Dialogue on a RES policy framework for 2030

towards2030

Policy Brief

The implications of selected external factors for EU RES policy

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About the project

The aim of **towards2030-*dialogue*** is to facilitate and guide the RES policy dialogue for the period towards 2030. This strategic initiative aims for an intense stakeholder dialogue that establishes a European vision of a joint future RES policy framework.

The dialogue process will be coupled with in-depth and continuous analysis of relevant topics that include RES in all energy sectors but with more detailed analyses for renewable electricity. The work will be based on results from the IEE project beyond 2020 (www.res-policy-beyond2020.eu), where policy pathways with different degrees of harmonisation have been analysed for the post 2020 period. **towards2030-*dialogue*** will directly build on these outcomes: complement, adapt and extend the assessment to the evolving policy process in Europe. The added value of **towards2030-*dialogue*** includes the analysis of alternative policy pathways for 2030, such as the (partial) opening of national support schemes, the clustering of regional support schemes as well as options to coordinate and align national schemes. Additionally, this project offers also an impact assessment of different target setting options for 2030, discussing advanced concepts for related effort sharing.

Who we are?

Vienna University of Technology, Energy Economics Group (EEG), Austria *(Project coordinator)*
Fraunhofer Institute for Systems- and Innovations Research (Fraunhofer ISI), Germany
Energy Research Centre of the Netherlands (ECN), Netherlands
Center for European Policy Studies (CEPS), Belgium
National Technical University of Athens (NTUA), Greece
Consejo Superior de Investigagiones Cientificas (CSIC), Spain
Ecofys Netherlands and affiliates (Ecofys), Netherlands
REKK Energiapiaci Tanacsado Ltd (REKK ET), Hungary
European University Institute, Florence School of Regulation (EUI), Italy

Introduction

This policy brief considers the implications of four external factors for the future evolution of EU renewables policy[1]. In particular it assesses whether the developments that are expected in these areas support the argument for increasing or at least maintaining the ambition levels of EU renewables policy. The factors considered are:

- the global cost of renewable energy
- the role of nuclear energy in the EU
- global fossil fuel and CCS prospects
- carbon pricing outside the EU

The brief is an output from Work Package 6 (WP6) of the Towards2030-dialogue project. The project seeks to stimulate and enable an informed and useful dialogue among key stakeholders about the 2030 renewables policy framework for the EU; the focus of WP6 is on the impact of major external influences on the evolution of that renewables policy framework. This policy brief builds on four issue papers developed as part of WP6[2].

How external factors influence EU renewables policy

EU renewables policy sits in the context of the EU's wider climate and energy policy framework. The vision of this framework is to create:

"*a low carbon economy which ensures competitive and affordable energy for all consumers, creates new opportunities for growth and jobs and provides greater security of energy supplies*"

How ambitious the EU should be when setting its renewable energy policies depends on the extent to which renewable energy is able (or is necessary) to help achieve this vision. The four 'external factors' listed above all have implications for this, in different ways, and therefore the developments that are expected in these four areas should be taken into account in dialogues about the future of EU renewables policy.

The following sections of this brief cover the four factors in turn. A brief summary of the recent history, current status and expected future trends for each factor, as presented in the relevant WP6 issue paper, is followed by discussion of the possible implications for EU renewables policy, taking into account the four objectives contained in the EU's broader climate and energy vision, as quoted above. The four objectives are:

- Decarbonisation (necessary to create "a low carbon economy")
- Competitive & affordable energy for all consumers
- New opportunities for jobs and growth
- Security of energy supplies.

The goal of the brief is to assess the extent to which renewable energy sources (RES) can contribute to the achievement of these objectives, or are necessary to achieve them, and thus whether a positive case can be made for high ambition in EU renewables policy, based on the anticipated evolution of the external factors covered. This brief does not attempt to present the relative merits of RES versus other decarbonisation options; these are already well known and amply discussed elsewhere. Instead the goal of the brief is to consider what the outlook for these external factors means for the EU's approach to RES policy. Do the expected trends argue for greater ambition with RES, or do they suggest caution or even a smaller role for RES?

[1] External in that they are external to EU renewables policy

[2] The issue papers are available at: http://towards2030.eu/the-project/results

The brief focusses only on the implications for RES within the electricity sector, and does not consider the implications for other uses of RES (e.g. for heat or transport) or for alternative measures such as energy efficiency.

Global cost of renewable energy[3]

Global RES capacity has grown very substantially over the last decade, increasing from around 100GW in 2004 to c. 660 GW by 2014. Wind and solar have been the main engines of growth, as can be seen in Figure 1.

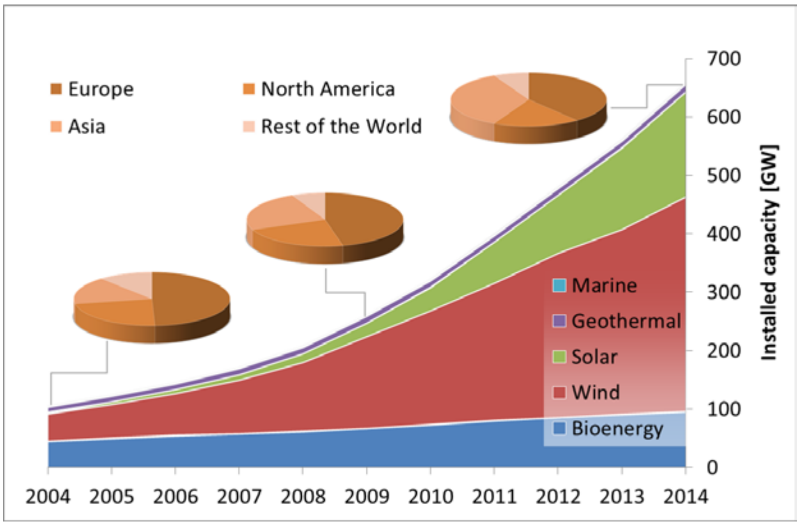

Figure 1: Global installed RES capacity, excluding hydro, and regional share. (Source: IRENA, 2015)

Europe has the largest share of overall RES capacity but recent growth in China has been so rapid that for some technologies, such as onshore wind, China now has the most capacity deployed.

The growth in capacity deployed has been accompanied by a steady reduction in the costs of most renewable energy technologies. These cost reductions have resulted from a combination of learning by doing (e.g. improvements in know-how based on cumulative experience) and from specific innovations that reduce costs or increase productivity. While the overall trend is clearly one of cost reduction, for certain technologies there have been periods of cost increase; in the case of offshore wind for example, progress towards deeper water sites has led to some cost increases. But for the two most important technologies for EU renewables – solar PV and onshore wind – the overall picture is of steady cost reduction with grid parity increasingly possible in better sites.

Turning to the future, further cost reductions are expected in both solar PV and wind (and indeed in other RES). For solar PV, the expectation is that the cost of the PV module (which accounts for 50-60% of total PV system costs) will continue to reduce at similar rates to those seen historically. Combined with cost reductions in other parts of the PV system and technical improvements from innovation, this will lead to continued overall cost reductions for solar PV. Figure 2 shows one estimate of this, from the IEA:

[3] For the original WP6 issue paper on global RES developments see: http://towards2030.eu/sites/default/files/Towards2030-dialogue%20Issue%20Paper%20on%20Global%20RES%20and%20Technology%20Learning%20-%20Issue%20Paper%20%2312.pdf

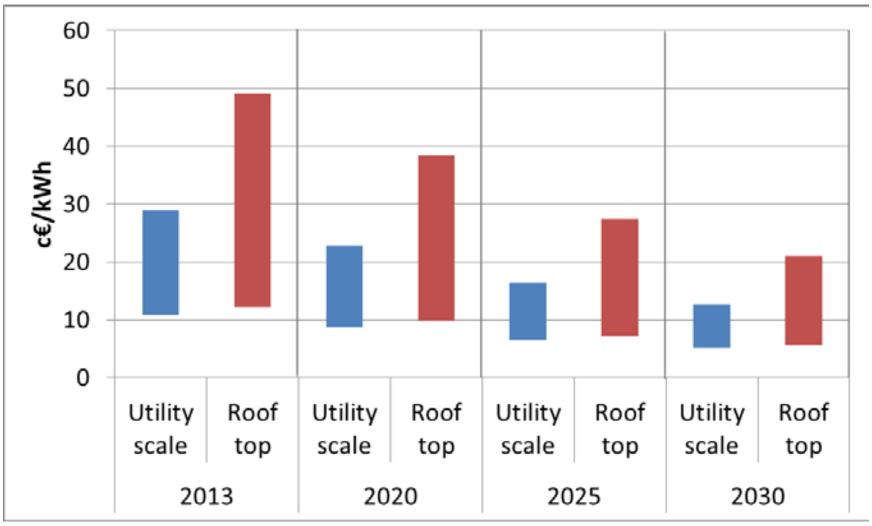

Figure 2: Projected cost of energy from utility scale and roof top solar PV to 2030 (Source: IEA, 2013)

Although recent cost reductions in onshore wind have not been so pronounced as for PV, significant future cost reductions are also expected for onshore wind. The IEA projects that the cost of energy from onshore wind will fall by 26% by 2050, with offshore costs falling by 52% over the same period[4]. The main driver of these cost reductions are technical innovations in the various components of the wind energy system, along with cost reductions in installation and O&M.

Implications for EU renewables policy

It seems obvious that developments in the cost of RES would have important implications for the role of RES in the EU's energy system (and in its response to climate change). Taking each objective in turn, the likely implications are as follows:

- Decarbonisation – the steady growth of global RES capacity, the technical improvements and the expected future cost reductions all support the argument that RES are an important and reliable way to reduce emissions (where the relevant renewable resources are available – as they are in Europe). From the point of view of the overall decarbonisation objective, the recent and expected trends make a positive case for an ambitious approach to RES.
- Competitive & affordable energy – as the costs of RES reduce in the future, and as they more consistently reach parity with fossil fuel dominated grids, the ability of RES to support the EU's objective of competitively priced and affordable energy clearly increases. The 'competitiveness' aspect of this depends largely on the pricing of energy in the EU's trading partners, who generally will have access to cheaper RES too. Compared to those countries who don't have renewable resources or choose to focus on other energy sources, cheaper RES will support increased competitiveness.
- New opportunities for jobs and growth – whether the EU is able to create new growth opportunities from improved, cheaper RES depends on where the innovations happen. If it is EU RES firms driving the innovation then this should create more jobs and growth for the EU. If the innovation happens overseas then the EU will capture less of the new opportunity, although the EU is likely to benefit from jobs and growth resulting from parts of the supply chain that locate in the EU.
- Security of energy supplies – having lower cost RES available in the future increases the pool of affordable energy options, which in turn enables increased diversity of supply. This is positive for energy security (technical issues such as intermittency or grid integration challenges are not considered here).

[4] IEA Technology Roadmap for Wind Energy (2013)

In summary, for three of the four objectives, the expected future development of RES costs is clearly supportive of an increased role for RES in the EU. This should hardly be surprising: RES are already established as a part of the energy system, and further cost reductions should support an enhanced role. Only in the case of the creation of new jobs and growth is the picture more mixed, but even here, it is likely to be broadly positive for the EU, and certainly not strongly negative.

Nuclear in the EU[5]

The second external factor considered in this brief is the outlook for nuclear energy in the EU. Nuclear energy's recent history in the EU is complicated and its outlook seems uncertain. It accounts for a major share of EU electricity production (28% of the EU's electricity is from nuclear), but much of the capacity is concentrated in one country (50% of the EU's nuclear capacity is in France, where it provides c.75% of power supply). 14 Member States currently operate nuclear plants, with several more states planning their first plants. The majority of Europe's reactors were built before 1990 and the average age is now over 30 years. Without life extensions or replacements, total nuclear capacity in Europe will therefore decline from around 120GW to c. 20GW by the 2040s.

New nuclear is a controversial issue in Europe today. Anti-nuclear voices were strengthened by the Fukushima disaster in Japan in 2011, which prompted Germany to plan the total phase out of nuclear from its energy system. In addition to concerns over nuclear safety, there remains the significant challenge of dealing with nuclear waste. The cost of nuclear energy also faces increasing scrutiny and challenge. In contrast to the trend seen in renewable energy, the cost of nuclear energy has increased over the last two decades. This has been driven by the lack of standardization (each nuclear plant is fairly unique compared to other technologies that have reached maturity) and by increasing safety requirements from nuclear industry regulators.

The two nuclear plants currently under construction in Europe (Olkiluoto in Finland, and Flamanville in France) are years behind schedule and costs have ballooned far beyond original estimates. Hinkley Point C, the first of the UK's planned new nuclear plants, was finally given approval in September 2016 but the project has been widely criticized for the very high cost of energy locked in for several decades. Against this backdrop, the outlook for nuclear in Europe looks highly uncertain. There is no serious expectation of substantial cost reductions in the short to medium term, and any further incidents – wherever in the world they occur – would lead more countries to question whether nuclear is a safe and sensible solution.

Implications for EU renewables policy

The interaction between the outlook for nuclear and the role of renewables is different in nature to the previous interaction considered in this brief, which centred on expected developments in the costs of RES. In this case, an alternative technology is the focus, and the implications are correspondingly different.

- Decarbonisation – decarbonisation of the energy system will be achieved through a combination of options. For the electricity sector, the uncertainty over the future role of nuclear – and in some cases the decision to exclude it as an option – means that more will need to be achieved using the remaining generation options. For many countries, this will mean turning even more to renewables (as is the case in Germany following Fukushima). The outlook for nuclear thus reinforces the need for an ambitious policy approach for RES.
- Competitive & affordable energy – the outlook for nuclear does not suggest that cost reductions can be expected in the short to medium term. As a result, the objective to provide competitive and affordable energy for EU consumers is supported by greater deployment of other energy sources that offer cost reduction potential and which are reaching parity with current, high carbon options, such as RES.

[5] For the original WP6 issue paper on nuclear in the EU see: http://towards2030.eu/sites/default/files/The%20role%20of%20nuclear%20power%20in%20the%20EU.pdf

- New jobs and growth – the ability of RES to support this objective is not directly affected by the outlook for nuclear (beyond the implications described for this objective in the RES costs section above).
- Security of energy supplies – as with the decarbonisation objective, an uncertain outlook for nuclear and concerns over its cost both support a greater role for diverse RES to increase the diversity of EU energy supplies.

The overall implication of the outlook for nuclear is that the EU is likely to have a greater need for RES to achieve its climate and energy objectives. This too is not surprising: if one of an already small set of options turns out to be less attractive, more will be required of the remaining options. The next section considers the implications of the outlook for another alternative to RES – fossil fuels and CCS.

Global prospects for fossil fuels and CCS[6]

The third external factor considered in this brief is the outlook for global fossil fuels and for CCS. This area is more complex than the other external factors considered in WP6 and in this policy brief. The issue paper on which this section is based notes the difficulty of predicting global fossil fuel trends and highlights as an example the high degree of variance seen between historical projections of global oil prices and what actually occurred. In other words, it seems to be harder to predict the future for global fossil fuel markets than it is for RES costs and nuclear (which is not to say that predictions for those topics should be treated as certain). It is correspondingly harder to make clear assessments of the implications for RES policy; notwithstanding this, the issue paper anticipates future demand for coal and oil to be considerably lower than that predicted by the IEA.

Anticipating the future for CCS is less challenging, as it is a single technology (or family of closely related technologies), rather than a multi-fuel global market greatly affected by (also uncertain) economic and geopolitical forces. This brief therefore focusses on the outlook for CCS. Furthermore, continued use of fossil fuels as the backbone of the global (and the EU's) energy system will require widespread deployment of CCS if GHG emissions are to be kept within limits consistent with the Paris Agreement. So the availability – or otherwise – of CCS must be a crucial determinant of the future role of fossil fuels in Europe, whatever the dominant future trends in global fossil fuel markets turn out to be.

The WP6 issue paper on fossil fuels and CCS observes that small-scale post-combustion capture technology can be considered a proven technology, and pre-combustion and oxyfuel technologies will possibly be proven in the medium-term. Large scale application of CCS to power generation plants however has not been commercially proven. Progress towards the goal of several large scale full-system CCS demonstration projects has been slower than hoped, and has suffered setbacks from e.g. cancellations of major trials. Due to the limited practical experience available, estimates of the costs of CCS feature considerable uncertainty. The assumptions on investment and operating costs (especially the assumed capacity factors) as well as on future cost reductions that underpin some of the high profile studies on CCS seem overly optimistic, and the cost estimates are often partial in nature (i.e. certain costs are not included). Furthermore, there are questions about how much CO_2 remains in power plant emissions where CCS has been applied, especially in the case of coal power plants. The conclusion of the paper is that the outlook for power generation CCS may be considerably less promising than that put forward by the IEA and IPCC. As with nuclear energy, an uncertain outlook for a key energy sector mitigation option has important implications for RES policy, though in the case of CCS, deployment is likely to be relatively limited pre-2030 even in the most optimistic scenarios.

Implications for EU renewables policy

- Decarbonisation – if CCS proves to be more expensive than hoped, or less effective at CO_2 removal than assumed (and / or is available at scale only in the longer term, i.e. post-2030) then other decar-

[6] For the original WP6 issue paper on fossil fuels and CCS see: http://towards2030.eu/sites/default/files/Towards2030-dialogue%20Issue%20Paper%20on%20Global%20prospects%20for%20fossil%20fuels-with%20special%20reference%20to%20geopolitical%20externalities%20and%20CCS-Issue%20Paper%20%239%202016.pdf

bonisation options will be needed at greater scale to meet the EU's targets. This supports ambition towards RES (especially when combined with the outlook for nuclear).

- Competitive & affordable energy – electricity from RES will be more competitive if CCS turns out to be more expensive than current estimates, in which case the ability of RES to support the competitive energy objective is increased. This would support greater RES ambition. This relationship is complicated by what happens to fossil fuel prices, as these affect the cost of energy from CCS; if fossil fuel prices reduce – due for example to steadily reducing global demand in an ambitious decarbonisation scenario – then the competitiveness of CCS would be improved.
- Create new opportunities for jobs and growth – as is the case with nuclear, the ability of (or need for) RES to support this objective is not directly affected by the outlook for CCS (beyond the implications described for this objective in the RES costs section above).
- Security of energy supplies – an uncertain outlook for the availability and future costs of CCS supports a greater role for a range of RES to increase the diversity of EU electricity supplies. Price volatility in the underlying fossil fuels used in CCS power plants also affects the degree to which CCS can help achieve energy security.

Looking across the four objectives, the outlook for CCS – principally the uncertainty about availability and about the robustness of optimistic cost expectations – lends weight to the arguments for an ambitious approach to RES policy. The implications are similar to those for the outlook for nuclear, i.e. uncertainty about the degree to which these options can or should be relied upon supports continued ambition in RES policy, because the EU may need RES to play a larger role in achieving its climate and energy objectives. Indeed, with a qualitatively similar outlook for both CCS and nuclear, and the possibility that neither is well placed to support EU objectives, when considering all three options, it would seem prudent to boost efforts to support innovation and deployment of the option with least problems and greatest potential.

The evolution of carbon pricing outside the EU[7]

The final factor considered in this brief is the development of climate policy outside the EU, in particular the emergence of carbon pricing schemes. This is relevant because the perception of what other countries are doing on climate change influences how politically feasible (or not) it is to introduce ambitious climate and RES policies in the EU, and because the competitiveness of energy pricing is determined by factors influencing energy prices in key trading partners.

Carbon pricing schemes are being considered or implemented in around 40 countries and 20 sub-national regions around the world, however the issue paper on this topic focused on the development of carbon pricing in China and the US. These two countries are of particular importance to the EU, as together they receive 25% of EU exports, provide 28% of its imports, and account for 40% of total global GHG emissions.

China is moving quickly from a standing start on carbon pricing. There are seven carbon trading pilot schemes in operation across the country (covering five cities and two provinces), which were approved in 2011 and commenced trading between June 2013 and June 2014. The pilot schemes cover around 1.2bn tonnes of CO_2, making them the second largest scheme in the world, after the EU ETS. China is currently planning the introduction of a nationwide emissions trading scheme, now scheduled for 2017.

Conversely, the US has a long and successful history of the use of emissions trading (starting with sulphur dioxide), and has two sub-national schemes in place (in California, and in nine north eastern states covered by the Regional Greenhouse Gas Initiative). President Obama's flagship domestic climate change initiative, the Clean Power Plan, contains provisions to encourage and enable states to use carbon pricing as a mechanism in the future.

[7] For the original WP6 issue paper on carbon pricing outside the EU see: http://towards2030.eu/sites/default/files/Carbon%20Pricing%20Outside%20the%20EU.pdf

Both China and the US have thus made great strides on carbon pricing in the last 5 years, but the outlook in both countries features significant uncertainty. How their carbon pricing schemes evolve will be determined by a range of 'enabling factors' that will influence the pricing levels seen and the extent of scheme coverage. The most important of these factors are: the overall level of ambition in national climate policy; the strength of political support for carbon pricing at the national level; the country's prior experience with market mechanisms and the capacity of domestic financial institutions; the level of transparency and data reliability; and the degree of alignment between broader economic policymaking and use of market mechanisms.

The two countries are positioned quite differently as regards these key factors. China has made a firm commitment to implementation of a national scheme, and it is unlikely there will be much deviation from that plan. The key questions for China are how effective the scheme will be, given China's limitations in some of the key enabling factors such as experience with market mechanisms, financial institution capacity, transparency and data, and broader economic policymaking. These challenges could lead to a poorly functioning scheme, resulting in low carbon prices, limited environmental impact and low international relevance.

Carbon pricing in the US faces very different challenges. The necessary enabling factors are all strong in the US with the exception of political will to roll out carbon pricing. There is very strong political opposition to carbon pricing schemes in many Republican states, and also in Congress. The key question then is whether the US continues with a 'patchwork' approach featuring a small number of states, or moves to a federally imposed, nationwide scheme, covering a high percentage of US emissions. The latter scenario would lead to much greater equivalence with the EU ETS.

Figure 3 illustrates these scenarios for China and the US, showing evolution between 2010 and 2015 for the two schemes in terms of the level of pricing, % of emissions covered, and total size of the scheme. The EU ETS is included for comparison (just 1 scenario in which prices increase).

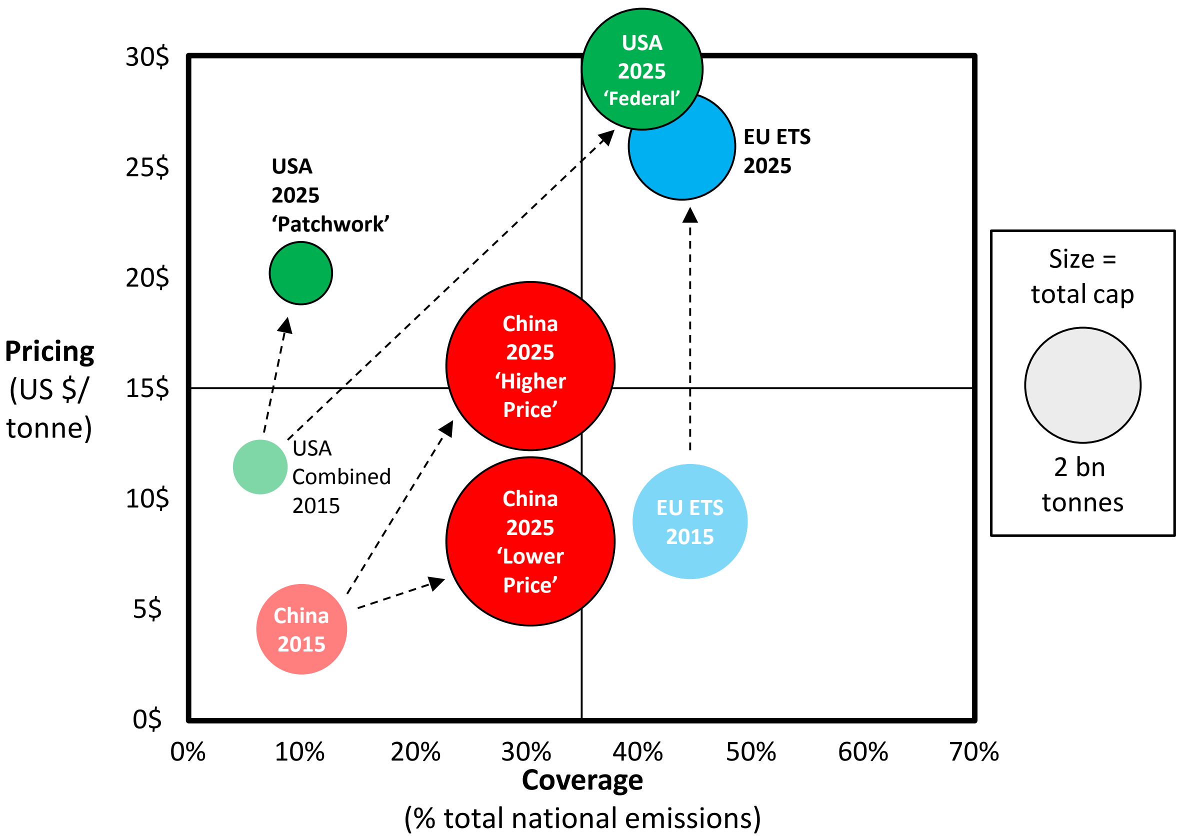

Figure 3: Potential scenarios for evolution of carbon pricing schemes in China and US (Source: original issue paper)

Whether the road ahead for carbon pricing is rough or smooth in either country, it seems likely that carbon pricing will only grow in scale, and thus relevance to the EU. China will introduce a nationwide scheme in 2017. California and the RGGI are committed to carbon pricing, and other US states have expressed interest in implementing carbon pricing. This growth in scheme relevance and 'equivalence' to the EU ETS, alongside the emergence of schemes in many other countries, has implications for EU climate and RES policy, as discussed in the next sub-section.

Implications for EU renewables policy

- Decarbonisation – as other countries, particularly key trading partners and leading global economies, put in place increasingly serious climate policies, and implement carbon pricing schemes, this makes it easier to introduce ambitious climate and renewables policies within the EU, as concerns that the EU is 'going it alone' are reduced. Greater ambition in other countries (as evidenced by increased adoption of carbon pricing) should also support greater deployment of RES globally, with positive effects for RES costs (as covered in the first factor discussed in this paper). Increased non EU carbon pricing should thus make it easier, and cheaper, to adopt RES. These implications would probably also apply to other decarbonisation technologies such as nuclear and CCS, all other things being equal (which they are not, as noted elsewhere in this brief).
- Competitive & affordable energy – more widespread carbon pricing in other countries, especially key trading partners and competitors, will increase the energy prices in those countries, thus creating a more level playing field and reducing any competitive disadvantage imposed on EU firms facing carbon prices that their international competitors are not exposed to. As with the decarbonisation objective this means that there should be less opposition to ambitious RES policy.
- Create new opportunities for jobs and growth – greater climate ambition and increased carbon pricing in other large economies could create demand for EU renewables firms, thus compounding the effects of ambitious RES policy within the EU to create new opportunities for jobs and growth. Equally, carbon pricing in other major economies may create demand for and incubate domestic firms within those countries, thus creating competition for EU RES firms. The implications for this objective are mixed, but in any case unlikely to be strongly negative.
- Security of energy supplies – the evolution of carbon pricing outside the EU has no significant direct implications for EU RES policy when considering this objective.

Overall, the implications of the growth of carbon pricing outside the EU are largely supportive for continued or increased ambition in EU RES policy. As with the other factors considered, this is not a surprising finding: as other countries adopt carbon pricing (and other accompanying climate policies), opposition to ambitious EU RES policies will soften, making them easier to put in place.

Summary: what do these external factors mean for EU renewables policy?

The outlook for four external factors is considered in this brief; in each case the implications for EU RES policy are found to be supportive of continued or increased ambition:

- The costs of two of the key RES for Europe – solar and wind – are expected to continue to fall. This will reduce the cost of decarbonisation and means that greater use of RES can deliver competitive, affordable energy while reducing price volatility and supporting creation of jobs and growth.
- The outlook for two important potential options for the decarbonisation of the electricity system – nuclear and CCS – features considerable uncertainty about the degree to which these options should be relied on and about their future costs. This supports ambition towards RES, on the basis that the EU may well have greater need of renewables to achieve its climate and energy objectives.

- The use of carbon pricing schemes in key trading partners (and other countries) seems set to grow, which should make it easier to implement ambitious RES policies, by reducing concerns about unilateral action and competitiveness.

The implications for each factor and objective are presented in summary form in the following table:

EU objective	Global RES development	Nuclear in the EU	Global FF & CCS prospects	Non EU carbon pricing
De-carbonisation	RES developments support major role	Unwise to rely on nuclear – need RES more	Unwise to rely on CCS – need RES more	Sign of global ambition; reduces anti RES lobbying in EU
Competitive & affordable energy	RES energy will be more affordable	Need RES more if nuclear costs increasing	Depends on FF prices	EU energy prices more competitive; reduced anti RES lobbying
New opportunities for Jobs & growth	Depends on e.g. where the innovations happen	No implications for RES role	No implications for RES role	May have more RES competition outside EU, but new opps too
Security of supplies	Increased diversity of affordable energy options	Nuclear a less promising option – need RES more	CCS a less promising option – need RES more	No implications for RES role

Table 1: Summary of implications for RES policy (green = supports RES ambition; orange = mixed; grey = no clear implications)

In summary, the outlook for these factors together suggests that an ambitious approach to RES will be less costly to the EU, that it is needed more, and that it will be easier to put in place.

EU RES policymakers should monitor developments in each of these external factors to inform strategic decisions about the role of RES and the level of ambition to pursue. If the future trend for these factors was expected to go in the opposite direction to those presented above (i.e.: costs of key RES increasing; nuclear getting cheaper and easier to deliver; CCS maturity imminent with certainty about costs; no carbon pricing progress outside EU), then this would present a clear challenge to the argument for an ambitious approach to RES.