Situational analysis of EU Renewable Energy legislation

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Abstract

In October 2014, the EU Heads of State and Government agreed to increase the EU's greenhouse gas reduction target to -40% by 2030. They also agreed to an EU level binding renewable energy target of 27% and 27% energy savings by the same date. Over the next years, the European Commission will have to present legislative and other initiatives to secure the implementation of these targets. The EU renewable energy directive is currently one of the main community level tools to further the planning and deployment of renewable energy in the Member States. Most likely, this directive will have to be reviewed and amended to accommodate the above-mentioned 2030 agreement.

This paper aims to apply a situational analysis tool to help answer the question on how EU renewable energy policy could be reshaped after 2020 as to further enhance renewable energy deployment in the EU and related Member State cooperation. It therefore seeks to assist policy makers with a forthcoming redesign of EU renewable energy policy.

The research identifies "internal" *strengths* and *weaknesses* of EU renewable energy legislation and relevant "external" and forward-looking *threats* and *opportunities*. The identification of these four elements is based factors, deemed relevant for the deployment of renewable energy and related cooperation between countries.

Once the internal strengths (S) and weaknesses (W) and the external threats (T) and opportunities (O) have been identified, a TOWS Matrix will be constructed. Heinz Weinrich developed the TOWS Matrix Situational Analysis tool in 1982. It aims to identify relationships between internal weaknesses and strengths and external threats and opportunities and is thus a tool that can assist in strategic planning.

The application of the TOWS matrix to EU renewable energy legislation leads to four strategies represented by a list of policy options. One of these four strategies consists of maximising the (use of the) opportunities by maximising the internal strengths. The other combinations lead to strategies that use strengths to minimise threats, minimise weaknesses by taking advantage of opportunities and minimise weaknesses to avoid threats.

1. Introduction

1.1. Goal of paper

This paper aims to apply a situational analysis tool to help answer the question on how EU renewable energy policy could be reshaped after 2020 as to further enhance renewable energy deployment in the EU and related Member State cooperation.

In October 2014, the EU Heads of State and Government agreed to increase the EU's greenhouse gas reduction target to -40% by 2030. They also agreed to an EU level binding renewable energy target of 27% and 27% energy savings by the same date. Over the next years, the European Commission will have to present legislative and other initiatives to secure the implementation of these targets. The EU renewable energy directive is currently one of the main community level tools to further the planning and deployment of renewable energy in the Member States. Most likely, this directive will have to be reviewed and amended to accommodate the above-mentioned 2030 agreement.

This paper seeks to help policy makers with the redesign of EU renewable energy policy by looking at the problem from different angles: the analysis of the current performance of the renewable energy directive, the challenges and opportunities that might arise in a future environment and how existing and future renewable energy is connected to other EU energy policies. To achieve this situational awareness a (for legislators) innovative methodology is applied.

1.2 Methodology and outline

The TOWS matrix is a strategic planning, and situational analysis tool for which the latter is the more prominent method to develop strategies. It is mostly, but not exclusively used in a corporate environment (Weihrich, 1982 & 1999; Dyson, 2004). The analysis starts by identifying the internal strengths (S) and weaknesses (W) of the principle object (e.g. the company) in relation to its primary goal (e.g. value maximisation) and by identifying external threats (T) and opportunities (O) to this goal (Chang, 2006). The analytical engine of TOWS is the construction of four scenarios through the combination of the identified internal strengths and weaknesses with the external threats and opportunities. This leads to four combinations: SO, WO, ST, WT. (see table 1.1).

Internal/Current ➔ External/ Current & Future 🡻	(S) Strengths	(W) Weaknesses
Opportunities (O)	SO *[maxi-maxi]* maximise internal strengths to maximise gains from external opportunities	WO *[mini-maxi]* minimise the internal weaknesses and maximise the available external opportunities
Threats (T)	ST *[maxi-mini]* maximise internal current strengths, which are capable of dealing with external threats	WT *[mini-mini]* diminish both the internal weaknesses and external threats

Figure 1.1 The TOWS matrix

The *WT (mini-mini)* strategy aims at diminishing both the internal weaknesses and external threats; this position also represents the situations which should be avoided (Weihrich, 1982). The *WO (mini-maxi)* strategy seeks to minimise the internal weaknesses and maximise on the available external opportunities. The *ST (maxi-mini)* strategy looks at the internal current strengths, which are capable of dealing with external threats and thereby focus on advancing the former. And finally the *SO (maxi-maxi)* strategy will seek to maximise the outcomes by working from the current internal strengths to maximise gains from external opportunities. The threats and opportunities can change over time, so it is possible to construct different TOWS matrices that assess the current, medium and long-term environment.

The TOWS methodology is more powerful than the well-known SWOT. First of all it adds to SWOT by systemically matching the sets of variables in the SWOT matrix. It also 'forces' decision makers to analyse the situation of e.g. their company and to develop strategies, tactics and actions for the effective attainment of its organisational objectives and its mission (Weihrich, 1982: p. 54). The process of studying the external environment (T and O) should give researchers and decision makers working with TOWS a better level of situational awareness.

For the application of TOWS in this paper, the principle object is the EU's renewable energy legislation and more specifically the 2009 renewable energy directive and the implementation thereof. The primary goal, assessed through the TOWS matrix, is the enhanced deployment of renewable energy after 2020 in the EU, including the related cooperation between Member States, with main focus on variable renewable electricity sources such as solar and wind.

As far as the authors are aware, through literature checks, the use of TOWS on legislation has not been published before. The closest analogue is the SWOT and analytic hierarchy process application to forestry planning in the context of a new forest certification system (Kurttila et al., 2000).

To achieve a consistent treatment of the internal strengths and weaknesses of EU renewable energy legislation and the external threats and opportunities, a list of assessment factors was developed. These factors, deemed relevant for the deployment of renewable energy and related cooperation between countries, were derived from scientific and other public available literature sources. The factors, as presented in section 2, are categorised in three groups: political and regulatory factors, financial and market factors and technology and infrastructure factors.

The next step (developed under section 3) is an audit of the 2009 EU renewable energy directive and the current status of implementation thereof. The identified strengths and weaknesses build upon the above mentioned factors, with focus on the political and regulatory elements. This analysis used literature analysis and in particular the most recent mid-term evaluation of the directive and its implementation (Kampman et al., 2015).

The threats and opportunities (developed under section 4) for renewable energy deployment in the EU and related enhanced Member State collaboration are external to the existing EU renewable energy legislation. This means that they form no direct part of the current renewable energy legislation but can include political and other elements that can affect the modus operandi of the current EU renewable energy legislation after 2020. The threats and opportunities are derived from the same main factors (i.e. political & regulatory, market & financial, technological & infrastructure) as the ones applied to the strengths and weaknesses analysis. The list of threats and opportunities presented is not meant to be exhaustive, but does in the authors' opinion attempt to reflect major elements at play in or related to renewable electricity deployment in the EU. The focus is on threats and opportunities that can materialise in the period 2020-2030. To avoid a high level of speculation they were constructed from elements (e.g. research papers, political decisions and investment plans) known in the current environment and next extrapolated towards the post 2020 time frame.

Section 5 finally sees the construction of the TOWS matrix and the four scenarios thereunder. Table 1.2 below summarises the above outlined methodology to reach this point. The four scenarios contain policy ideas or proposals, responding to the specific combination of strengths, weaknesses, threats and opportunities, with the goal to enhance EU renewable energy deployment and related member state cooperation in the period 2020-2030.

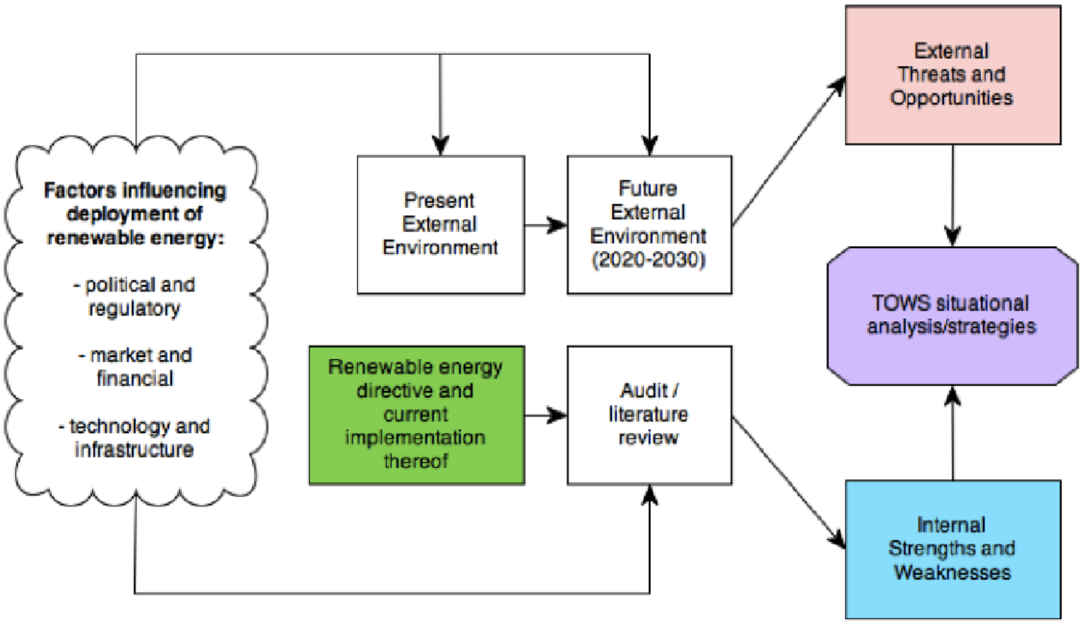

Figure 1.2 Methodology to build TOWS matrix

The paper ends with a discussion of the results, further application of the TOWS matrix to other relevant parts of EU energy law and how the methodology can be further developed.

2. Factors that influence deployment of renewable and related Member State cooperation

The factors used to assist with the identification of the internal strengths and weaknesses and the external threats are derived from a review of literature. They are grouped in three categories: Political & Regulatory, Market & Financial and Technological & Infrastructure. Some of the factors are linked or influence other factors (e.g. regulatory factors influence financing cost).

2.1 Political and regulatory factors

Political Commitment, regulatory stability and predictability

A clear political and societal long-term commitment towards renewable energy is a condition to enable a favourable (investment) environment for renewable energy. Commitment, stability, reliability and predictability are all elements that increase confidence of market actors, reduce regulatory risks, and hence significantly reduce cost of capital (De Jager et al. 2011: p. 125). Political commitment can be expressed through medium and long-term planning documents that show how policy makers expect to implement a pre-determined goal. A stable regulatory environment can reduce the risk for renewable energy investments. The long-term visibility of policies for renewable energy provides assurances for investors, as shorter timeframes can increase risk and uncertainty (Blythe, 2007: p.14-15).

Public participation and transparency in these processes is important to enhance the public and hence political support for renewable energy commitments, policies and projects (Steinbach, 2013).

Binding supranational goals and/or obligations

Binding supranational targets and/or regulatory obligations for a country reinforce both factors mentioned above. If country is bound by such goals the risks of policy backtracking can be lower (Painuly, 2001; Blythe, 2007: p.15). Such supranational binding obligations can also be conducive for cooperation between two or more countries on renewable energy projects or infrastructure. In particular, if the supranational law allows countries to meet their obligation through cooperation with other countries. An example would be the use of (statistical) trade of renewable energy between borders.

Addressing existing regulatory barriers for deployment of renewable energy

Reducing regulatory barriers and hence investor risk, requires the implementation of *clear rules for equal application* to ensure a fair and competitive playing field for players (Blythe, 2007: p. 17; Andoura, 2015). In the case of renewable energy important regulatory barriers relate to permitting procedures (e.g. time and administrative cost), connection and access to the grid, dispatch priority and permission for auto-consumption of renewable energy (Fouquet et al. 2015). A misaligned regulatory environment between different countries can be a barrier for joint or cross-border projects and investments (Flament et al., 2015: p. 106-107).

Reporting, monitoring, compliance and enforcement

Successful policies to enhance deployment of renewable energy, in particular in the case of supranational binding targets and measures, depend on good reporting and monitoring of their implementation and a credible compliance and enforcement regime (Tallberg, 2020: p. 637).

2.2 Market and financial factors

Electricity market environment

Renewable energy investors and generators will have to operate in the existing power market. Therefore the economic viability of renewable electricity will depend of the functioning of the (day ahead) wholesale market, the intra-day market, the balancing market and, for certain producers, the retail market. A marginal plant or cost based merit order market has a strong interaction with renewable energy production because renewables can replace, at certain times, marginal fossil fuel based power plants and hence reduce the profitability of these production installations. This effect becomes stronger when renewable production grows (Sensfuß, 2008; Schleicher-Tappeser, 2012). Intraday and balancing markets are economical very relevant for renewable energy producers because they settle the difference between expected production a day ahead and actual production on the settlement time. Balancing this difference can be an important cost for renewable energy producers. The development and completion of the EU internal electricity market will play a significant role in the functioning of these markets e.g. through price coupling and the removal of nationally installed barriers (e.g. regulated prices and price caps) (Brüning, 2014; Füss, 2014).

Costs and financing

Renewable energy investments have a high Capital Expenditure (CAPEX) compared to other forms of electricity production. On the other hand, the variable operational costs of renewable electricity generation (Operational Expenditure or OPEX) are lower (Rodriguez et al., 2015: p. 660). The Levelised Cost of Electricity (LCOE) can be used as a benchmark to compare the 'overall competitiveness of different generating technologies'. It is calculated by taking the total cost to build and operate a power-generating plant over its lifetime divided by the total power generated over that lifetime. (U.S. EIA, 2014; Kost, 2013).

There is a strong interaction between the LCOE and the political, regulatory and market environment. Policy commitment, stability, reliability and predictability reduce the regulatory risk and hence the levelised cost of electricity (LCOE) can be reduced by 10 % to 30 %. Regulatory barriers can have a direct effect on the LCOE in the range of 5 % to 10 % (De Jager et al., 2011: p. 125).

The LCOE as defined above might not be the best metric for comparing variable renewable energy (e.g. wind and solar) with other generation technologies in a market environment. Ueckerdt et al. propose the use of a system LCOE, which seeks to comprise all economic costs of variable renewable energy in a simple cost metric instead of comparing costs and values. That metric contains not only the standard LCOE but also reflect the costs of variability that occur on a system level (Ueckerdt et al., 2013).

In most cases the full cost of renewable energy still exceeds the 'average wholesale electricity prices' meaning there is still a dependency and requirement for *financial support mechanisms* to 'offset the difference between costs and revenues' (IEA, 2014, p.115). In particular the high CAPEX of renewable power production plants is an important investment barrier.

Governments can use a wide range of financing policy tools to enable further deployment of renewable energy. These include feed-in tariffs, feed-in premiums, renewable portfolio standards in combination with (tradable) clean energy certificates, investment grants and tax breaks, loan and loan guarantees (Wing et al., 2015: p.2). The designs of each of these instruments can differ significantly. Different or diverging financing or support mechanisms in neighbouring countries can be a barrier for cross-border cooperation (Flament et al., 2015: p. 106-107).

Macro-economic environment

The over-all economic climate is an important factor for renewable energy investments. This includes the impact on access and cost of capital, important for high CAPEX investments, and the extent to which public budgets are available for financing and infrastructure support (Liebreich, 2015).

2.3 Technological & Infrastructure Factors

Technology learning curves

Technological improvements have led to a significant decrease in the cost of renewable electricity, in particular for wind and solar PV (measured as power output per unit cost) (Benson, 2014: p. 748-750). These important efficiency improvements are a feature of industries that are becoming mature. These performance increases are related to the development of a large market, induced through public policy, and the related efficiency gains through the supply chains following stable or growing demand (Schleicher-Tappeser, 2012: p. 2-3).

Infrastructure

Higher levels of variable renewable energy can bring challenges to power networks (Schleicher-Tappeser, 2012: p. 5). Grid connectivity and flexibility impacts revenues for renewable energy producers as curtailments can occur when operators seek to minimise the output by renewables (e.g. solar PV & wind) to minimise congestion particularly in smaller or more isolated grids (Bird, 2014, p.8; Kane, 2014). Infrastructural investments such as national and international grid connections can work to offset the imbalances and intermittent generation of renewable energy while further supporting investments (Priem, 2013; Energiewende Agora, 2013; Andersen, 2014; Bründlinger, 2014;

Bronski, 2015). Additional tools are storage (DG Energy, Working Paper, 20xx), increased grid capacity, Active Network Management (ANM) and operational practices (Bird, 2014; Kane, 2014; European Commission, 2014a). These investments and tools can also enable the completion of the EU internal energy market and enhance security of supply (European Commission, 2014a; Andoura, 2015: p. 109-112; European Council, 2014a; Flament et al., 2015: p. 106-107).

3. Internal strengths and weaknesses

3.1 Strengths

3.1.1. Political & Regulatory strengths

Binding renewable energy targets (S1)

Binding 2020 renewable energy targets, including interim targets, for each Member State form an important strength of EU renewable energy legislation. An in depth interim evaluation of the performance of the directive showed that introducing these targets was both effective and efficient (Kampman et al., 2015: p. 19-20). Currently most, but not all, Member States are on track to meet their 2020 target. The EU wide target of 20% renewable energy by 2020 is very likely to be achieved (European Environment Agency, 2015: p. 14).

Binding measures to remove regulatory and other barriers (S2)

Another key feature and strength of the directive are the binding measures to remove regulatory barriers within the Member States (Klessman, 2010; Peeters, 2014; Wyns, et al., 2014, Kampman et al., 2015). These include the priority access to the grids, priority dispatching, a transparency platform as well as administrative procedures, regulations and codes which need to be implemented or altered to facilitate the deployment of renewable energy across Europe.

Planning and reporting assisting the compliance regime (S3)

The National Renewable Energy Action Plans (NREAPs) and the bi-annual reporting on their implementation can be regarded as the key governance tools throughout the Directive. The NREAPs should provide a detailed roadmap of how each State endeavours to reach its allocated 2020 binding renewable energy target. The NREAPs also require Member States to indicate the 'measures [taken] for achieving the targets', which includes the policies, measures and mechanisms (see above) implemented. The NREAPs together with the bi-annual reporting of their implementation serve as the central mechanism, or point of reference from which compliance and progress can be tracked.

This allows for corrective actions, in case of underperformance, to rectify the situation. (Wyns et al., 2014: p. 5-6)

3.1.2 Market & Financial strengths

Mechanisms for cooperation between Member States (S4)

The directive introduced a list of mechanisms that allow Member States to cooperate in the achievement of their binding targets. These include the statistical transfers of renewable energy, joint projects, joint support schemes, and the use of guarantees of origin. These mechanisms can help achieve the EU wide target and respective Member States target in a cost-efficient manner. They can also facilitate the streamlining of support mechanisms between countries. So far these mechanisms have not been used that much, though it is expected that more statistical transfers will occur over the next years (Klessmann et al., 2014, p. 1-5).

3.1.3 Technological & Infrastructure strengths

The directive puts in place specific requirements for transmission and distribution operators regarding the access to the grid but also how costs for grid investments are carried and shared. These elements are already covered above in (S2) that deals with the removal of regulatory barriers.

3.2 Weaknesses

3.2.1 Political & Regulatory weaknesses

Sunset on binding targets (W1)

While the binding targets for 2020 are a key feature of the current renewable energy directive there are no automatic in-built provisions for the extension of national or EU wide binding renewable energy targets through the directive after 2020. This creates an environment of policy uncertainty (Klessmann et al., 2014: p. 5; IEA, 2015: 23-24).

Uncertainty about future of binding measures (W2)

According to the provisions in the current directive, the NREAPs and reporting thereof seizes to function after 2020. These plans are instrumental in establishing national policies and measures to meet targets and for monitoring the implementation of measures to reduce regulatory barriers. Uncertainty about their continuation after 2020 creates another layer of policy risk (Klessmann et al., 2014: p. 5; IEA, 2015: 23-24; Wyns et al., 2014: p. 42).

Limited compliance regime and uneven implementation (W3)

The compliance and enforcement regime in the current directive is limited to the cumbersome EU infringement procedure. If a Member State is not complying with the directive it can hence take years before sanctions can imposed after a decision by the European Court of Justice. The directive has no internal compliance mechanism. Furthermore, it seems that enforcement of the provisions in the directive by the Commission is shallow. For instance, Member States that are not meeting the interim renewable energy targets are not seen as infringing provisions in the directive. Finally, the provisions in the directive (in particular the measures to remove regulatory barriers) are implemented unevenly in different EU Member States (CEER, 2015).

3.2.2. Market & Financial weaknesses

Weak and conflicting provisions on financing (W4)

The current provisions on financing renewable energy in the directive are limited (Wyns et al., 2014: p.43). For instance, there is no rule preventing retroactive changes to renewable energy financing policies in Member States. Such changes, affecting existing investments could be detrimental to future investor confidence. This weakness is also visible through the strained relationship between EU State Aid rules and renewable energy financing by Member States. In some cases it takes more than two years for DG Competition to approve national renewable energy subsidies (Kampman et al., 2015, p. 40). The resulting uncertainty again hinders investor confidence and hence renewable energy deployment. Finally, the provisions have led to an uneven implementation of renewable energy financing across Member States (CEER, 2015). This can stand in the way of future renewable energy investments cooperation (Flament, 2014: p. 83).

3.2.3. Technological & Infrastructure weaknesses

Limited requirements regarding infrastructure enhancement including related cooperation between Member States (W5)

The provisions in the directive regarding grid-readiness for higher levels of (variable) renewable energy are not pro-active. National renewable targets were set but not backed up by binding requirements to prepare the national grid infrastructure to deal with a higher level of variable renewable electricity. While the directive has provisions to enhance cooperation between Member States it does not introduce requirements that prevents Member States from blocking renewable energy flows across their borders (Puka et al., 2014).

4. External threats and opportunities

4.1 Threats

4.1.1. Political and regulatory threats

Binding renewable energy targets for Member States cease to exist after 2020 (T1)

In October 2014, the European Council agreed on an EU wide renewable energy target of 27% by 2030 but that this target shall not be translated into binding national targets (European Council, 2014). This will introduce a level of regulatory uncertainty and can increase the LCOE of renewable energy (De Jager et al., 2011). Removing these binding targets would also negate the need of e.g. statistical transfers as a cooperation mechanism (Klessmann et al., 2014)..

Binding measures present under the current EU renewable energy directive cease to exist after 2020 (T2)

A further erosion of binding measures under the EU renewable energy directive is possible. This could imply abandoning the binding long-term planning on renewable energy for Member States and important EU measures and mechanisms aimed at eliminating regulatory barriers (e.g. priority grid access for renewable energy). New joint Member States projects or investments can also become more difficult following a divergence in national regulatory environments and barriers (Flament, 2014: p. 85-91).

Growing deployment of renewable energy can lead to increased public resistance (T3)

Finally, the growth of renewable energy through increased land-use can lead to increased public resistance[1] (Stigka et al., 2014: p. 103). Resistance by citizens and industry can also increase if additional costs for renewables are passed through in the retail electricity price at unacceptable high rates or if they lead to over-subsidising (Reuters, 2014). This could force governments to lower their ambition with regard to future renewable energy deployment.

[1] On shore wind energy or high voltage transmission lines connecting renewable energy to grid, due to their growing visibility and land use are possible examples triggering public resistance.

4.1.2. Market and financial threats

The self-destructive power of renewables in a marginal cost based wholesale electricity market (T4)

Ironically, an important threat to the deployment of more renewable electricity is the deployment of more renewables itself. Energiewende Agora explains this as follows (Energiewende Agora, 2013: p.22): "The fundamental problem is this: Wind and PV cannot earn enough revenues to cover the average cost of their initial investment in the market, because the price will always be lower than the market price average whenever the wind is blowing or electricity can be produced from these weather-dependent technologies."

Incumbent non-renewable electricity power generators profitability is also under pressure due to the same merit order effect. This could lead to Member States introducing broad capacity payment markets that heavily favour incumbent installations and/or significant curtailing of renewable energy production. Higher CO2 prices (under the EU ETS) will not solve this problem because they will make fossil fuel based power more expensive while marginal cost for renewables will remain very low (Energiewende Agora, 2013: p.23).

Structural low economic growth and deflation in Europe (T5)

Structural anaemic growth in the EU, coupled with a level of deflation can be an important economic threat to renewable energy deployment [reference EU Japan]. In such economic environment investment decisions could be postponed and low CAPEX projects prioritised. The latter would be unfavourable for (high CAPEX) renewable energy investments (Liebreich, 2015). Public finances, through lower tax revenues, would also be affected and would lose (part of) the ability to offer financial incentives for renewable energy investments. Financing joint projects between Member States would also become more challenging.

4.1.3. Technological and infrastructure threats

Member States' protectionism through electricity infrastructure (T6)

It is possible that some EU Member States (will) underinvest in cross-border electricity infrastructure or worse block existing flows of electricity as to protect domestic incumbent power producers and as such impede the cost effective deployment of renewable energy across the EU (Puka et al., 2014; Fernandes et al., 2013).

Stubborn LCOE gap for off-shore wind energy (T7)

There is a risk that certain renewable energy technology learning curves will not come down quickly enough as to further improve the LCOE of renewable electricity as compared to non-renewable power sources. A specific example is off-shore wind energy with an LCOE that is still notably higher than most other sources of power production (EY, 2015: p. 10). Because off-shore wind energy will have to be an important contributor to meeting the EU's 2030 target (by delivering up to 64.8 GW installed capacity by 2030), addressing this gap is important. There is scope for technological, regulatory and supply chain improvements that can bring offshore wind LCOE down significantly within a decade. However a declining deployment rate of off-shore wind plants, following an unstable investment climate in the EU would prevent tapping into these cost-savings (EY, 2015).

4.2. Opportunities

4.2.1. Political and regulatory opportunities

Policy diffusion, alignment and momentum (O1)

The investments in renewable energy in the EU over the past decade are themselves an enabling factor or opportunity creator for future investments. Two factors are at play here. First of all, the EU has seen renewable energy frontrunners emerge such as Portugal, Denmark and Germany (EEA, 2015). These leaders by example could see their policies and policy lessons emulated in other Member States. Secondly, the large investments in renewable energy introduce an element of policy momentum through employment that has been generated in the sector (IRENA, 2014a; p.67-71). Further investment in renewable energy hence becomes an option to maintain (or even increase) the employment levels in that sector.

Renewables help meet energy savings goal and improve energy security (O2)

The unstable geopolitical climate in Europe's neighbourhood and the EU's high dependence of imported primary energy brought the issue of energy security into focus. The political answer to this challenge consists of increasing the EU's domestic energy production, moderating energy demand, green energy as part of the formation of an EU energy union (European Council, 2014a: p.18). Higher renewable energy deployment comes with the co-benefit of providing additional 'primary energy savings' (Harmsen et al., 2011) and hence can contribute to the EU's 2030 27% primary energy savings target.

4.2.2. Market and financial opportunities

Synergies with growing global market for renewable energy (O3)

Renewable energy investments are growing outside the EU. In particular China, and the US have recently seen significant investments (IRENA, 2014a). These large and growing markets offer investment opportunities for EU renewable energy (services) companies. A stable and growing domestic EU market can enable these EU companies to grab a higher global market share.

Completion of the EU internal electricity Market assisted by ENTSO-E network codes (O4)

Following the implementation of the 3rd energy package, Europe's wholesale electricity market seems to be working (Andoura et al., 2015). In particular, the Euphemia smart IT algorithm has been instrumental in enabling the price coupling between the wholesale day ahead markets of seven power exchanges representing 19 European Countries (European Power Exchange, 2014). This price coupling leads to welfare optimisation of the EU power market through better matching of supply and demand across a larger region (Füss et al., 2014).

The European Network of Transmission Systems Operators for electricity (ENTSO-E) network codes are sets of binding rules, which apply to one or more parts of the energy sector and form the practical implementation of this EU internal electricity market (ENTSO-E, 2015). Implementing the Network Code on Energy Balancing will benefit renewable energy deployment due to the cost-savings of an EU ancillary balancing market (Hammons, 2008; Imperial College London et al., 2014: p. 24). This can reduce the need for capacity payment mechanisms. The Demand Connection Network

Code will facilitate industrial demand response. There is an important potential for industrial load management in the EU (16 GW) (Klobasa, 2012: p.9) and hence better integration of renewable energy sources. Finally, the High Voltage Direct Current (HVDC) Network Code will introduce standardisation in the technical rules (and hence technologies) for HVDC transmission line connections. The further deployment of HVDC in the EU will be essential for linking renewable energy and in particular off-shore wind energy to the different power grids. The HVDC Network Code standardisation can lead to important cost savings (Flament, 2014: p.11).

4.2.3. Technological and infrastructure opportunities

LCOE gap collapsing for some key technologies and balance of system cost cutting opportunities (O5)

The levelised cost of electricity (LCOE) for solar PV and onshore wind is expected to further come down over the next decades. According to Kost et al. (Kost et al., 2013) by 2030 onshore wind will have the lowest LCOE over-all and Solar PV in Germany will become competitive with brown coal and hard coal and Combined Cycle Gas Turbines (CCGT).

With equipment costs of PV panels and wind turbines gradually coming down, the Balance of System (BOS) costs are forming a larger share of the overall investment cost for renewables (Moné et al. 2014) and hence become an opportunity for further cost savings. Addressing these costs forms an important opportunity to further reduce the investment cost and risk of renewable energy sources.

Domestic and grid scale battery storage becomes economically attractive between 2020-2030 (O6)

Energy storage, in particular through the use of batteries, has seen an important cost reduction over the last decade. It is estimated that the cost per kWh reaches USD 150 in the period 2020-2030 (Nykvist et al., 2015). At that price point, battery storage becomes competitive with peaking power plants. Hence, the technology can be seen rolled out at a large scale over the next decade. Renewable electricity generators would see less curtailment, since grid supply congestion will be dealt with through storage. The need for standby capacity (payments) will also be reduced. At this moment only Germany has a national regulation on energy storage (European Commission DG ENER working paper, 20xx). California pioneered in 2013 an energy storage target that obliges utilities to procure 1.325 GW of cost effective energy storage by 2020. The global market for battery storage could be worth more than $400 billion by 2030 (a 2015 estimate by Citigroup (Cleantechnica, 2015)). Smart demand stimulating policies in the EU can create important opportunity to grab a significant share of this market.

The Enabling power of Projects of Common Interest in EU energy infrastructure and the Juncker investment plan (O7)

It is likely that by 2020, following the on-going commissioning and construction of the EU's projects of common interest in energy infrastructure with the support of the European Commission's investment plan for Europe (European Commission, 2014) the EU will come close to the achievement of its 10% electricity interconnection target between Member States. However, still more projects need to be identified for the true integration of the Iberian Peninsula within the European electricity market (European Commission 2013: p.14). These investments will facilitate the functioning and coupling of EU wholesale and ancillary electricity markets, through the reduction of bottlenecks at the border of Member States.

5. Constructing the TOWS matrix and situational analysis

Having identified the internal strengths and weaknesses of the EU's renewable energy legislation and the external threats and opportunities (see table 5.1 below), the TOWS situational analysis and matrix can now be constructed.

Internal Strengths	Internal Weaknesses
• *Binding renewable energy targets (S1)* • *Binding measures to remove regulatory and other barriers (S2)* • *Planning and reporting assiting the compliance regime (S3)* • *Mechanisms for cooperation between Member States (S4)*	• *Sunset on binding targets (W1)* • *Uncertainty about future of binding measures (W2)* • *Limited compliance regime and uneven implementation (W3)* • *Weak and conflicting provisions on financing (W4)* • *Limited requirements regarding infrastructure enhancement including related cooperation between Member States (W5)*
External Opportunities	**External Threats**
• *Policy diffusion, alignment and momentum (O1)* • *Renewables help meet energy savings goal and improve energy security (O2)* • *Synergies with growing global market for renewable energy (O3)* • *Completion of the EU internal electricity Market assisted by ENTSO-E network codes (O4)* • *LCOE gap collapsing for some key technologies and balance of system cost cutting opportunities (O5)* • *Domestic and grid scale battery storage becomes economically attractive between 2020-2030 (O6)* • *The Enabling power of Projects of Common Interest in EU energy infrastructure and the Juncker plan (O7)*	• *Binding renewable energy targets for Member States cease to exist after 2020 (T1)* • *Binding measures present under the current EU renewable energy directive cease to exist after 2020 (T2)* • *Growing deployment of renewable energy can lead to inceased public resistance (T3)* • *The self-destructive power of renewables in a marginal cost based wholesale electricity market (T4)* • *Structural low economic growth and deflation in Europe (T5)* • *Member States' protectionism through electricity infrastructure (T6)* • *Stubborn LCOE gap for off-shore wind energy (T7)*

Figure 5.1. overview of developed internal strengths and weaknesses and external threats and opportunities.

5.1. The WT or mini-mini strategy: *Liquidation and merger*

In general, the aim of the W T str

threats. This is a preca

1982 & 1999) .

If no binding national targets stop after 2020 (T1) and also binding measures, including planning, cease to exist after 2020 (T2) this will exploit the uncertainties over the post 2020 legal form of the renewable energy directive (W1, W2). In practice, due to the loss of major strengths, the EU renewable energy directive faces de facto liquidation after 2020. A strategic response could be to merge important parts (e.g. binding measures) of the current directive with other EU energy legislation as to salvage important strengths of the current framework. One example would be to use the forthcoming review of the EU Internal Energy Market legislation to absorb part of the current renewable energy directive. However, it is not certain to what extent this is possible and hence important parts of the renewable energy directive could still disappear. (T1, T2 : W1, W2)

5.2. The WO or mini-maxi strategy: *Move on and hope for the best*

This strategy has the goal to minimise the weaknesses and to maximise the opportunities. E.g. what are the current weaknesses in EU' s renewable energy legislation that prevent taking advantage of future opportunities.

Here the option would be to extend the EU renewable energy directive beyond 2020, but in a condensed manner. Binding targets could disappear but binding energy planning and measures are maintained. This would reduce part of the regulatory uncertainty. Furthermore, existing planning and reporting regimes could be technically improved and streamlined. The compliance regime can become functional, e.g. through strict follow up of the European Commission of the implementation of NREAPs and binding measures (W2, W3 : O5).

The uncertainty on the presence of binding targets after 2020 could be (partially) mitigated through enhanced energy efficiency regulations (e.g. through inclusion of renewable energy in building standards) (W1 :O3, O5) and the optimisation of the EU internal energy market (to remove further barriers for renewable energy deployment) and cross-border investments (W1, W5 : O4, O7). Finally streamlining of EU state aid rules with provisions in the renewable energy directive could make use of the momentum and further diffusion of renewable energy policies in Member States (W4 : O1).

It can be concluded that in this strategy the success of renewable energy depends on improved functioning of the current renewable energy directive, but even more so, other parts of EU energy policy to start pulling more weight.

5.3. The ST or maxi-mini strategy: *Plan against failure*

This strategy is based on maximising strengths of the EU's renewable energy legislation and to use these to minimise threats coming from the external environment.

Here the strengths of the NREAPs could be enhanced to deal with the possible absence of binding national targets after 2020. For instance, Member States could be free to set their own 2020 renewable targets but these become embedded into a binding and strictly monitored 2020-2030 NREAP. Other parameters or indicators could be added to the NREAPs and the reporting thereof to allow for better track-keeping. (S2, S3 : T1)

The NREAPs could also be enhanced through demanding higher levels of transparency and public consultation and participation. Public support for renewable energy can be further encouraged through introduction of measures that bind EU Member States to encourage financial stakeholdership (e.g. cooperative models) by citizens in renewable energy. It also reduces dependence on foreign direct investments and sovereign loans. (S2 : T3, T5) Resistance towards higher costs retail of electricity prices could be reduced through the introduction of cost containment measures, such as a fixed Internal Rate of Return (IRR) as support benchmark. (S2 : T3, T5)

Finally, NREAPs could get a component that includes joint projects between Member States or other forms of cooperation[2] and the binding measures can be enhanced to include removal of cross-border barriers to renewable energy deployment. (S2, S3, S4 : T6)

Specific attention could go to measures and national plans that seek to address the higher LCOE of off-shore wind energy. For instance, unlocking of EU R&D support and infrastructure funding can be made conditional to Member States creating a market for these new technologies in their 2020-2030 NREAPs or seek to cooperate in this area. (S2, S3 : T7)

5.4. The SO or maxi-maxi strategy: *Use the force*

The goal of the SO Strategy is to move to a position where strengths can be expanded and opportunities can be maximised. There are multiple actions that can be considered under this strategy.

Enhancing the NREAPs and binding measures to include (streamlined) financing provisions can be important to unlock low-cost renewable energy in 2020-2030 (S2, S3 : O5). This can include the use of Positive net benefit differential (PNBD) model for joint benefit calculation of joint projects between Member States (Flament, 2013: p.57-58) (S2, S3 : O4, O7).

Unlock the potential of the powerful "triad" of higher levels of (battery) storage, demand response and high voltage interconnections by introducing binding targets. Resistance of Member States towards these new targets could be mitigated through flexibility that allows Member States to choose or combine the three options (e.g. jointly expressed as x% of the total installed capacity in a Member State). (S1, S2 : O4, O6, O7)

The opportunity of reducing the BOS costs could be used through enhanced measures that reduce regulatory and other costs not related to the renewable energy installation itself. Furthermore,

[2] This includes the option of Member States presenting joint NREAPs

demand side measures requiring the integration of renewable energy in buildings and other infrastructure could bring down the BOS cost through scale advantages. (S2 : O5)

The scope of the binding measures could be broadened to include ENTSO-E and the obligation to make their 10 year network development plans and regional investment plans and network codes (e.g. development of EU balancing markets) forward compatible with the EU's 2030 renewable energy target. The Agency for the Cooperation of Energy Regulators (ACER) can act as the verifier, and enforcer of this obligation. Furthermore, ACER can be tasked to verify national electricity regulations for compatibility with higher levels of renewable energy deployment (S2, S3 : O4, O7). It is also possible to implement these requirements using other parts of EU energy law, but consistency with EU 2030 renewable energy goals should be a priority.

	STRENGTHS (internal) Binding renewable energy targets (S1) Binding measures to remove regulatory and other barriers (S2) Planning and reporting assisting the compliance regime (S3) Mechanisms for cooperation between Member States (S4)	**WEAKNESSES (internal)** Sunset on binding targets (W1) Uncertainty about future of binding measures (W2) Limited compliance regime and uneven implementation (W3) Weak and conflicting provisions on financing (W4) Limited requirements regarding infrastructure enhancement including related cooperation between Member States (W5)
OPPORTUNITIES (external) Policy diffusion, alignment and momentum (O1) Renewables help energy savings & energy security (O2) Synergies with growing global market for renewable energy (O3) Completion of EU internal electricity Market & ENTSO-E network codes (O4) LCOE gap collapsing for some key technologies & balance of system cost cutting (O5) Domestic and grid scale battery storage economically attractive between 2020-2030 (O6) The Enabling power of Projects of Common Interest & Juncker investment plan (O7)	***(SO) Use the Force*** NREAPs and binding measures to include (streamlined) financing provisions (S2, S3 : O5) and the use of Positive net benefit differential (PNBD) model for joint benefit calculation of projects between Member States (S2, S3 : O4, O7). Binding "triad" of 2030 storage, demand response and high voltage interconnections targets for Member States (S1, S2 : O4, O6, O7). Bring in enhanced measures to reduce regulatory & other costs not related to the renewable energy technology itself. Demand side measures requiring the integration of renewable energy in buildings and other infrastructure to bring down the balance of system cost (S2 : O5) Binding measures to include for obligation for ENTSO-E obligation to make 10y year network development plans and network codes forward compatible with the EU's 2030 renewable energy target. ACER tasked to verify national electricity regulations for compatibility with higher levels of renewable energy (S2, S3 : O4, O7).	***(WO) Move on and hope for the best*** Binding targets could disappear but binding energy planning and measures are maintained. Existing planning, reporting and compliance regimes could be technically improved and streamlined. (W2, W3 : O5). Enhanced energy efficiency regulations (e.g. through inclusion of renewable energy in building standards) (W1 :O3, O5) Optimisation of the EU internal energy market and cross-border investments (W1, W5 : O4, O7). Streamlining of EU state aid rules with provisions in the renewable energy directive (W4 : O1).
THREATS (external) Binding renewable energy targets for Member States cease to exist after 2020 (T1) Binding measures cease to exist after 2020 (T2) Growing deployment of renewable energy can lead to increased public resistance (T3) The self-destructive power of renewables in a marginal cost based wholesale electricity market (T4) Structural low economic growth and deflation in Europe (T5) Member States' protectionism through electricity infrastructure (T6) LCOE gap for off-shore wind energy (T7)	***(ST) Plan against failure*** Bottom up targets set by Member States but binding through (2020-2030) NREAPs (S2, S3 : T1). The NREAPs demanding higher levels of transparency and public consultation and participation. (S2 : T3, T5) Introduction of cost containment measures, such as a fixed Internal Rate of Return (IRR) as support benchmark (S2 : T3, T5) NREAPs to include joint projects between Member States or other forms of cooperation. Binding measures to include removal of cross-border barriers (S2, S3, S4 : T6) Measures and NREAPs to address the higher LCOE of off-shore wind energy. EU R&D and infrastructure funding for Member States creating a market or cooperation in this area. (S2, S3 : T7)	***(WT) Liquidation and Merger*** EU renewable energy directive faces de facto liquidation after 2020. Option exists to merge important parts (e.g. binding measures) of the current directive with other EU energy legislation (e.g. EED, IEM) as to salvage important strengths of the current framework. However not certain to what extent this is possible and hence important parts of the renewable energy directive could still disappear. (T1, T2 : W1, W2)

Figure 5.2 Final TOWS matrix

6. Conclusions and discussion

The policy recommendations following the application of the TOWS methodology, as mentioned in section 5, seem relevant and in some cases innovative and powerful. In particular the combined "triad" of storage, demand response and interconnection targets, emerging as combination of different opportunities, is a possible interesting policy innovation. Overall, many options formulated under the scenarios, with *liquidation and merger* being the most extreme example, do suggest a stronger and/or improved interaction of a reviewed renewable energy directive with other parts of EU energy law (e.g. internal energy market, state aid and energy efficiency). This is an important and policy relevant result in the current context of better regulation and policy streamlining as promoted by the European Commission (European Commission, 2015).

It would be interesting, as follow-up research to this paper, to apply a similar TOWS matrix to these related parts of EU energy law and explore if the policy recommendation are similar, complementary or even contradictory to those presented here.

The next step could be consistency testing of the results through a survey with experts and policy makers. The use of Analytic Hierarchy Process (AHP), a commonly used decision analysis method, can help here (Kurttila et al., 2000 and Chang et al., 2005).

The TOWS matrix can become an additional tool for policy makers in addition to impact assessments and economic models. In particular TOWS can enhance the forward-looking situational awareness during the development of new legislation and hence lead to a more robust legislative framework.

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