Mountains or Molehills???

PARADIGM CHANGE
CAPITAL PARTNERS

In association with:

NORTON ROSE

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Executive Summary

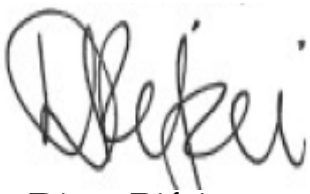
There is widespread concern about the massive investment needs in the UK power sector over the next decade. **Several studies have suggested financing requirements of up to £200Bn to meet the government 2020 carbon reduction targets.** This research note by Paradigm Change Capital Partners ('PCCP'), in association with Norton Rose takes a pragmatic view at the anticipated build out of the proposed renewable energy technologies, with some noteworthy conclusions:

- **The renewable energy binding government targets can be met with significantly lower capital deployment than assumed to date**
- **Considerable amounts of this required capital has in fact already been committed, further reducing the overall future need**
- **In contrast however, the intensity with which this capital will be needed could pose financing challenges**

The overarching concern therefore, is related not so much to the total volume of capital required, but to the timing and concentration of this requirement.

Acknowledgements

Many thanks to the participants of our roundtables, who through their excellent feedback, patience and generosity, provided key insights into the signficant current trends, strategic concerns and the elasticity of this young market. We are particularly grateful to Vivid Economics who supplied insights and analysis on the Committee on Climate Change's targets and capital recycling. We look forward to seeing you all again at our future events and welcome any further comments or questions.



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1. Introduction

The investment to finance the government's most ambitious targets for renewables, leads to a requirement of around £79 billion between now and 2020. This capital investment represents a build out of some additional 30 GW of renewable energy capacity, in line with the "stretch ambition" scenario of the Committee on Climate Change. The majority of this (c. 23GW) would be dedicated to on and offshore wind.

According to our analysis, the actual binding commitment, as per the European Commission 2009[1] legislation and UK Climate Change Act[2]**, can be met with 19 GW of additional renewable energy capacity**. This **would require total construction capital of £51 billion** leading up to 2020, not taking into account any recycling of capital in the intervening time, which would contribute to reducing this number further.

Nonetheless, this projection does not consider constraints such as regulatory uncertainty, planning, supply chain, infrastructure bottlenecks and labour skills shortage, amongst others, which could affect the timing with which the generation projects apply for construction capital, as well as the mix of technologies comprising the renewables build out.

Considering this profile for capital demand, availability of such capital could be further constraint due to issues such as the competition for capital from mooted nuclear investment, other countries vying for capital, as well as availability from traditional capital providers. Last but not least, there could be periods of time when there are compressed and concentrated high needs for capital, exacerbating these capital constraints.

This report analyses renewable energy investment projections and respective capital requirements by applying different "reality" filters to the stretch scenarios. The first section presents in more detail the government renewable energy aspirations, followed by Section 3, where we report our findings utilising an electricity market simulation analysis to meet the binding environmental targets. Section 4 and 5 look into more depth at potential operational obstacles and delays, while 6 details the actual costs of delivering the projected investment, followed by section 7's availability of capital.

[1] http://ec.europa.eu/clima/policies/brief/eu/package_en.htm
[2] http://www.decc.gov.uk/en/content/cms/legislation/en/content/cms/legislation/cc_act_08/cc_act_08.aspx

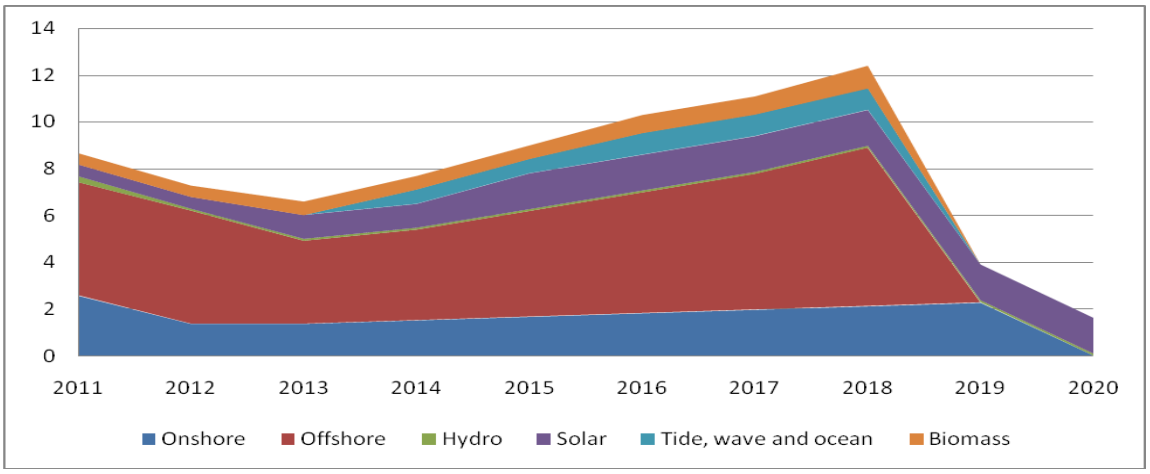
2. The Government's Ambition

If the UK is to meet the objectives of policymakers[3], the gross investment requirement for UK renewables - from 2011-2020 - will be in the region of £79 billion. The programme would deliver 30 GW of grid connected renewables and the offshore grid transmission network. This estimate is lower than many numbers regularly touted with respect to the UK's low-carbon investment needs, partially due to its pure focus on renewables (along with the offshore transmission network). Other numbers variably include for instance, onshore network investment, CCGT, CCS, nuclear and renewable heat.

Those targets envisage a steady ramping up of investment throughout the decade. The implied average annual investment in the early years is estimated at less than £7.5 billion, but could reach more than £12.5 billion per annum towards the end of the decade.

Offshore and onshore wind dominate the investment programme. The delivery of an additional 12 GW of offshore wind would require more than £39 billion of investment, c.50% of the total. A further £17 billion would be required to deliver the domestic onshore wind programmes, with the remaining £23 billion going to biomass, tidal, solar and hydro.

Figure 1 Gross investment in UK renewables to 2020 is estimated at £79bn[4]



Source: Vivid Economics

[3] The calculations are based on the roll-out of on-shore and off-shore wind as envisaged by the UK's Committee on Climate Change, construction of an offshore transmission network consistent with these targets, in addition to the investment in other renewables as set out in DECC's National Renewable Energy Strategy.

[4] The profile of £bn investment in this, and all the figures, reflect when capital would need to be committed. The drop in investment observed from 2018 is due to the fact that commitments to investments needed to meet 2020 targets will have been made by then. We have excluded overlapping commitments needed for build out beyond 2020.

3. Market Driven Investment

The previous section presents a particularly ambitious renewable energy target, which aims at stretch goals, rather than what the binding legislation demands. The Climate Change Act 2008 legislates that the UK reduce greenhouse gas emissions by 80% compared to 1990 levels, by 2050[5]. The EU Directive 2009/28/EC on the promotion of the use of energy from renewable sources requires that the UK increase its share of renewables in gross final energy consumption to 15% by 2020. DECC's Renewable Energy Strategy (RES), indicated that in order to meet this energy target, 30% of electricity generation would need to come from renewable sources by 2020.

PCCP's generation investment market model[6] has been utilised to evaluate which investments are likely to be made in the UK's renewable energy space given current incentives[7], while meeting the aforementioned binding carbon and renewable energy constraints. Not taking into account supply chain, planning and capital constraints, the model predicts that **current incentives will likely deliver around 19 GW of new renewable capacity by 2020, allowing UK to comfortably meet its policy targets. The total renewable energy investment requirement for this scenario - including offshore transmission – drops considerably to c. £50 billion from c. £80.**

The model simulates profit maximising plants operating within a competitive electricity market, as well as their investment and decommissioning decisions. **For renewable energy in particular, investment decisions are optimised between the various technologies, by taking into account the ROC banding, availability of resource (especially for wind) and local fixed costs, amongst other variables**. Subsidy availability is assumed to be in effect until the environmental targets are met.

Market-led investment is again dominated by wind. Capacity in on-shore and off-shore wind would each increase by about 8 GW respectively, while solar and biomass would contribute 2GW and 1.6GW respectively (please see data annex for a more detailed breakdown).

Unlike the government assumptions, where investment deployment is incremental and smooth, our market model investment path is more front-loaded. **Almost 70% (figure 2) of**

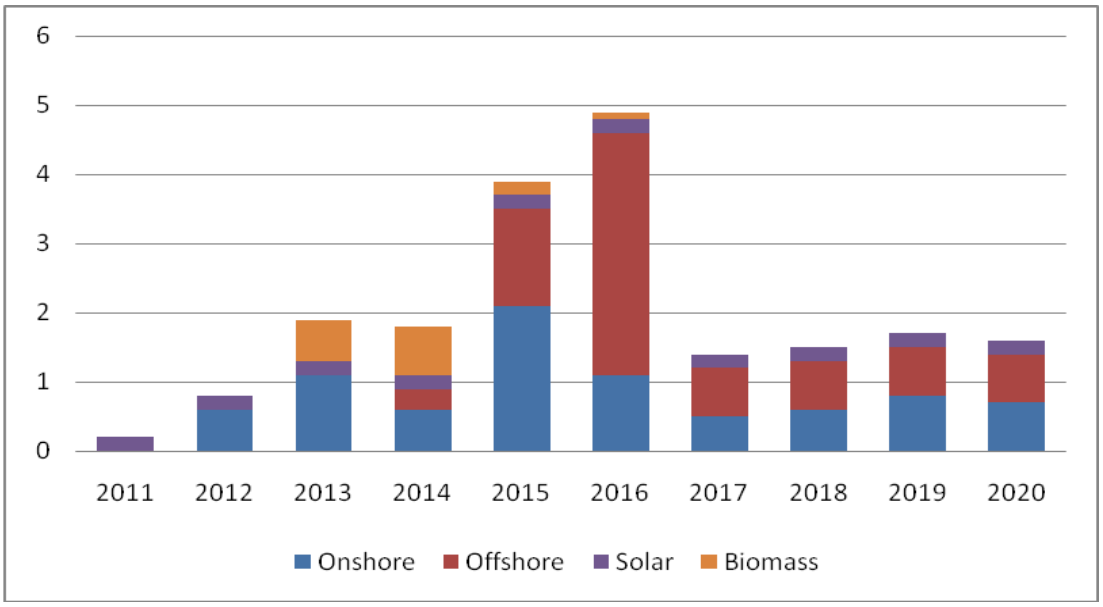
[5] The Act provisions for 5 year carbon budgets so as to meet this target and the 2008-2022 carbon budgets were implemented through the Carbon Budgets Order 2009. The Low Carbon Transition Plan (LCTP) published by DECC in July 2009 breaks down these carbon budgets into sectors.

[6] Our main assumptions are in line with the DECC Electricity Market Reform Analysis of Policy Option report

[7] Centred around the current Renewables Obligation Certificate scheme and a carbon price signal based on DECC carbon price projections

the investment program would be delivered before 2017, which implies that significant capital would need to be committed well before that. Furthermore, given that offshore wind represents around half of the new investment, the offshore grid would also need to be developed, significantly increasing the total cost.

Figure 2 Market Model Renewable Generation Investment Projections (GW)



Source: Paradigm Change Capital Partners

4. On The Ground Realities

The PCCP market model assumes on-time delivery of new generation capacity. This section considers each technology's potential for delivery and therefore its actual probability for investment, given operational realities.

- **On-shore wind:** In the case of on-shore wind, there are continued difficulties with the planning regime. On-shore project developers assume no more than a 50:50 chance of getting planning consent, slightly higher in Scotland and Wales and lower in England. Consequently, the market may not be called on to finance the 8 GW envisaged under the market scenario. That being said, around 5GW of new onshore wind farms are already under construction or have been consented and 7GW are in planning[8]. Many projects are relatively small "in-fill" operations for which development / planning risks are disproportionate. Of the 5GW, 1.4GW are already under construction and it is likely that developers will proceed with the majority of the remaining 3.65GW already consented. These will most likely be financed under the current Renewables Obligation regime. Beyond this, UK developers will increasingly face planning difficulties, as well as competition for finance with projects elsewhere in Europe and worldwide. This makes it particularly difficult to predict what proportion of projects under planning will be constructed. If however, we assume the normal average of 50:50 is applied to the 7GW in planning, then the 3.5GW which should get built will, in addition to the current 5GW, slightly exceeding the required 8GW.

- **Biomass:** The biomass target of 1.6 GW in the market scenario is relatively modest and could easily be surpassed if biomass co-firing were made attractive for large coal-fired generators like Drax[9]. However, there is nervousness about currency and feedstock risks, including whether there are enough sustainable feedstock sources. It is also possible that the government might tilt the incentive structure in favour of renewable heat, which will give biomass a distinct advantage as there are fewer low carbon technology alternatives in this space.

- **Solar PV:** The positive response to the new feed-in tariff regime, and the experience in Germany, suggests this target of 2GW may be achievable with the right policy support. The government has recently put the system under review however, and is anticipated to reduce the FIT subsidy to residential level installations around 50KW or less. This would make solar PV more of a retail finance business, attractive to large-scale investors only if projects can be aggregated.

[8] Source: http://www.bwea.com

[9] In fact around 1GW of biomass might be delivered by Drax power alone as recently indicated

- **Off-shore wind:** The market players appear ready to finance the 7.7GW of off-shore wind and its transmission envisaged under the market scenario. With sufficient price incentive - equivalent to the current ROC arrangement – as well as assurances regarding both transmission capacity and supply chain bottlenecks, there may be appetite to build well beyond the 7.7GW by 2020. Given the constraints of the other technologies offshore wind might be required to act as an absorbent substitute. From the 7.7GW of offshore projected, some 4GW[10] are already under construction or have been approved. Our research indicates however, that capital has been committed for some 3GW already, implying that only a further 4.7GW would need to be financed, in addition to funding for development of the offshore transmission system.

- **Tidal and Wave/Hydro:** These three technologies are not expected to deliver a significant amount of carbon reduction before 2020, due to size restrictions (hydro) and immature technologies (tidal/wave), albeit tidal and wave have considerable potential past 2020.

[10] www.bwea.com

5. Time Profile of Capital Commitment

Whereas the total renewable energy generation requirements seem achievable by 2020, we have identified several factors which could converge to lead to a spike in the demand for capital:

- **Supply chain and infrastructure constraints** in the form of ports, vessels, wind turbines, PV installation companies, onshore grid upgrades and offshore sub sea cables, biomass feedstock and others, could act as potential delays to renewable energy investment and deployment. This might push construction and therefore investment required closer to the 2020 target deadline.

- **Electricity market reform (EMR) -** Although designed to support low-carbon investment, the details of the reform package have yet to be determined and communicated to renewable energy and finance constituents. This is conversely acting as an incentive for developers and financiers to rush construction, in order to take advantage of the mooted grandfathering of the current ROC regime till 2017. This is due to participants' familiarity with this mechanism as well as the certainty of handsome remuneration under current subsidy levels. This scenario could be derailed should the government decide to stretch the grandfathering out further, albeit that would only provide a year or two more of leeway. Additionally, the remuneration is up for review at the moment and although it is anticipated that current levels will prevail, a serious cut would disincentivise the rush to build, as the market decides to await the new regime.

- **There is ongoing conjecture regarding the intent of this government to enable the build out of nuclear power, with the DECC report suggesting that some 1.6GW will come online by 2019**. Should that be the case, European utilities, currently the largest investors in this technology, would face competition within their balance sheet vis-à-vis their commitments to renewable energy and particularly offshore wind. Coincidentally, they would be looking to commit this substantial capital for nuclear in 2013-2014, potentially further exacerbating the competition for capital during that time period.

- **In addition, and with the globalisation of capital movement, providers to the UK of various types of funding could see a call on that resource from other countries and regions which could offer equal, if not more attractive returns.**

- **At the writing of this report, there are a limited number of investors who understand this space - particularly newer technologies such as offshore wind – and are willing to commit large sums to its construction.** With the anticipated spike in capital demand occurring with such a short lead time (2013), there is some doubt as to the number of

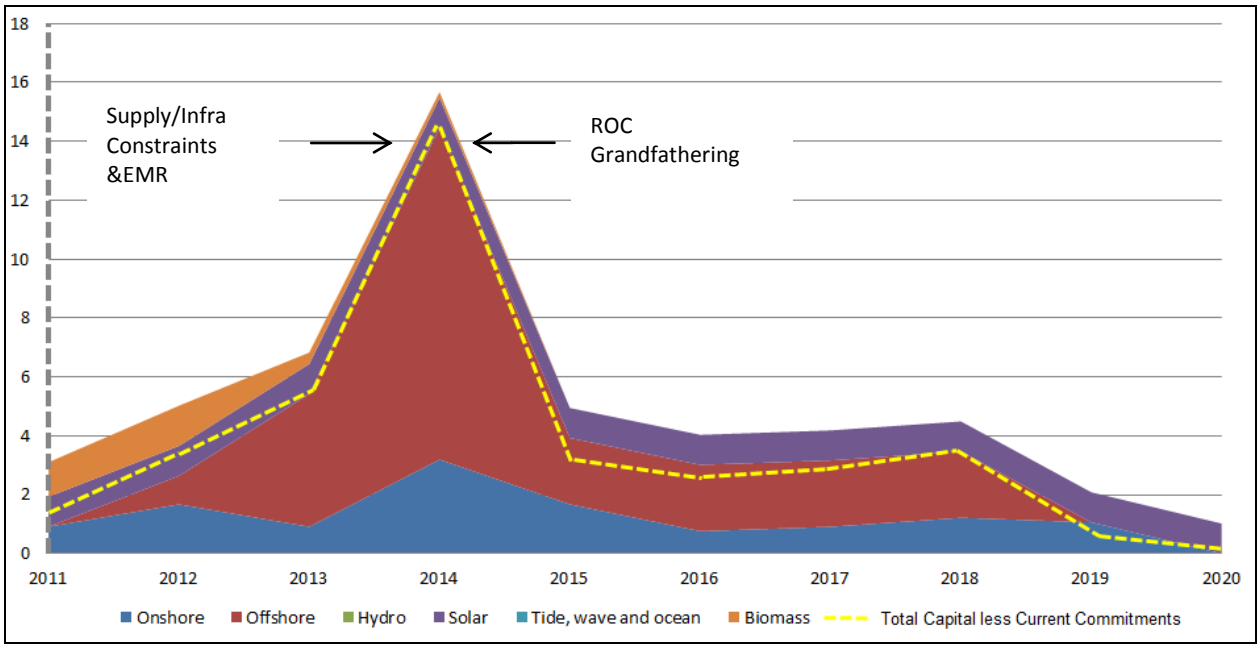
new investors who will have come up to speed sufficiently to invest in this capital intensive and somewhat unproven technology.

- **One mitigating, if challenging to quantify factor which could contribute to relaxing the spike, is the potential for capital providers to sell off existing assets and recycle their capital into new projects by 2013, thereby relieving the pressure for new and additional funds.**

6. Capital Allocated vs. Required

Taking into account the lead time of projects and the fact that capital needs to be committed around 1-2 years before construction starts, depending on the technology, our analysis suggests that capital demand will exhibit a large spike between 2013 and 2015, as Figure 3, illustrates:

Figure 3 Market Model Renewable Generation Funding Requirements (GW)



Source: Paradigm Change/Vivid Economics

The total funding requirement during this spike, based on the market model, is c. £27.5bn.

Nonetheless, as previously highlighted, there is significant capital which has already been committed for both under construction / consented onshore and offshore wind projects. According to our assumptions, this committed capital amounts to c. £14.5bn. Consequently, the yet uncommitted capital required for the remaining construction drops further to £36.6bn. With this scenario, the funding need during the spike from 2013 – 2015 totals £19.6Bn (yellow dashed line in Figure 3).

Two further issues need to be taken into consideration that will affect the capital requirement profile: the recycling of capital post construction, as well as the capital required for domestic energy efficiency.

Although it is difficult to quantify the exact percentage in advance, we believe there is scope for some recycling of capital post construction, which could be invested in subsequent projects. This amount could be significant depending on the gearing level (for both construction and operation) and re-investment assumptions, based on the attractiveness of

competing investments at the time of capital release. Even assuming a small percentage gets ploughed back in could smooth out the capital commitment profile.

Domestic energy efficiency capital requirements to 2020 are c. £17.6bn but the investment profile is smoothly spread across the decade. Furthermore, it should be noted here that similarly to solar, energy efficiency will be a retail finance business and although the total amount is significant it is not expected that it will be competing for capital with renewable generation, due to its differing investment profile and investor base.

7. The Supply of Capital

Capital Providers

There are several parties who provide finance across the lifecycle, as well as the capital structure, to ensure the successful build out of renewable energy assets. While many investors do have a leaning towards regulated assets, when these assets are capital intensive and the technology is still in the earlier stages of being proven, such as offshore wind, the providers become more limited. At the moment, the providers in the UK are:

- **Utilities and independent developers** – These two parties provide the equity capital required to bring a project through the early stages to the construction phase. Depending on the order in which certain milestones are achieved, they could choose to start building utilising entirely their own balance sheet, later bringing banks into the financing cycle to bear the remaining construction costs and drawing some of their equity out over time.

- **Private Equity / Infrastructure Funds** – These players have not generally been a major contributor of capital to the bulk of offshore wind construction, due to the unproven nature of this technology. They have however been actively involved in providing equity, both in the construction and operational phase, for primarily utility scale onshore wind and solar.

- **Banks** – They currently provide a bulk of the construction costs, which vary for the different technologies, with onshore wind attracting a higher percentage of debt for instance, than offshore. When providing debt to offshore farms in the construction phase, banks have generally required more reassurance and guarantees from the equity providers and sponsors, vis-à-vis that to onshore farms.

- **Pension Funds** – There have been exceptional instances of pension funds directly taking stakes in offshore wind farms and providing equity capital, albeit generally where they are teaming up with a strong operating partner. Furthermore, the conditions under which they have provided this capital have been quite distinct, unique and risk averse. Conversely, they have invested in several cases in portfolios of the more mature technologies such as onshore wind, solar and transmission. There is much talk about these entities participating heavily in this asset class in the future, however our extensive conversations with them indicate that a higher degree of comfort, education and risk assessment has to be achieved before such wholesale involvement.

- **Other** – A range of parties in the supply chain, such as manufacturers, EPC providers, ECAs, multilaterals and others provide temporary, bridge,

equipment finance and funding support during various parts of the procurement and construction which allow projects to proceed.

Amount of Capital Available

Utilities & Developers

With respect to the UK, where offshore wind is the predominant preference for fulfilling its 2020 targets, the field has primarily been led to date by utilities, who have had the balance sheet and expertise to carry out these large scale, complex projects. Going forward however, these utilities find themselves stretched on several fronts and confronting three competing priorities:

- Equity dilution – Most utilities, while eager to grow their equity base to invest more widely, are restricted due to investor negativity regarding EPS dilution, amongst other factors.

- Credit rating concerns – Most are also currently at, if not near the amount of debt they can access on balance sheet without jeapordising their credit rating. As a result, they are constraint in the amount of debt capital they can raise and deploy.

- Divestments – There have been a slew of divestments by large utilities, however they have not been an exercise in de-levering balance sheets and strengthening cash position, so much as a desire to cycle out of low yielding assets, into higher yielding ones. This focus has been concentrated on moving into emerging markets, rather than emerging technologies.

- Some figures nonethelss estimate a high end of £45Bn of dry powder potentially available on aggregate utility balance sheets for investment globally. However this amount is an estimate and only a portion of it will be deployed in renewable energy in the UK. Additionally, recent large commitments for projects in the pipeline (such as London Array, the Walneys and Lincs) will have soaked up a considerable amount of this sub-capacity.

- Independent developers – Have been more active in the onshore wind sector where they have successfully provided equity capital for portfolios of projects later sold to utilities or private equity. Going forward they will continue to provide capital for a pipeline of onshore projects, as well as acting as smaller partners in bidding with the utilities in consortia for offshore projects. We don't anticipate that more than a broad estimate of c.£500mm will come from this constituency over the next 9 years.

Private Equity / Infrastructure Funds

Private equity is still quite cautious about offshore wind, having been a bigger participant in onshore wind and solar so far, on a European wide basis. Increasingly, they are considering biomass and offshore wind, although these investments don't seem likely to begin occuring before 2014. Even then however, private equity's deployment will occur in very selective projects with strong partners. Infrastructure funds however, are populating rapidly with several focussed exclusively on renewable energy and we anticipate several billion of investment from them, particularly in transmission, as well as operational generation assets.

Banks

Banks are increasingly facing constraints on the amount of long term, lower rated debt they can hold on balance sheet, which forms the majority of loans to renewable energy projects. The approaching Basle 3 regulations and higher ROE requirements are the main drivers of this shift. This will increasingly lead to banks taking a pure agency role, originating and thereafter bundling the debt off to capital markets, the investors of which will most likely be the pension funds, with the support of multilaterals.

Pension Funds and other insitutional investors

Pension funds have $28 trillion in funds under management globally, a very small portion of which can be allocated to this space. Nonetheless, this can be a significant amount in total volume terms. This type of investor has very defined investment criteria and requires considerable due diligence to get involved in an emergent asset class. Moreover, they are not a homogenous group acting singularly, but vary investment decisions according to size, location, type of mandate, risk appetite, underlying benefitiaries, etc. They will need to feel comfortable that they understand the types of risks involved and can quantify them, especially as they relate and correlate to other risks in the rest of their overall portfolio. They are largly predisposed to this sector however.

Overall, we do not see a serious challenge by these investors to supply the capital required, provided:

- The regulatory environment in the UK clarifies rapidly, offers stability and adequate remuneration versus other global opportunities and doesn't introduce complex and unfamiliar risks into the financing equation

- The spike gets smoothed out through recycling and potential extention of the ROC grandfathering, or through the rapid introduction of a new equally attractive regime

- The supply chain and other operational constraints are resolved in a timely manner

A note of caution: We flag a warning sign for the years following 2020 and out to 2050. Post 2020, in particular, will be where the majority of the most challenging low carbon projects are executed. It is expected that offshore wind will to move into significantly deeper waters, CCS will potentially come online, with nuclear to pick up pace. All three of these technologies are hugely capital intensive, are in some instances still unproven and have unknown cost structures. The 2020 target is met with the low hanging fruit, however post 2020 is the true challenge, one which we will be actively investigating to determine when and where there might be capital constraints.

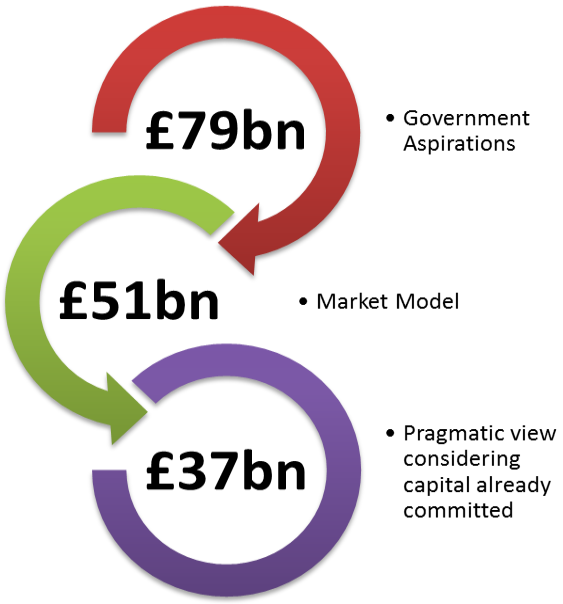
8. Conclusions

Over the last six months, there has been a plethora of intimidatingly large numbers bandied about regarding the renewable energy investment required to meet UK government 2020 target. This report submits that the number, when looked at from an economic, market, operational and realistic build out perspective, taking into account what has been committed to date, yields a very different and much milder picture (figure 4).

One of our key conclusions is that it would only require an additional 19GW of renewable energy to meet the 2020 targets in the most cost efficient manner, entailing some £37Bn in additional required capital commitments (or £54Bn including domestic energy efficiency).

A further conclusion is that barring any unforeseen developments, there is a strong likelihood of having a condensed requirement for capital between 2013-15. This would have the effect of raising the cost of capital, impacting the investment horizon and returns (and therefore the decision to invest) for supply chain participants, as well as creating a serious burden on market particpants and the grid planning process. We hope that higlighting this scenario will galvanise participants to contemplate ways to circumvent it.

Figure 4 Committed Capital Requirement Waterfall (£Bn)



Annex: Data Tables

Additional capacity under Government Stretch Ambition (GW)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Onshore	0.8	0.9	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.5	11.0
Offshore	0.5	0.7	0.9	0.9	1.1	1.2	1.4	1.6	1.8	2.1	12.2
Hydro	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4
Solar	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	2.6
Tide, wave and ocean	0	0	0	0	0	0.2	0.2	0.3	0.3	0.3	1.3
Biomass	<0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	2.6
Total	1.5	1.8	2.2	2.2	2.7	3.1	3.4	3.9	4.2	4.7	30.1

Additional capacity under Market Response (GW)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Onshore	0.0	0.6	1.1	0.6	2.1	1.1	0.5	0.6	0.8	0.7	8.2
Offshore	0.0	0.0	0.0	0.3	1.4	3.5	0.7	0.7	0.7	0.7	7.7
Hydro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solar	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.7
Tide, wave and ocean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biomass	0.0	0.0	0.6	0.7	0.2	0.1	0.0	0.0	0.0	0.0	1.6
Total	0.2	0.8	1.8	1.7	4.0	4.8	1.3	1.5	1.6	1.6	19.2

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