposure to unconventionals (specialized companies as operators in the Canadian oil sands) face highest relative risk.

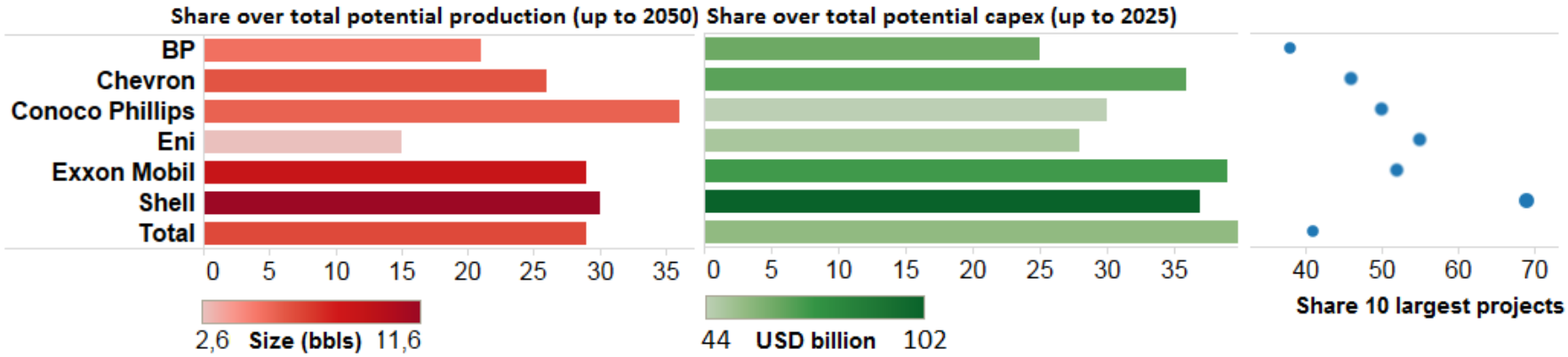
Company	Oil Sands	Total high cost/high risk	%age high cost/high risk capex
CNRL	38,507	38,555	51%
Cenovus Energy	25,650	28,855	62%
OGX Petroleo e Gas		28,138	91%
Athabasca Oil Sands Corp	23,634	23,698	89%
Laricina Energy	14,428	14,428	97%
Teck Resources Limited	12,502	12,502	100%
MEG Energy	12,278	12,278	64%
OSUM	11,755	11,755	99%
Denbury Resources		9,656	57%
Queiroz Galvao E&P		7,562	100%

Source: CTI (2014).

Major's exposure

Heterogeneous presence across most oil types

- Exposure to arctic (Conoco, Eni) and to oil sands (Conoco, Shell).



Life cycle stage: cancel or defer high cost undeveloped projects that account for most of unneeded capex and represent a hit list for investors demanding cost savings.

Source: own elaboration based on data from CTI (2014).

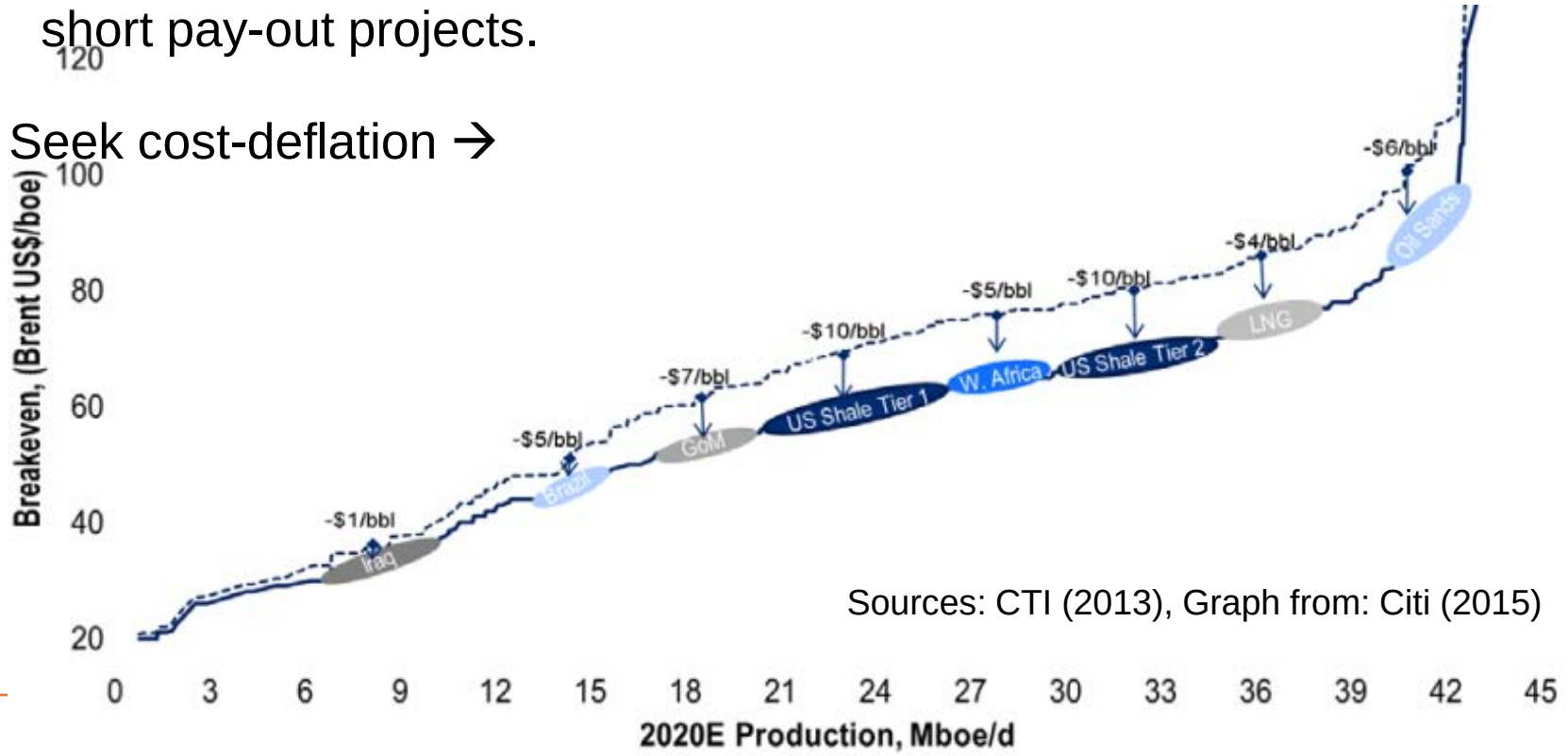
What should operators do?

1) Put capital expenditures into context:

- Timing of planned expenditure and of the producion start
- Proportion of a project on ten-year capex expenditures
- Regional or oil category concentration of capex
- Other cashflow commitments

2) Cut capex to the upper end of the cost curve, seek short lead-time, short pay-out projects.

3) Seek cost-deflation →



Sources: CTI (2013), Graph from: Citi (2015)

What should operators do?

CTI recently examined the portfolios of the oil & gas majors in aggregate:

- Portfolio made only by new upstream projects 2D-consistent creates more shareholder value compared with a BAU portfolio.
  - At $100/bbl upstream assets are worth USD 55bn more under a 2D rather than BAU sanction approach.
- Companies that sanction lower cost projects should show less volatility in their valuations as their asset values are less sensitive to oil price changes.
- An high cost oil company has a greater risk of failing to pay a dividend or facing bankruptcy: investors wanting to correctly value these companies should use a higher discount rate.

	Oil price ($/bbl)							
NPV uplift in 2D compared to BAU (%)	$40	$60	$80	$100	$120	$140	$160	$180
2D vs BAU (10% discount rate)	-	43%	15%	5%	0%	-3%	-5%	-6%
2D vs BAU (FFRP adjusted, 10.5% discount rate)	-	51%	21%	11%	6%	3%	1%	0%

Source: CTI (2016).

Stranding risk for fossil fuel electricity generation

Are large scale, capital-intensive electricity generation assets facing climate risk?

1. **Stagnant or falling electricity demand growth**
   - EU electricity demand fell 3.3% from 2008 to 2013, whilst GDP grew 4.1%.
2. **Renewable electricity generation** (eroded market share and peak demand, add to market oversupply).
   - Five largest companies' renewables generation share averaged 5% in 2013 (15% EU average), with the exception of Enel, forerunner in its 2008's EGP separation.
3. **Consumers demand response and decentralized energy**

- EU's 5 largest power generators collectively lost over 100 billion euros (37% of value) from 2008 to 2013.
- In 2013 €32 billion were impaired by 16 major utilities: 66% of which was related to generation assets (71 GW having closed since 2010).

Sources: Robinson (2015), CTI (2015b)

Stranding risk for coal based electricity generation

→ In total, the EU has 150GW of coal-fired capacity, of which 65% is subcritical:

- Germany (34%), Poland (21%), and United Kingdom (13%).

2008-2013

→ Net closure of coal-fired power stations 19 GW (4.2% decline).

→ High heterogeneity among five majors: -38% EON, -3% RWE, 21% Enel, 72% EDF, 168% GDF (9% average increase).

Drivers of risk for coal generation in the EU:

- Fixed **investment costs** hard to recover with depressed wholesale prices and curtailed running hours.
- **NOx and SO2** emission performance standards (LCPD and IED)
- **Public and investors' opposition.**
- **Rising CO2 prices**: ETS is ineffective, yet expectations after the MSR contributed to an increase in coal LCOE.

Sources: Cadelcott (2015), Robinson (2015), CTI (2015b)

What should operators do? (2)

Short term responses

- Cash savings by reducing costs and improving efficiency, spreading risk by hedging power in forward markets and by geographical and sector diversification.
- Target specific aspects of regulation as a basis to lobby for compensatory policies, as capacity remuneration mechanisms.

Mothball	Postpone operations until changes in input or output prices improve profitability
Convert	Modify asset to provide new services
Improve	Invest in thechnology to improve competitiveness
Switch	Swith inputs (fuel) or outputs (power) via contract renegotiation
Divest	Partial or complete unit sale

Long term strategy

Reorient investment strategies: ENEL and E.ON split into two companies: a fossil fuel (and nuclear) based, focused on short-term returns, and a growth oriented company focused on renewable and decentralized generation.

Setting new business models: retail services (energy efficiency, smart meter installation); provision of grid-tied renewable infrastructure and grid-scale storage.

Sources: Cadelcott (2015), Robinson (2015), CTI (2015b)

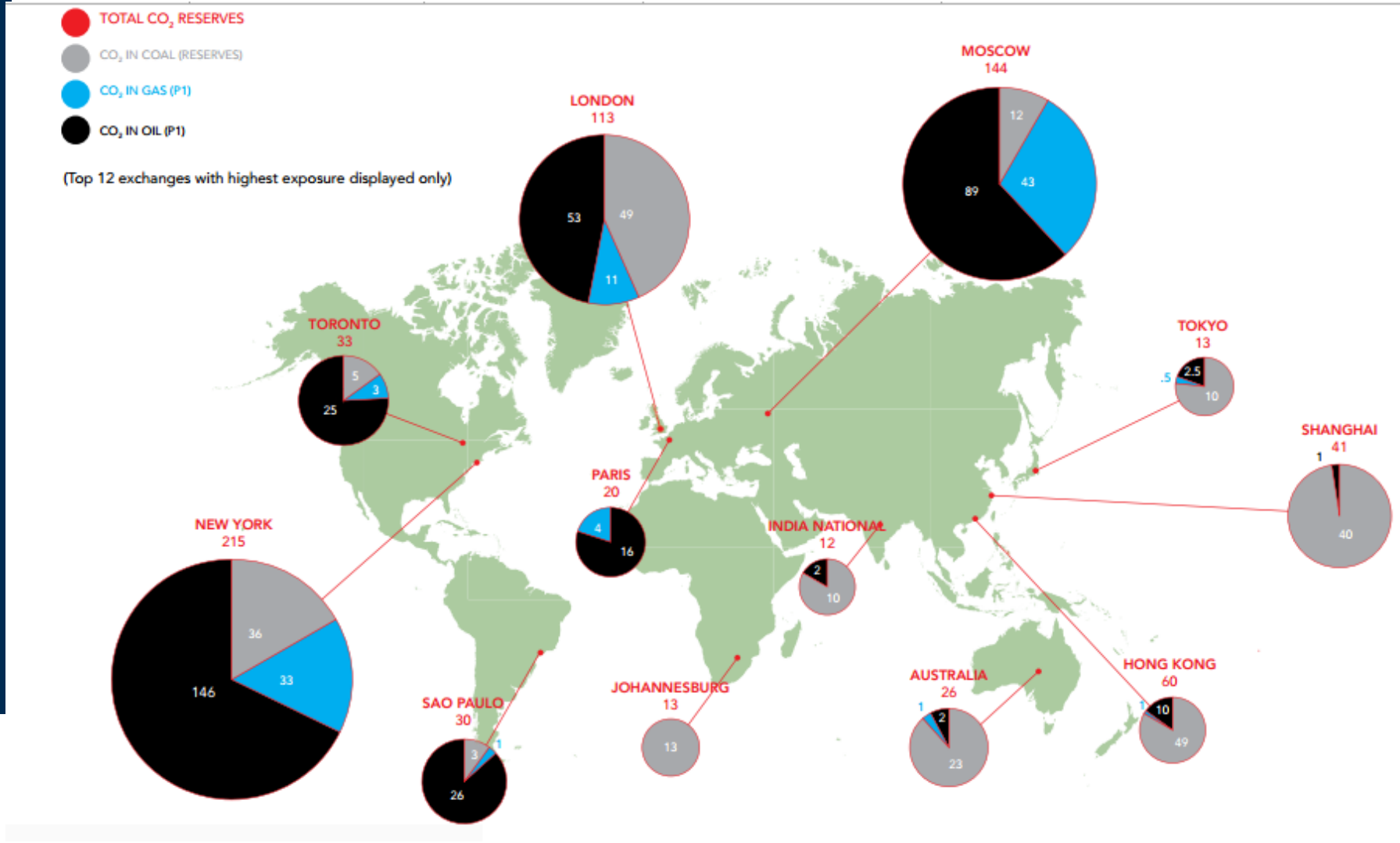
What should investors do?

1.1 trillion of capex at stake in the next decade for the private oil sector.

Asset owners and managers should:

- **Understand exposure** to the upper end of carbon cost curve
- Identify companies with the majority of capex earnmarked for high cost projects
- Focus **engagement** on projects requiring USD 95/bbl or more and set thresholds for exposure to projects on the cost curve
- **Communicate** to company management that value overbears volume
- Require **disclosure** of demand and price assumptions underpinning strategy
- Support **transparency** through publication of sensitivity analysis and stress test to oil price.

Carbon exposure of major stock exchanges



Source: CTI (2013)

Carbon Asset Risk (CAR)

Carbon asset risk: potential for an investor to experience financial loss due to unmanaged operator carbon risk

Investors, insurers, asset managers are increasingly asking fossil fuel companies to assess, disclose, and address CAR.

CAR is a function of the type of financial relationship with the operator (e.g. corporate loan, project finance, equity or bond), and its duration or “tenor”.

Understanding of where different types of financing sit in the capital stack is key

All specific aspects of financing (type of capital, tenor, seniority) affect the risk and return profiles of a financial investment, and detemine whether operator carbon risk translates into CAR.

Carbon risk exposure of an investment

Carbon risk exposure of an investment is informed by financial asset type & tenor, and carbon risk factors such as:

- Policy and regulatory factors
- Energy innovation factors: disruptive technologies
- Economic factors: the risk of today's lower energy prices
- **Reputational factors:** non-divesters may face reputational risk if they get the downside risks wrong or make losses from fossil fuels investments.

Anticipating changes in the demand of capital: The introduction of more stringent carbon policies, disruptive technologies, and the potential development of climate litigation will change the risk-adjusted returns of different financial assets, creating **financial risk** and **opportunity**.

Carbon risk exposure of an investment (2)

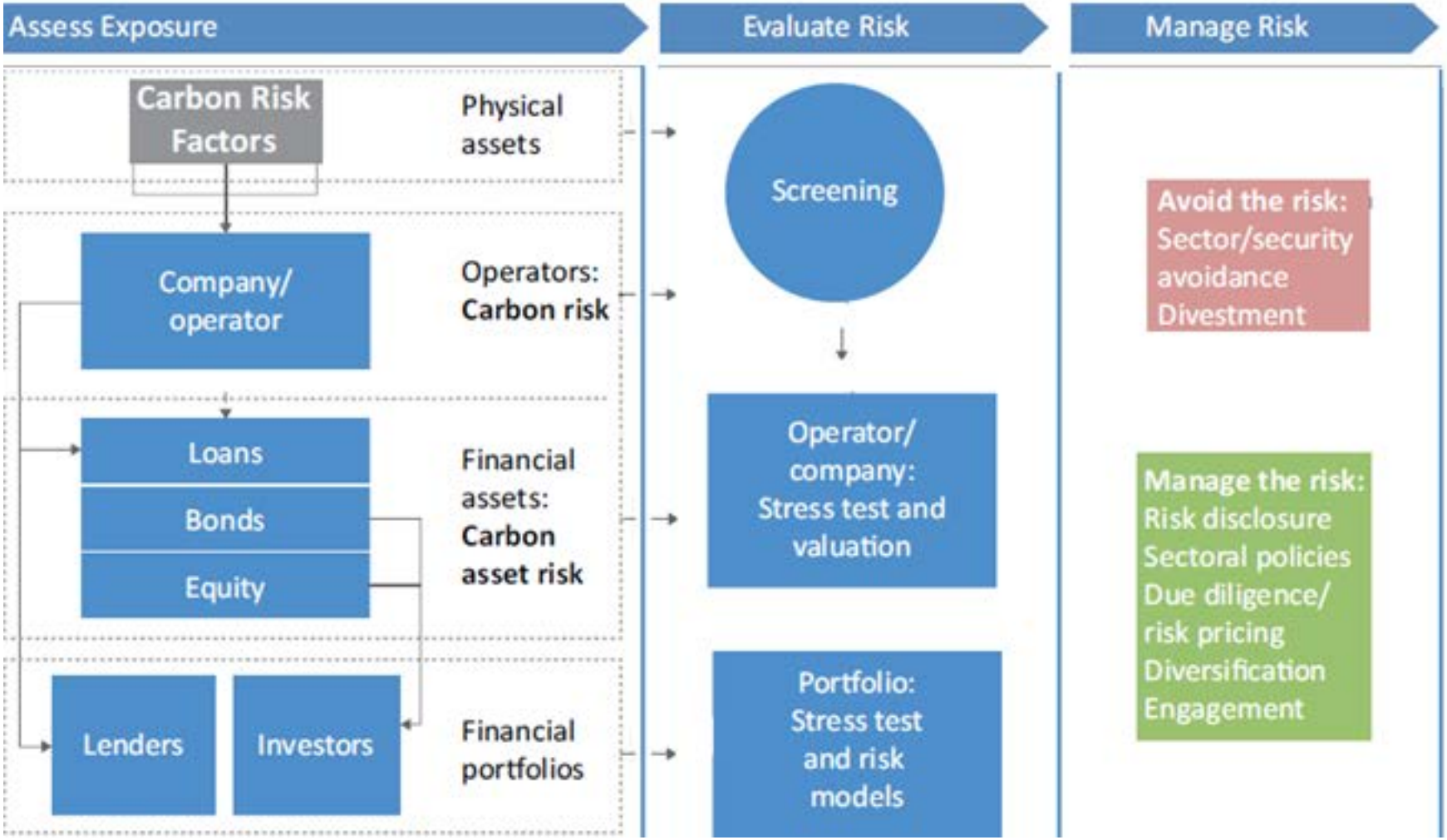
Long-term vs. short-term carbon asset risk exposure

Before, climate regulation were the main stranding risk, and this was perceived as not immediate or urgent. It was a tangible risk for truly longer-term investors such as **insurance companies** and **Sovereign Wealth Funds (SWFs).**

Today, stranded risks are perceived as **short-term risks**, because of the collapse in energy prices that have led fossil fuel industries to cut capex and made operating assets unprofitable.

This made it more urgent to address stranding risks for investors and lenders, including shorter-term financiers such as **private equity** and **pension funds**.

How to manage the Carbon Asset Risk?



Source: UNEP 2015

How to manage the Carbon Asset Risk? (2)

Risk exposure can be managed by a combination of:

- **Disclosure** of information is a prerequisite for the effectiveness of the assessment, evaluation and management of climate risk.
- **Engagement** of shareholder and lenders with the company to assess and monitor thorough time the risk management approach adopted. Lender could include such considerations in the due diligence, while shareholders can establish ongoing discussions with company management and file resolution.
- The returns impacted due to climate change could be hedged by investors through cross-industry and regional **reallocation**.
- **Divestment** strategies.

Disclosure

Disclosure of information is a **prerequisite** for the effectiveness of the assessment, evaluation and management of climate risk.

- **Portfolio Decarbonisation Coalition**

A multi-stakeholder initiative that will drive GHG emissions reductions by mobilizing a critical mass of **institutional investors** committed to gradually decarbonizing their portfolios.

- **Montréal Carbon Pledge**

Investors commit themselves to **measuring** and publicly **disclosing** the carbon footprint of their investment portfolios on an annual basis.

- A best practice in the **French Energy Transition Law** (2015)

Strengthening **mandatory** climate disclosure requirements for listed companies and financial institutions, vs. the **voluntary** non financial disclosure directive in the EU.

Divestment

The **divestment movement** started in September 2013, when the Carbon Tracker Initiative launched the **Carbon Asset Risk (CAR) Initiative.**

The CAR Initiative was launched as **75 investors representing USD 3.5 trillion in assets** called on 45 of the world's largest fossil fuel companies to address the physical and financial risk of climate change and to come clean on the risks of stranded assets.

As of September **2015**, institutions and individuals representing **USD 2.6 trillion in assets** have committed themselves to divesting from specific fossil fuel companies, particularly those involved in **coal** and, in some cases, **tar sands**.

Divestment (2)

There are **four approaches** that investors can choose to adopt **to implement a divestment strategy:**

1. **100% divestment** from all fossil fuels companies;
2. **Partial divestment** (**tilting**) according to index classification, revenue criteria or breakeven prices;
3. **Value chain analysis** of the companies that are involved in fossil fuels;
4. **Worst-in-class approach** based on carbon intensity of individual companies.

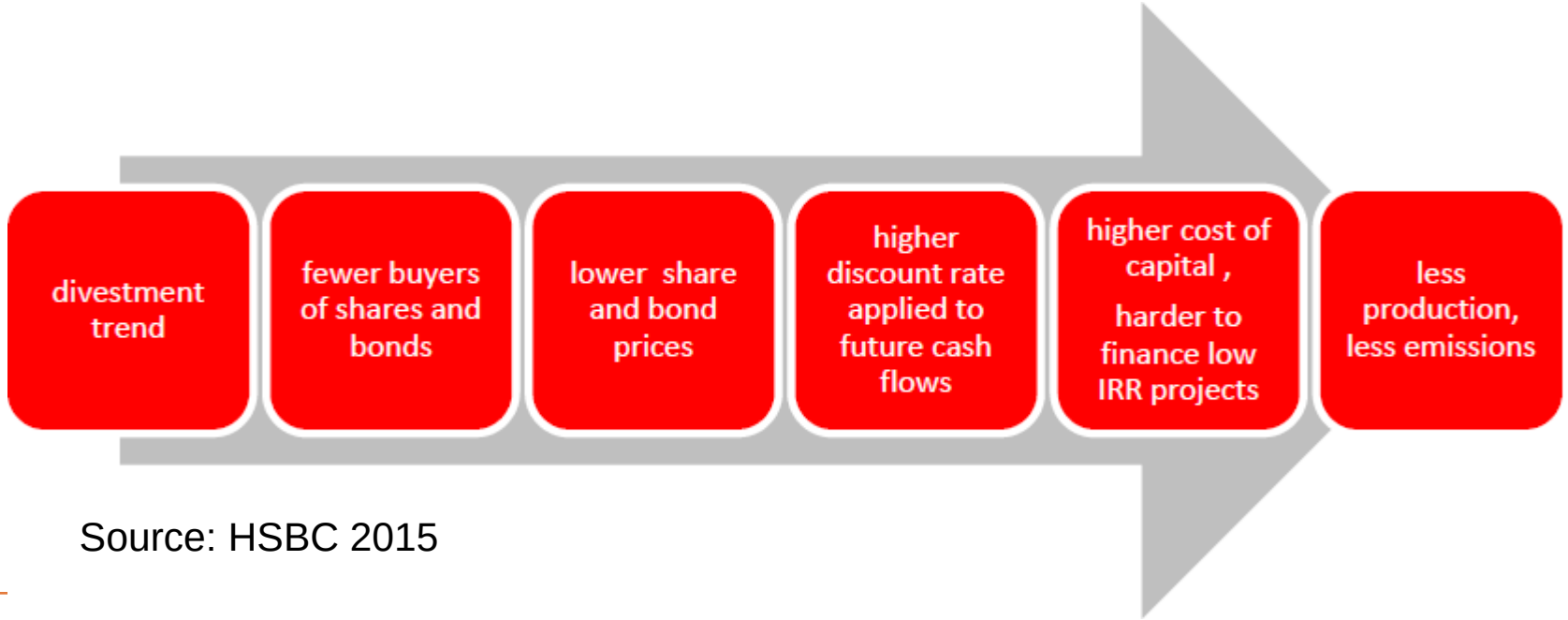
Divestment (3)

Source: HSBC 2015

Investor	Country	Category	Strategy	Divestment	Date of announcement
Second AP Fund	Sweden	Pension	Partial divestment	12 coal and 8 oil-and-gas companies.	Oct-14
ANU	Australia	College	Partial divestment	Iluka Resources, Independence Group, Newcrest, Sandfire, Oil Search, Santos and Sirius, representing 5.1% of holdings.	Oct-14
Rockefeller Brothers Fund	US	Family fund	Fossil fuels	Initially, coal and tar sands. Ultimately, all fossil fuels.	Sep-14
Storebrand	Norway	Pension	Partial divestment	13 coal extractors and six firms that are heavily exposed to oil sands, later decision to divest from coal-heavy utilities.	Jan-14
Boxtel	Netherlands	Local authority	Partial divestment	200 fossil fuel companies that hold the largest coal, oil, and gas reserves.	Oct-13
Orebro	Norway	Local authority	Fossil fuels	All fossil fuels	Jun-13
Church of Sweden	Sweden	Religious	Fossil fuels	All fossil fuels	Sep-14
The University of Glasgow	UK	College	Partial divestment	Divested £18m from the fossil fuel industry and froze new investments	Oct-14
Green Mountain College	US	College	Partial divestment	200 fossil fuel companies that hold the largest coal, oil, and gas reserves.	May-13
Hampshire College	US	College	Fossil fuels	All fossil fuels	Dec-11
Peralta Colleges	US	College	Partial divestment	200 fossil fuel companies that hold the largest coal, oil, and gas reserves.	Dec-13
Prescott College	US	College	Partial divestment	200 largest fossil fuel corporations over the next 3 years	Feb-14
San Francisco State Univ	US	College	Partial divestment	Coal and tar sands companies, began process to look at fully divesting from the fossil fuel industry	May-13
Sterling College	US	College	Partial divestment	200 fossil fuel companies that hold the largest coal, oil, and gas reserves.	Feb-13
Stanford	US	College	Coal	Coal mining companies	May-14
World Council of Churches	Switzerland	Religious	Fossil fuels	All fossil fuels	Jul-14
The University of Sydney	Australia	College	Carbon	Cut its fossil fuel investments by reducing the carbon footprint of its portfolio by 20% over three years	Feb-15
Oslo	Norway	Local authority	Coal	Coal companies	Mar-15
Nordea	Sweden	Asset Manager	Coal	Up to 40 coal-mining companies	Jan-15
KPL Pension Fund	Norway	Pension	Coal	Companies that derive more than 50 per cent of their revenues from coal	Nov-15
Local Government Super	Australia	Pension	Coal	Companies that make more than a third of their revenues from coal mining or coal-fired electricity generation	Oct-14
Norges Bank IM	Norway	Sovereign Wealth Fund	ESG	22 carbon-intensive fossil fuel companies	Feb-15

Does divestment extend the carbon budget?

In economic terms, divestment works as described here, where less demand for shares and bonds ultimately **increases the cost of capital to companies and limits the ability to finance expensive projects**, which is particularly damaging in the energy sector where projects are inherently long term and with riskier IRR.



Source: HSBC 2015

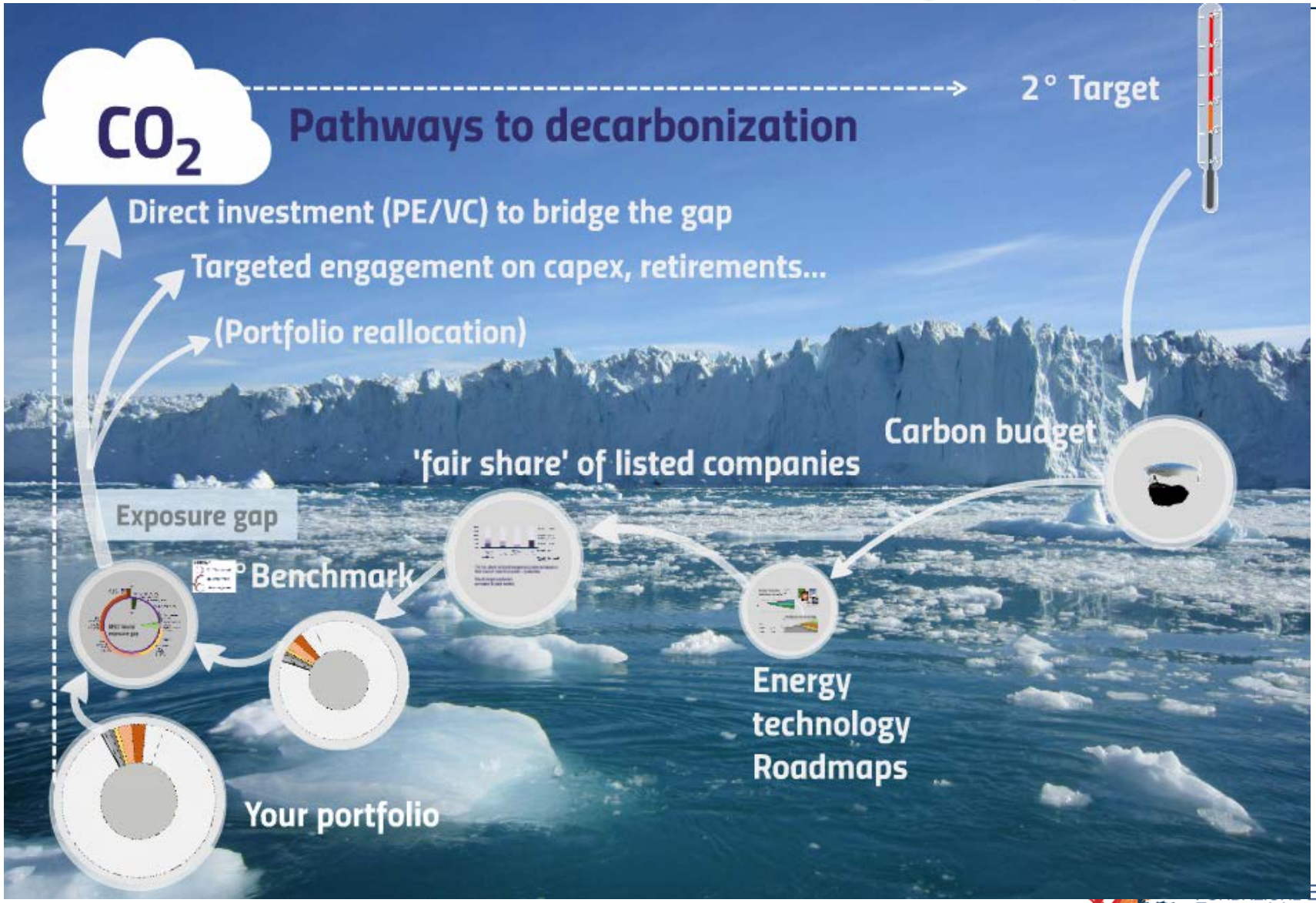
Does divestment extend the carbon budget? (2)

From a carbon budget perspective divestment seems positive because it extends the time available to implement policy, invest in low-carbon energy infrastructure and scale up emerging technologies that facilitate a faster transition to a low carbon economy.

Although, some important **challenges** exist:

- Divestment **increases the cost of capital** and limits the ability to finance expensive green projects;
- **Transition risks**: indirect threats including new regulations, shifting market demand, technological innovation and changing societal expectations;
- **Financing gap**: the investment need for energy transition is an additional **USD 1 trillion per year in clean energy by 2030.**

Does divestment extend the carbon budget? (3)



Source: 2II, 2015

How to fill the financing gap for energy transition?

Positive returns are associated with retaining exposure to the **energy sector**, but **reallocating** portfolios **towards low carbon energy**, by replacing fossil fuel stocks with energy efficiency and renewable energy investments.

Clean energy investment has grown rapidly in recent years: **USD 270 billion** was invested in renewables in **2014**. (In 2013 the world added more low-carbon electricity capacity than fossil fuel capacity).

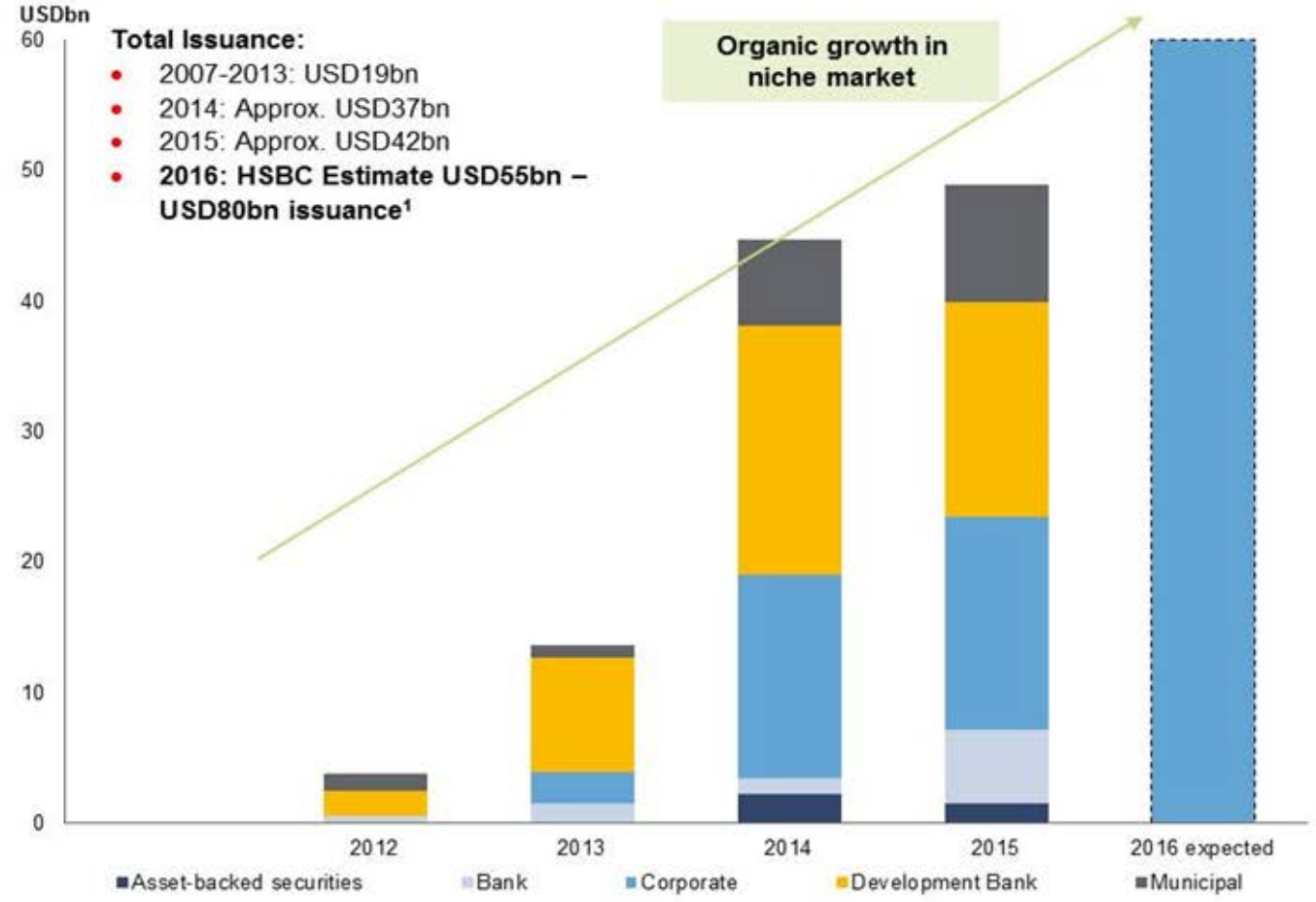
The costs of low-carbon technologies continue to fall, and new finance vehicles are starting to take off:
green bonds

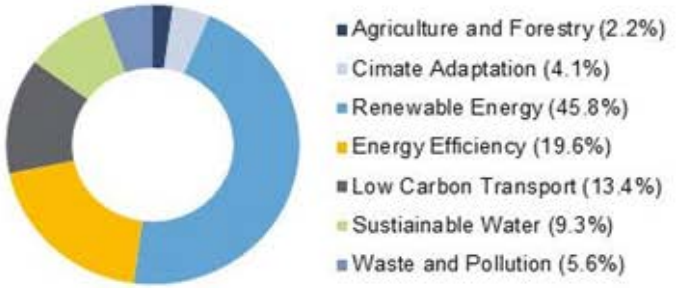
Green Bonds

- Green bonds are labelled bonds specifically issued to finance environmental protection, sustainability or specific climate mitigation and adaptation measures.
- They can be issued by governments, development banks, commercial banks or **corporations.**
- As of **2015** a total of **USD 598 billion** of climate-aligned bonds, of which **USD 65 billion** are labelled green bonds.
- The majority of issuances have **tenors over 10 years**, reflecting the long-term nature of climate assets, such as energy infrastructure bonds.

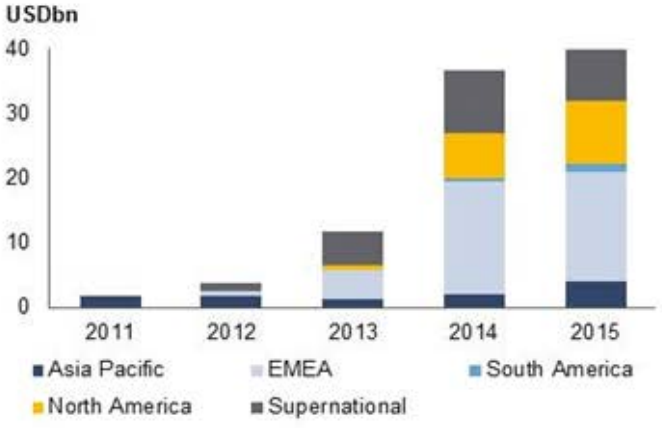
Green Bonds (1)

Green bonds finance a range of green projects, with the largest proportion of proceeds going to renewable energy and energy efficiency projects





Global Green Bond Issuances

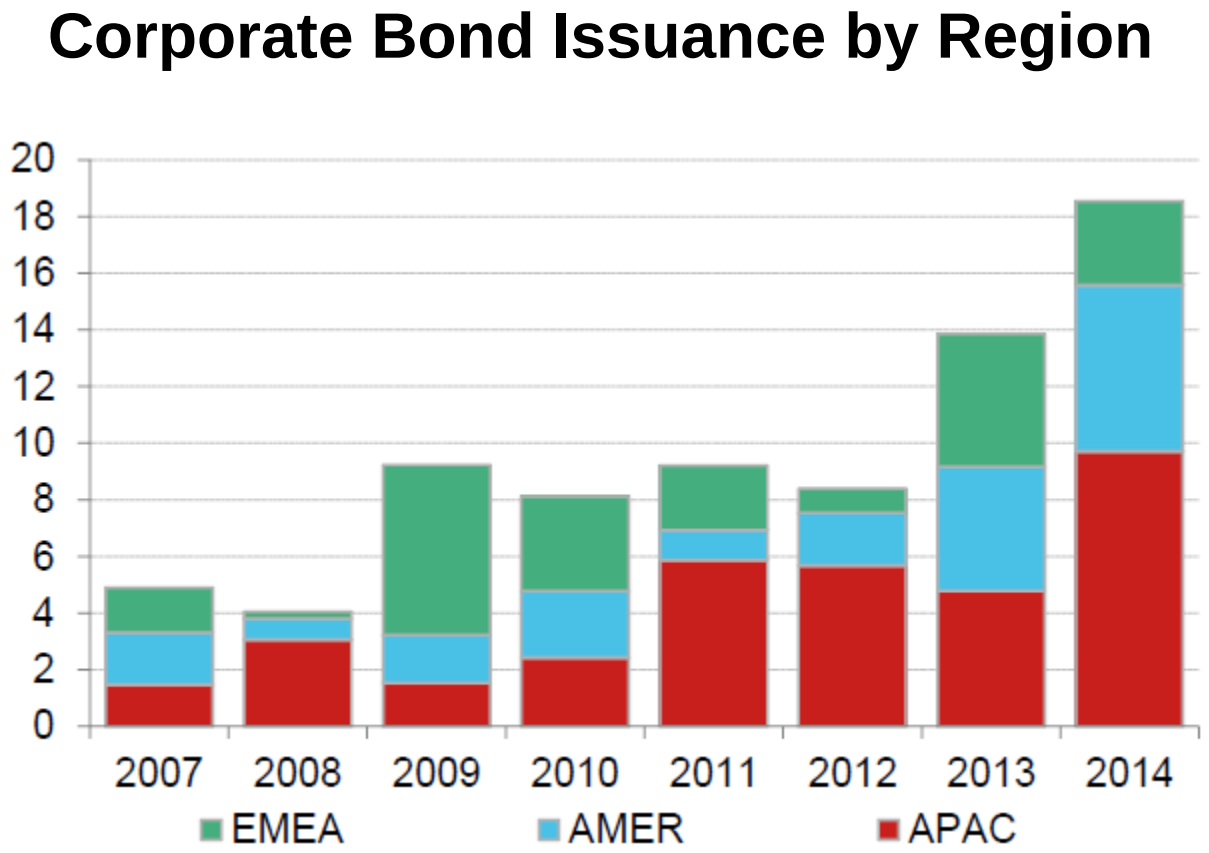


Note:
1. HSBC Climate Change Centre of Excellence research report. Global Green Bonds, Outlook for 2016: https://www.research.hsbc.com/R/20/pkkdkVm

Source: Climate Bonds Initiative 2015 Market Update, http://www.climatebonds.net/resources/publications/2015-green-bonds-market-update

Distribution by issuer type and geographic area Source: Climate Bond Initiative (2015)

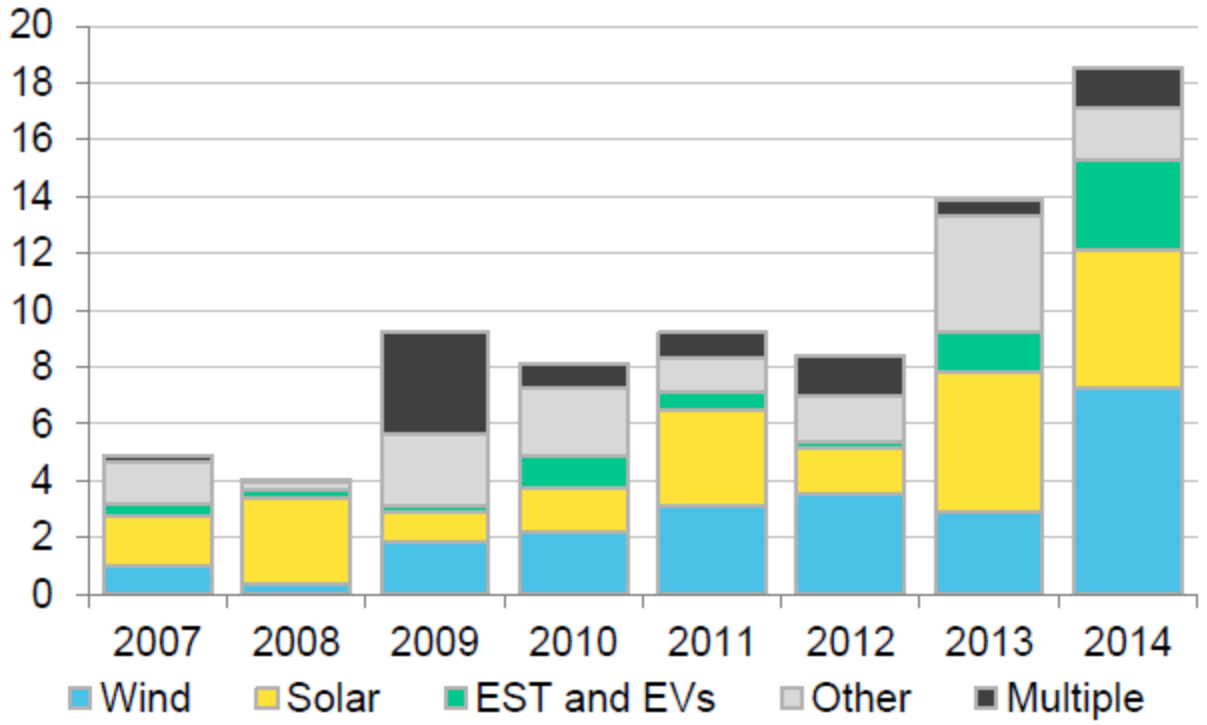
Green Bonds (2)



Source: Bloomberg New Energy Finance

Green Bonds (3)

Corporate Bond Issuance by Sector



Source: Bloomberg New Energy Finance

Green Bonds (4)

Green bonds play also a very important role as **refinancing tools**, which is key especially during higher risk construction phase of renewable energy projects, with the aim to ensure investors and developers that once operational the asset can be refinanced through bonds.

Green bonds are looking increasingly attractive to **insurance companies** that aim to meet their risk and return objectives while producing as positive environmental or social impact (e.g., Zurich bought a USD34 million, 30-year fixed-rate green bond issue from the World Bank in February 2015).

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Thank you for your attention

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