

Climate Finance

Policy Risk and Investment

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Climate Finance: Prices, Returns and Enterprise

Trading financial products created to mitigate carbon emissions:

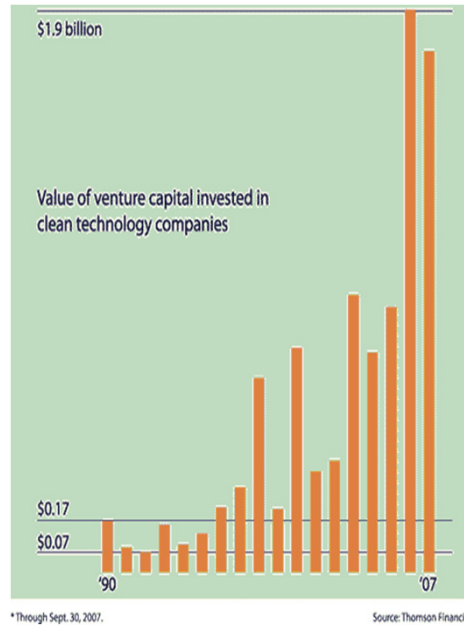
- Daily “carbon” products (spots, forwards and options) originate from “cap & trade” markets (eg EUAs) or “offset” projects (eg CERs).

Financing & Investing in Renewables, Cleantech, Energy Efficiency:

- As an emerging sector of the economy, an asset class for investment funds, a compliance obligation on carbon emitters and a voluntary target for the carbon neutral aspirations of companies, cities and regions, \$Trillions are at stake, with many different business models.

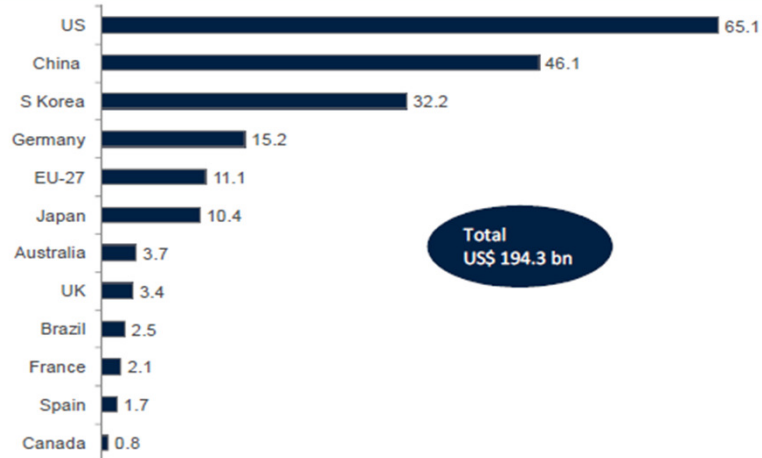
How well do private financial opportunities align with policy targets?

Private Capital has flowed into CDMs, Renewables, Cleantech



And Governments see the sector as an economic recovery opportunity...

Green Components of National Economic Stimuli, 2010, US\$ billions

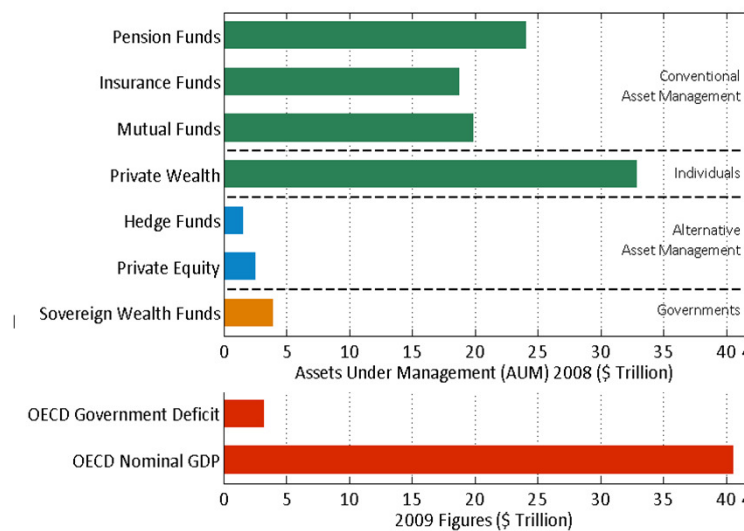


WEF 2011

But to achieve GHG stabilisation

- Estimates of need are huge (*IEA Estimates \$5.3 Trillion during 2010-2020 for GHG Stabilisation trajectory*)
- Successes are small in comparison (*CDM has stimulated maybe \$100 billion so far; about 650 million CERs issued to date*)
- Government stimulus is important....but the private sector may not be following at the level required....*The Funding Gap is Well-known*

Institutional Investors remain the target



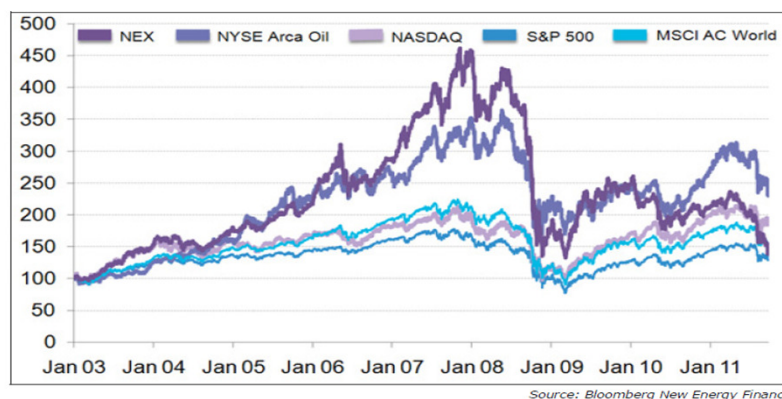
Source: Marcelo Labre, IFSL, IMF, OECD

Institutional Investors and Power

- Projects need to be **investment grade**
- Ratings agencies like the big power companies, but not individual new tech projects
- Projects need to be **large**.
- Projects need to have the desirable **risk-return profile**

NEX is now Underperforming and the sector is appearing to be high risk

NEX vs AMEX Oil, Nasdaq and S&P 500



Many New Business are in Financial Distress (eg US solar)

Risk is often Underestimated in Many Policy Models

Levelised cost and MAC models often use single, low discount rate for all technologies

Estimated post-tax nominal hurdle rates (returns required on investment),
Base Case, 2007

Technology	Vertically integrated company	Independent power producer
CCGT	8.3 – 9.2%	12.6%
Coal (Advanced super-critical)	7.8 – 8.8%	12.1%
Nuclear (Pressurised Water Reactor)	9.5 – 10.5%	14.0%
Coal (Advanced super-critical) with CCS	11.1 – 12.2%	15.4%

Source: Dynamics of GB Electricity Generation Investment, Redpoint Energy Ltd, 2007, www.redpointenergy.com

And even a single investment should be viewed as Multi Project

Wind involves three stages, often with refinancing or change of ownerships:

1. **Development**
Feasibility, Design, Permissions, Pre-construction
(Developers may look for 5x investment return)
2. **Construction**
Site work, construction and commissioning
(Engineering companies may look for 12% return)
3. **Operational**
Production and Maintenance
(Producers may look for 10% return)

How much investor microstructure do policy-makers need to understand?

Policy interventions tend to increase risk

Policy interventions for **decarbonisation** may be too many and too inter-related:

- *Carbon Prices, Carbon Taxes, Carbon Price Support*
- *FiTs and ROCs*
- *Selective Technology Support, Tax Credits, Performance Standards*

Simulation Model

Abatement Stack of 16 Technologies with marginal costs and capacities for abatement by 2020 and 2030. BAU Projection to 2030.

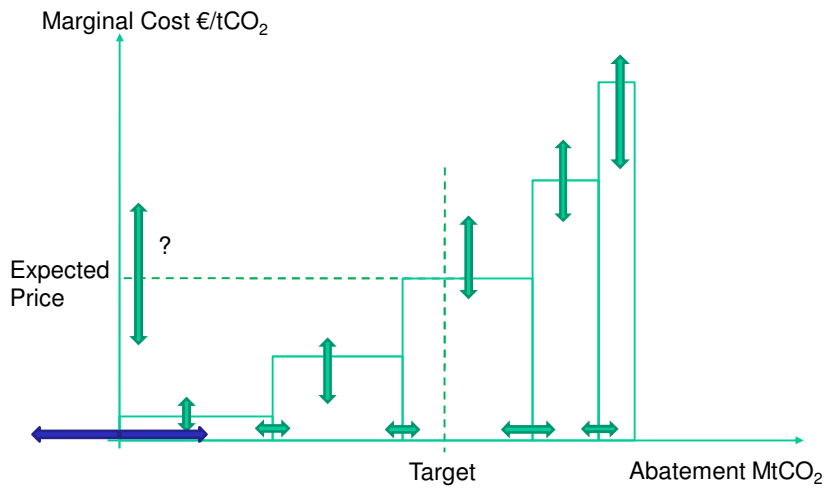
(Data from EU Primes model and IEA WEO)

Model Risk: Uncertainties on Demand, Costs & Capacities simulated by Monte Carlo methods.

Policy Risk: Selective support for technologies and quota for offsets. Different abatement target levels for 2020

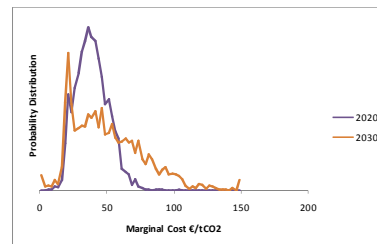
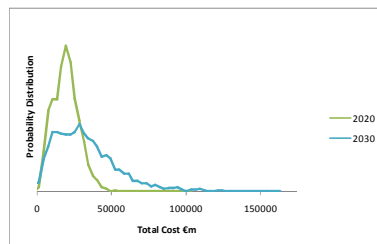
(Blyth, Bunn, Kettunen, Wilson, *Energy Policy*, 2009)

The simulation model makes the marginal abatement model stochastic, and introduces policy effects.....

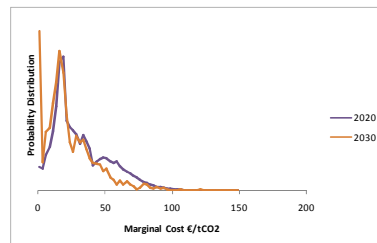
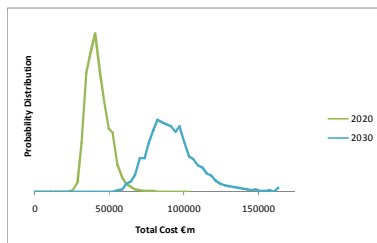


20% EU-wide abatement scenario

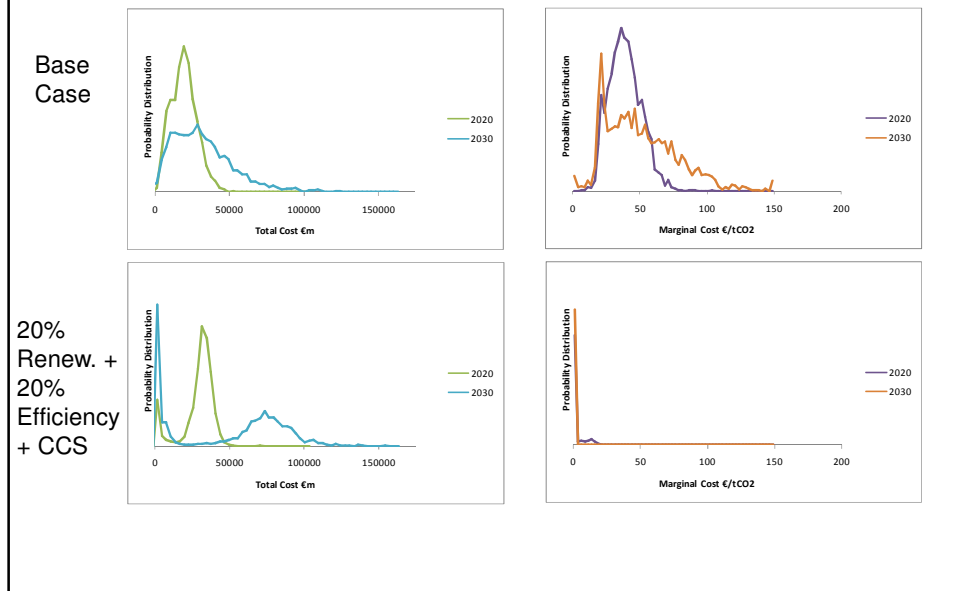
Base Case



20% Renew + CCS support



20% EU-wide abatement scenario



Policy interventions tend to increase risk

- **Policy** interventions for **decarbonisation** may be too many, but will likely continue to be so.
- How will industry respond? More **Delays**? More **Consolidation**? **Fewer New Entrants**?
- How much investment risk can the utilities take on to their balance sheets?
- Will utilities prefer to be asset operators, if institutional investors are tempted to become asset owners...

Carbon Price Formation

Analytical Approaches:

Compliance Activities by Agents in the Market:

- Qualified Emitters must trade yearly to comply....
- Motivates models of demand and supply

Expectations about Future Prices:

- Allowances are now bankable indefinitely.....
- Motivates models based upon discounting forward expectations

Casual Analysis suggests fuel switching was, *at times*, a Significant Driver of Spot EUA Returns in Phase 1

For fuel switching to gas from coal in the power dispatching, **fuel switching cost**, *fsc*,

Dirty dark spread – $0.9fsc$ = Dirty spark spread – $0.4fsc$

(Depending on carbon intensities of the coal and gas plants)

Regression Model of EUAs between 20/09/2005 and 25/04/2006

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.019261	0.042989	0.448047	0.6548
D(FSC(-2))	0.020863	0.006265	3.329946	0.0011
D(OIL)	0.094542	0.039477	2.394832	0.0178

Model between
6/06/2006 3/30/2007

	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.055671	0.021150	-2.632175	0.0091
D(CARBON_SPOT(-1))	0.241481	0.065072	3.710979	0.0003
D(CARBON_SPOT(-2))	-0.132989	0.065442	-2.032172	0.0434
D(FSC(-2))	0.020034	0.006694	2.992610	0.0031
D(OIL)	0.070463	0.016632	4.236717	0.0000

Casual Analysis suggests Phase 2 *may be* more forward looking

FSC seems less significant

Oil dynamics are important for expectations and Forward prices may be influencing spots

.....but all of these are inter-related.....

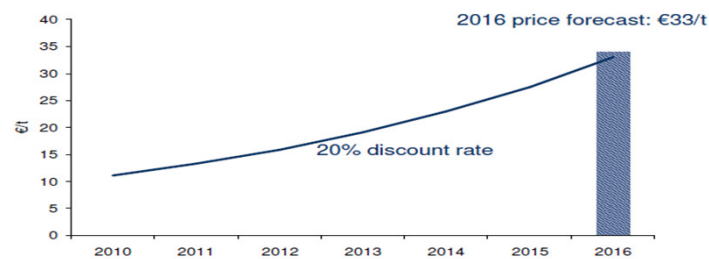
.....one of several possible models for spot 2008-2009 is:

	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.022059	0.024005	-0.918947	0.3588
D(CARBON2011(-1))	0.098722	0.046381	2.128509	0.0341
D(OIL(-2))	-0.027682	0.010171	-2.721533	0.0069
D(OIL)	0.093128	0.010135	9.188750	0.0000

The Risk in the Term Structure is Higher than Expected

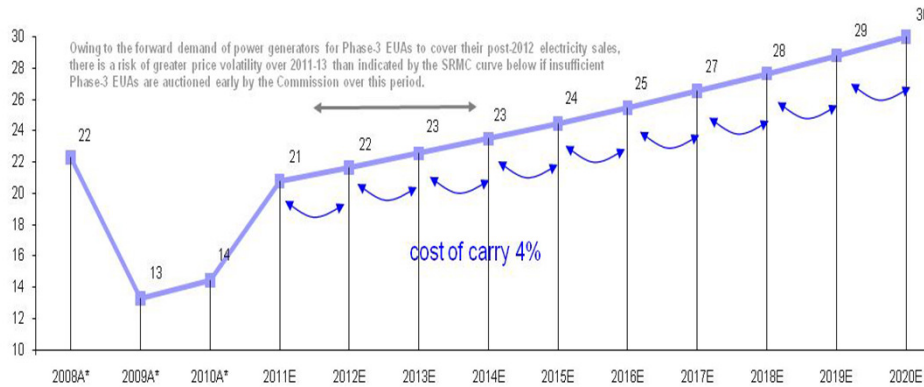
EUAs are bankable, but appear to carry a high discount rate in forward models....

For Example, in 2010, when prices were around €12/tonne, Point Carbon was forecasting €33/tonne for Dec 2016.....



The Risk in the Term Structure is Higher than Expected

Deutsche Bank analysts undertook a similar approach, but resolved the dilemma by expecting the market to revert out of its “inefficiencies”....



Forward Spreads in the Market reveal Policy Risk Premium



Forward Demand mainly from the Hedging requirements (<3yrs) of Power Generators

Electricity Markets are now at a Delicate Balance of Liberalisation and Policy Control

- Policy intent to ensure security and sustainability have a complex interaction with market liberalisation.
- If policy risk adds substantially to market risk, understanding market structure evolution and financial product characteristics is crucial.
- The nature of regulatory risk may then become more delicate and confusing.
- The price of risk in carbon finance remains under-researched