

“Investing under a carbon cloud”

Chris Wheaton
for Finding Petroleum
November 2015



Allianz 
Global Investors

Understand. Act.

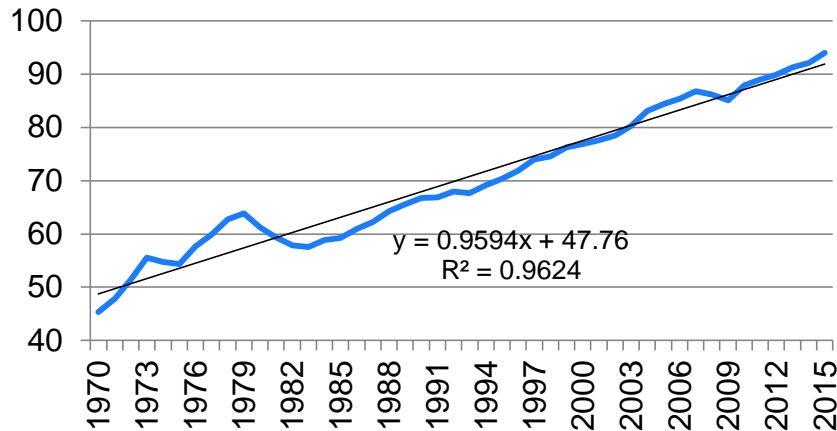
Agenda

- Is carbon tax on oil & gas the biggest threat to oil demand and the oil industry?



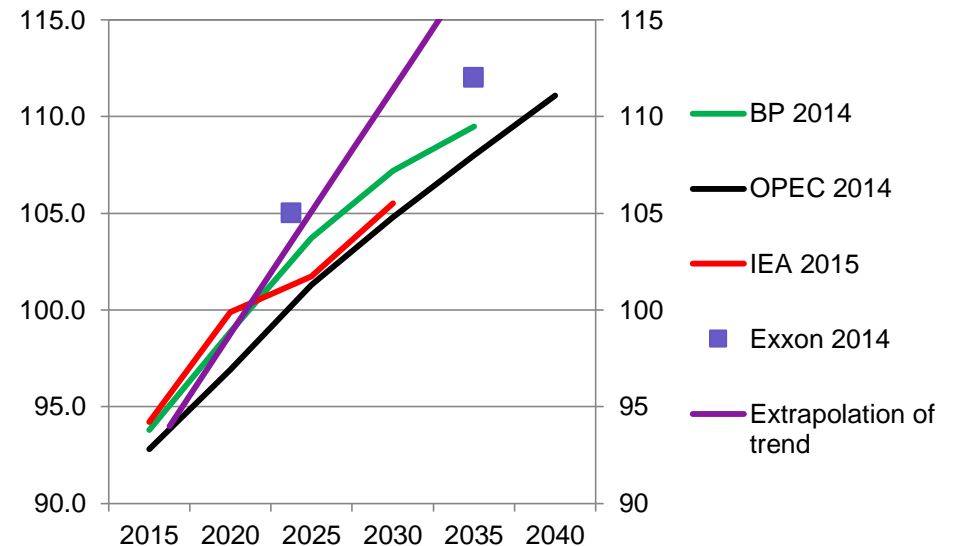
The Oil Industry's past: not a guide to the future

Global oil demand 1970- 2015E Mbbls/d



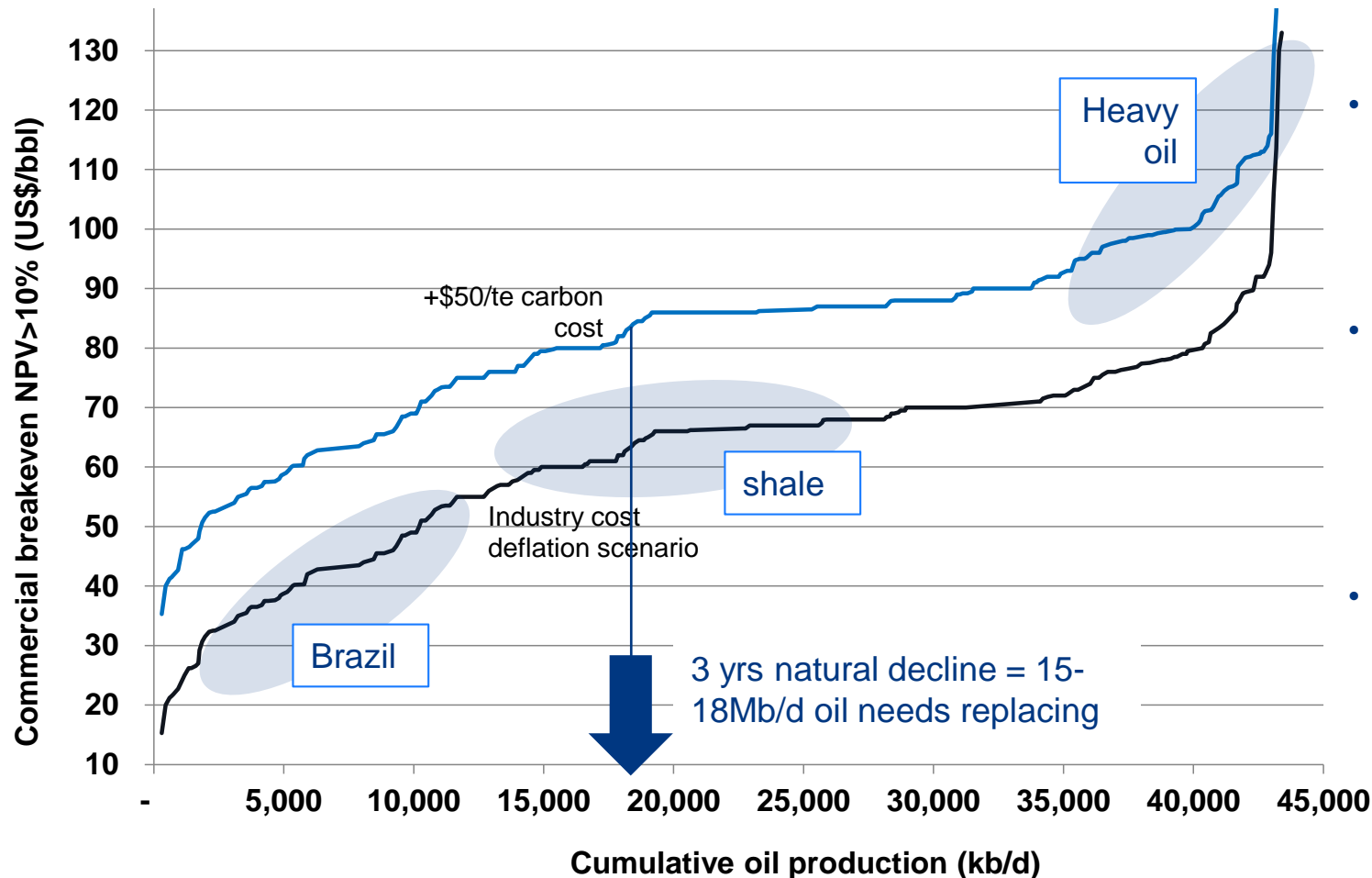
- 45 year trend: oil demand averaged +0.9~1Mb/d growth p.a., or +1.1Mb/d since 1983
- Nobody believes this will continue, either- forecasts all point to oil demand well below trend
- ...and then, on top, what could Carbon taxes do to oil demand?

Global oil demand forecasts by source to 2040



What does global oil cost curve look like with carbon tax added?

- In one word: UGLY



- This includes benefit of current industry capital cost deflation of c. 25% vs 2014 base
- To replace natural decline of 18Mb/d over 3 years would need >\$80 oil, not \$60-70 as at current costs
- This outcome not **(yet?)** politically acceptable...?

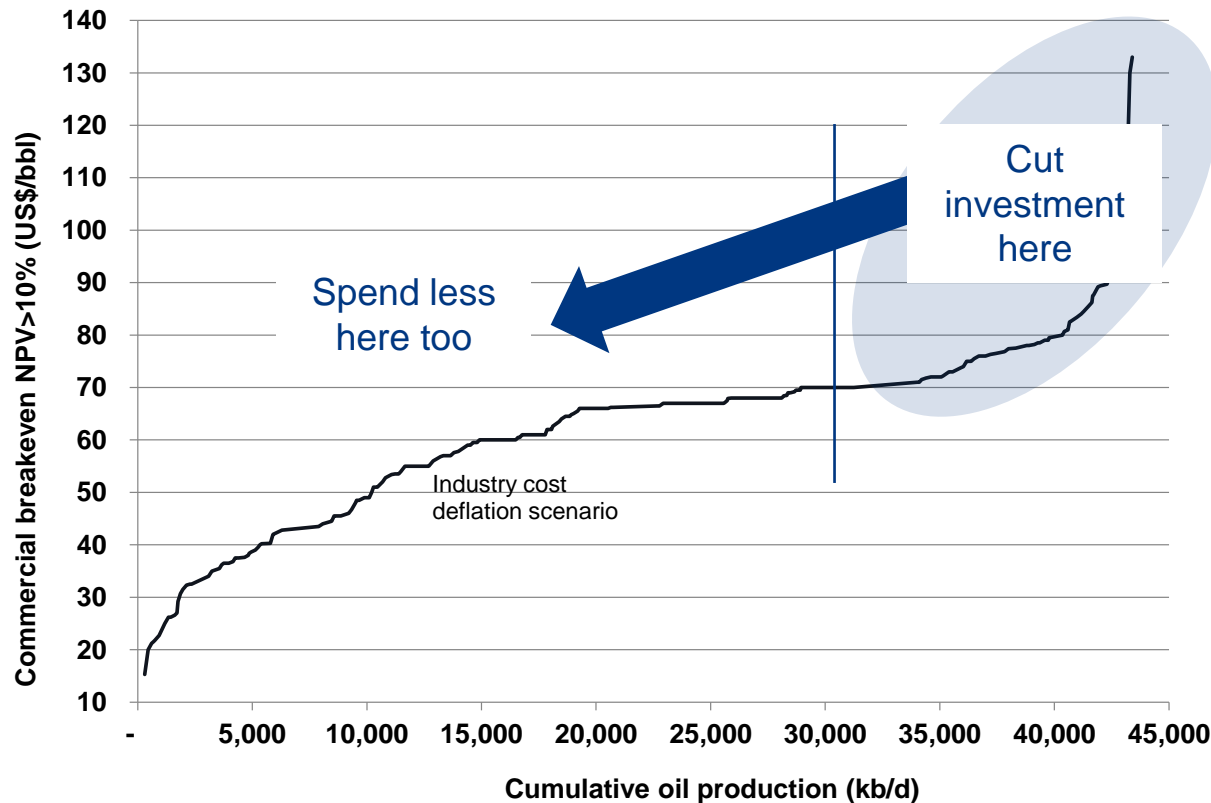
Carbon taxes: would be a lose/lose outcome

- A \$20/bbl impact from carbon tax imposed on oil companies would reduce post-tax Return on capital employed for the industry by c. 4 p.p. i.e. by ~one-third (well, assuming RoCE recovers from currently low levels back to “normality” by 2018!). **This is an unattractive outcome for shareholders and oil consumers too because it would guarantee a return to \$100 oil as industry fights to survive and cuts investment.**
- Remember that 5% annual decline in oil production or 4.5-5Mb/d, plus 0.8Mb/d decline from US shale, means global oil production decline is 5-6Mb/d, this is the “demand” that the oil price has to act as an incentive to replace. On top of this is any growth in oil demand!
- Note that there is not much shift within the cost curve- heavy oil looks a little more disadvantaged, but it was almost all 3rd/4th quartile already, and is only c. 10% of future production volume
- I’ve not assumed any use of CO₂ in EOR projects- this could change economics of late life oil assets e.g. North Sea . I think this could be really exciting area to invest in but there are massive issues here though- separation of CO₂ producer (utilities, industries) and CO₂ re-user (oil company), big start-up costs, lack of funding/risk capital, lack of CO₂ grid etc.



Short-term dash for growth has cost shareholders money

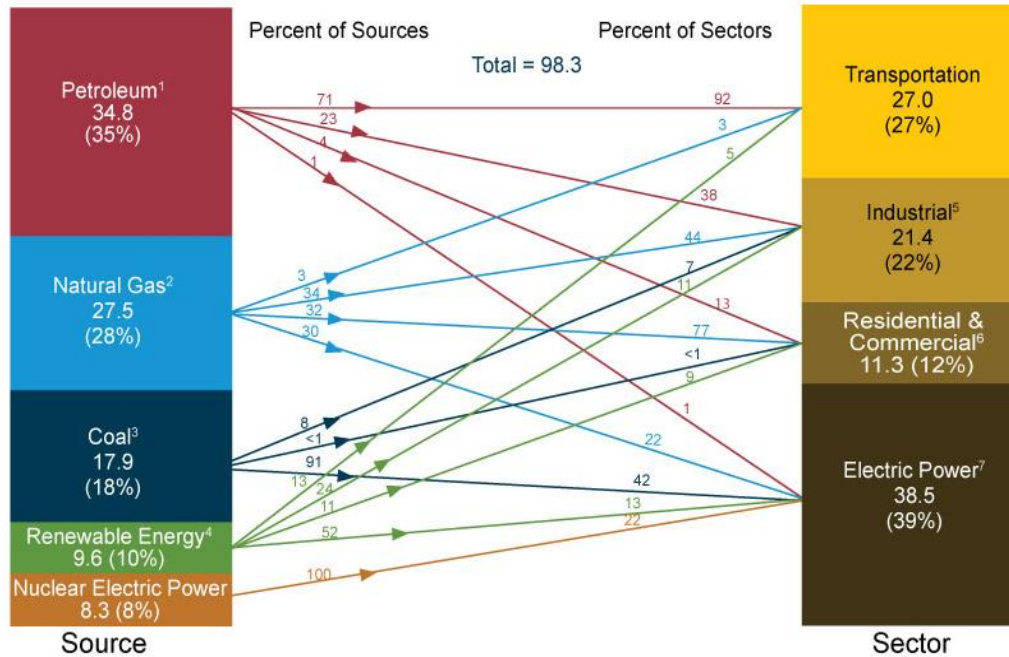
- However, the shape of the curve suggests that for every 1Mb/d reduction in total oil demand growth + decline offset, **equilibrium oil price should fall by \$5-8/bbl.**



- Chasing the marginal growth barrel has been VERY expensive (though to be fair, \$100 oil was incentivising companies to invest in marginal projects) and the benefits to cashflow, return on capital etc. from not doing marginal projects more than offset lower oil prices.
- **I want oil companies to grow profitably** in the future- that may mean limiting growth to <2%. **I want companies to focus on RoCE and cashflow per share** and to **focus on longer-term risks to the business models**

Longer-term impacts on oil & gas demand

Primary Energy Consumption by Source and Sector, 2014
(Quadrillion Btu)



- Two threats for loss of market share by Oil & Gas stand out:

1) Transportation- where oil has 92% market share;

2) Nat Gas power gen and industrial/residential heating market.

- Both threats have one thing in common- disruption by the **Lithium-ion battery**

¹ Does not include biofuels that have been blended with petroleum—biofuels are included in "Renewable Energy."
² Excludes supplemental gaseous fuels.
³ Includes less than -0.1 quadrillion Btu of coal coke net imports.
⁴ Conventional hydroelectric power, geothermal, solar/photovoltaic, wind, and biomass.
⁵ Includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.
⁶ Includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.

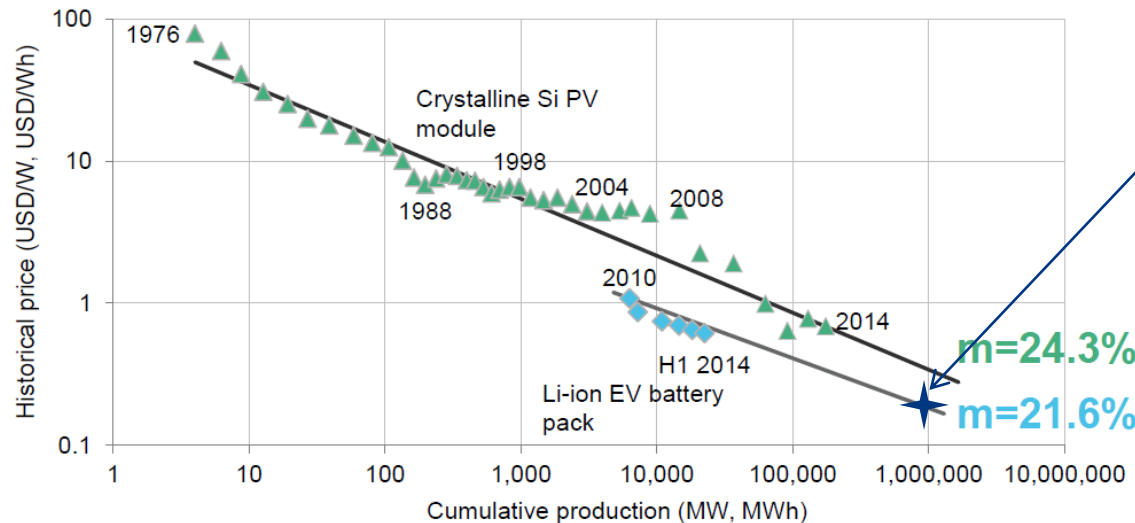
⁷ Electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes 0.2 quadrillion Btu of electricity net imports not shown under "Source."
 Notes: Primary energy in the form that it is first accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy (for example, coal is used to generate electricity). * Sum of components may not equal total due to independent rounding.
 Sources: U.S. Energy Information Administration, Monthly Energy Review (March 2015), Tables 1.3, 2.1-2.6.



The longer-term risk: not carbon tax, but the Lithium-ion battery

- **The biggest existential threat to the Oil industry is not \$50 oil price or \$50/te Carbon Tax, but the Lithium-ion battery.** Li-ion battery could attack both Oil's 95% share of the transportation fuel market AND NatGas's 50% share of heating and power market
- Li-ion costs falling fast- and with combined market for energy storage plus Electric vehicles, could fall faster

LITHIUM-ION EV BATTERY EXPERIENCE CURVE COMPARED WITH SOLAR PV EXPERIENCE CURVE **Bloomberg**
NEW ENERGY FINANCE



Note: Prices are in real (2014) USD.

Source: Bloomberg New Energy Finance, Maycock, Battery University, MIT

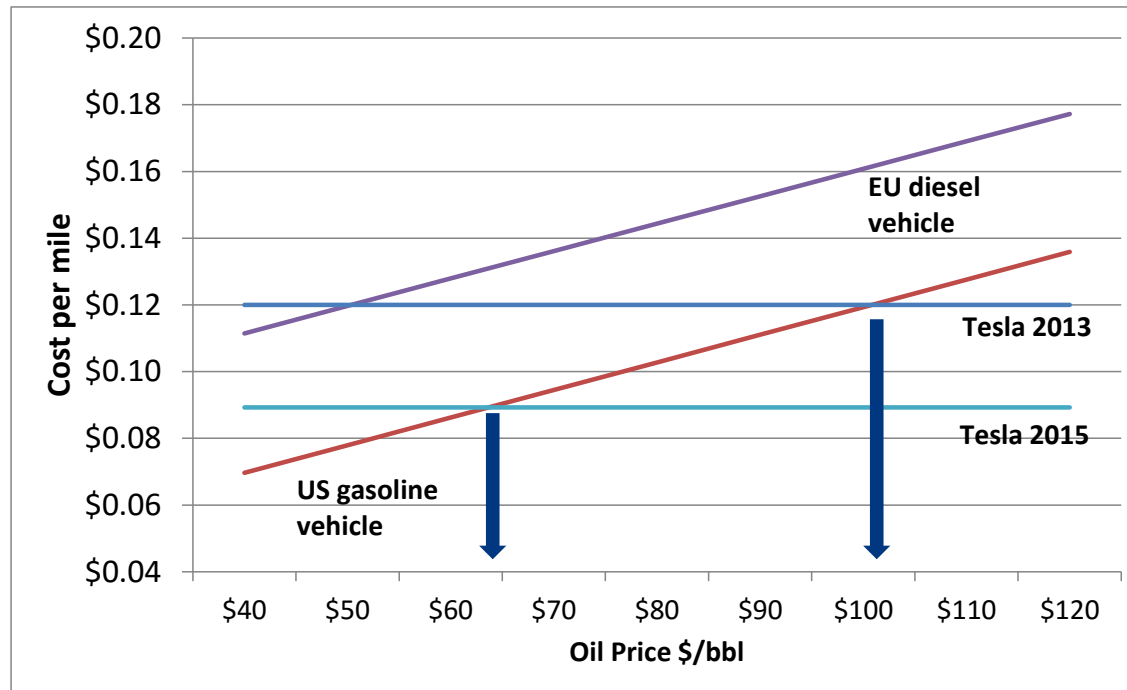
- On IEA forecasts, by 2019 there will be enough electric vehicles manufactured to drop battery costs close to the <\$150/kWh “liftoff point” where EV is cost competitive with gasoline engines



On a marginal cost basis, Li-Ion already beating combustion engine

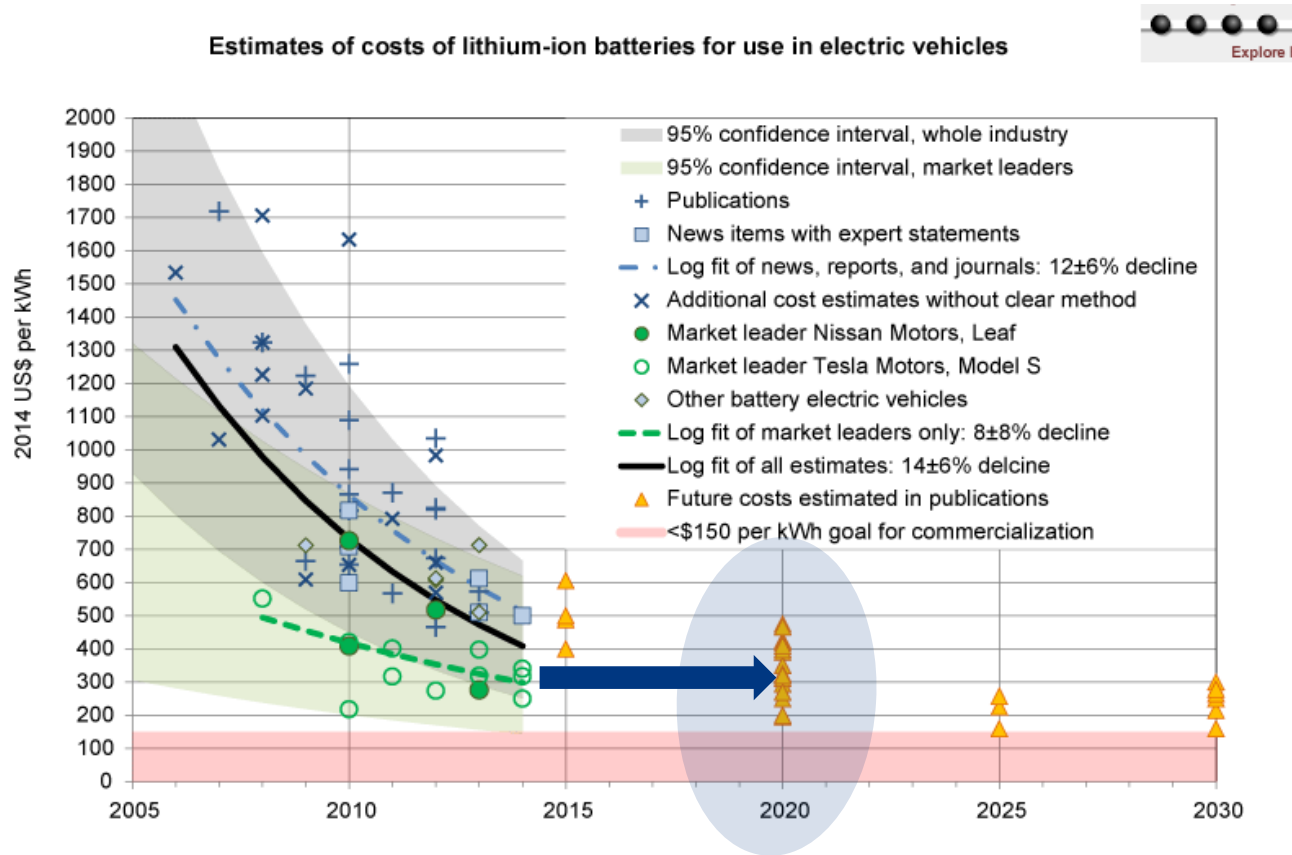
- Combination of improving battery technology plus benefits of scale mean on a marginal cost basis plug-in electric vehicles now cheaper than ICE in EU, and above oil prices in mid-high \$60/bbl in US
- Issue now is to get all-in battery costs down sufficiently to make additional capital cost outlay vs ICE car match the savings from going electric- and this will happen, I just don't know how quickly...

Cost per mile: Tesla (plug in EV) vs US gasoline /EU diesel ICE vehicles



- Marginal cost parity was at >\$100 oil 2 yrs ago, now is at mid-\$60/bbl 2 years later
- This number only going to go lower...

Li-ion battery costs already trending below forecasts



Björn Nykvist and Måns Nilsson, 2015

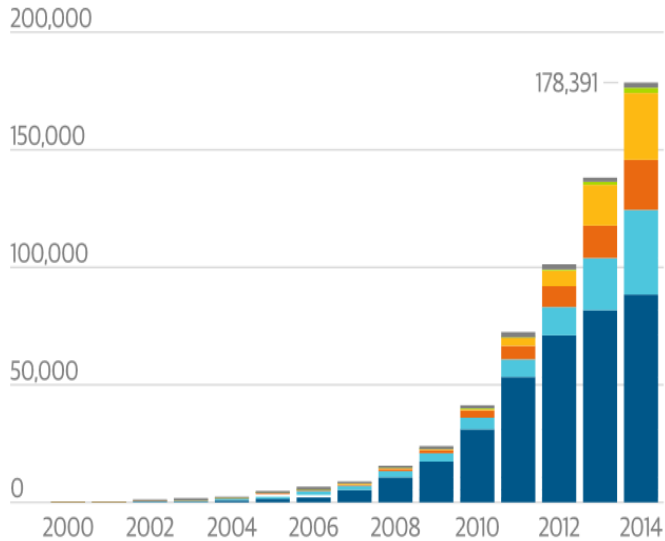
- 2015 Li-ion battery costs are already below 2020 forecasts made in 2012 by IEA and other learned experts...
- Remember what Nobel Prize-winning physicist Niels Bohr said **“It’s difficult to make predictions, particularly about the future”**
- Magic number is \$100-150/kWh- at this point, electric vehicles can be cost competitive with internal combustion engines (Q: with or without subsidy? I would expect subsidies to disappear over time as seen in solar industry)

Solar is next market to benefit from Li-ion cost reductions

Solar assumed to be small part of energy mix despite growth rate

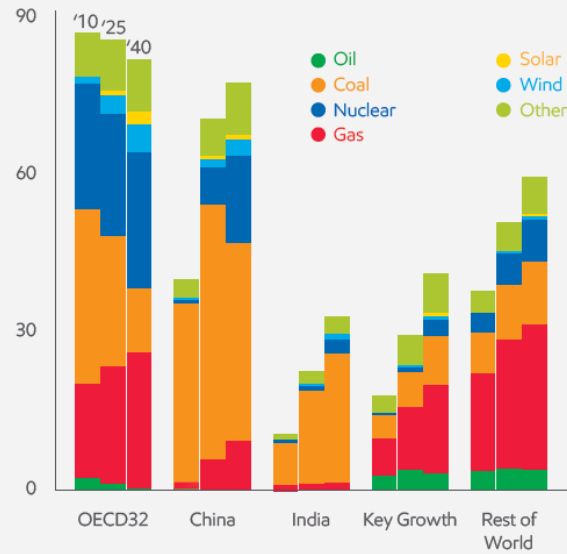
Cumulative installed capacity, MW

Europe | Asia Pacific | Americas | China | Middle East and Africa | Others



Fuel for electricity generation by region

Quadrillion BTUs



- Solar assumed to be small part of future energy mix and gas a large part of mix...but what if this assumption is wrong?
- Focus on solar is always on cost per W, this ignores 1) need to store electricity, not just produce it; 2) installation costs
- panel efficiency not increasing fast at all- even best panels only at 23% efficiency, up from 10% 15 years ago
- Is this rate of growth in solar compatible with forecasts for growth in gas demand? Could emerging market economies skip the “gas” phase entirely?



My contentions and/or conclusions

- **Sticking \$50/te cost of carbon on oil & gas is unlikely to be an outcome of COP21**
- **The biggest “threat“ to oil demand and the Oil industry...is NOT \$50 oil or \$50/te carbon tax but the Lithium-Ion battery**
- **...and the biggest threat to the Natural Gas industry is...also the Lithium-Ion battery**
- Marginal costs of Li-ion for transport use already undercut oil, issue is high capital cost of vehicles- which history tells us will get fixed over time- and lack of rapid charging/charging network
- Impact on oil demand will come not from plug-in electric vehicles but combination of switch to gasoline-hybrids for small/medium vehicles plus behavioural change from separating car ownership from car usage- car clubs, Uber etc.
- When analysing renewables costs, you have to include battery storage costs too. Yes, “Grid parity” cost (cost < current electricity cost) or “Grid parity” (cost < transmission cost) is possible, but the limiting factor is not cost but Watts per m², and the majority of users will still have to have a grid connection
- **This is not just one fight for market share but two different fights: Oil vs Li-ion, Gas vs Renewables + Li-ion combo**
- **Gas is the consensus “fuel of the future” but there could be unappreciated competitive risks-** renewables could push gas up the cost curve (as we’ve already seen in Europe)

Disclaimer

Investing involves risk. The value of an investment and the income from it may fall as well as rise and investors might not get back the full amount invested. This is a marketing communication issued by Allianz Global Investors Europe GmbH, www.allianzgi.com, an investment company with limited liability, incorporated in Germany, with its registered office at Bockenheimer Landstrasse 42-44, 60323 Frankfurt/M, registered with the local court Frankfurt/M under HRB 9340, authorised by Bundesanstalt für Finanzdienstleistungsaufsicht (www.bafin.de).