Dialogue on a RES policy framework for 2030

towards2030

D4.2

Ex-ante assessment of potential gap-avoiding and gap-filling instruments regarding the 2030 RE target

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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)*
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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

This report

Until now, in particular PV and wind have experienced substantial cost reductions that brought them close to levelised cost of electricity generation from conventional generation technologies. Now, it is necessary to offer investors attractive framework conditions for these mature RES-E technologies while ensuring minimal costs for society, in order to attain the targets for RES-E deployment that were formulated by the EU.

This report aims to identify challenges faced by investors of mature RES-E technologies, and to suggest policy options to tackle these challenges. The challenges addressed in this report are related to factors which affect RES-E deployment in a 2030 timeframe in the EU. The analysis will focus on policy design options that have been proposed in the recent policy discussion. The method will be based on qualitative comparisons between different alternatives for each challenge. Thereby, we substantiate the analysis of the challenges and possible solutions with selected country case studies.

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1 Introduction

1.1 EU 2030 Targets

The debate on the post-2020 architecture of EU's energy and climate targets was initiated by the European Commission (henceforth: Commission) with the publication of a green paper in March 2013 (European Commission 2013) and a communication in 2014 (European Commission 2014). It was followed by lengthy and controversial discussions among the member states: Some argued for ambitious and binding targets, others highlighted national sovereignty in this field (Bonn et al. 2015, pp. 4–5). In October 2014, after two failed attempts, the European Council finally agreed on the 2030 Climate and Energy Framework (European Council 2014, pp. 2–5). Table 1 shows the policy targets that shall be achieved until 2030.

Table 1 EU 2030 Targets (European Council 2014, pp. 2–7; European Commission 2016a, p. 2)

Area	Description	Type
Renewable Energy	27 % renewable energy share in the EU final energy consumption	binding
GHG reduction	40 % reduction in greenhouse gas emissions compared to 1990	binding
Energy efficiency	27 % reduction in primary energy demand compared to a baseline scenario	indicative
	Commission Proposal 11/2016: 30%	binding
Interconnectivity	15 % interconnectivity between member states referring to their installed production capacity	indicative

The targets regarding renewable energy (RE) share and improvement of energy efficiency were taken up and confirmed in the Conclusions of the Council of the European Union (henceforth: Council) from November 2015 (Council of the European Union 2015). The RE target "will be binding at EU level" (Council of the European Union 2015, p. 3). However both the binding RE target and the efficiency target "will not be translated into nationally binding targets" (Council of the European Union 2015, p. 3). This means that all member states have to deliver collectively, however it is not specified to what extent each single state has to contribute to the common targets.

Within the **towards2030**-*dialogue* action, the identification and qualitative analysis of target setting options regarding the allocation of a common target to individual member states has already been covered by the **towards2030**-*dialogue* Issue Papers No. 2 and No. 4. These Issue Papers discussed the introduction of public benchmarks to allocate an EU wide target to member states (cf. chapter 1.2). As in the meantime it was agreed upon to not introduce mandatory national targets, the focus of this report aims to answer the following question:

How to reach the common EU target in the absence of national targets?

Therefore, we analyse policy instruments that could potentially be introduced at EU level to help member states to collectively achieve the binding common target of 27% RE share in the final energy consumption. A total of six policy instruments are discussed:

- top-up premium
- investment grants for immature technologies
- WACC equaliser
- EU wide tender
- flexible national quota
- national heat quota

They are presented in detail in chapter 3. An ex-ante and qualitative assessment of these instruments is the core of this report (chapter 5), based on the following criteria: effectiveness, static and dynamic efficiency, political acceptability, legal and financial feasibility (chapter 4). Strengths and weaknesses are found and presented for each of the policy instruments; none of them is assessed as positive with regards to all criteria. Thus, the instruments are compared to each other and discussed referring to disparate weighting of the applied criteria in the end of this report (chapter 6).

1.2 The EU 2030 Governance System

Progress Assessment based on National Energy and Climate Plans

To "help ensure that the EU meets its energy policy goals" (European Council 2014, p. 10) by the joint efforts of the member states a new "governance system" (European Council 2014, p. 10) shall be developed. This was also confirmed by the Council of the European Union (2015) and within the proposal made by the Commission on a new Governance regulation (European Commission 2016c). Such a governance[1] system shall be based on so called **National Energy and Climate Plans** and the monitoring of their implementation (Council of the European Union 2015, p. 7). These national plans shall bring together and simplify existing reporting requirements on renewable energy, energy efficiency and greenhouse gas reduction and shall show how member states plan to achieve their domestic objectives in those fields (European Commission 2014, p. 12).

Therefore, member states shall pledge **national contributions to the 2030 targets including trajectories** (Council of the European Union 2015, p. 9). This means, the national contributions **shall be self-defined**. In addition, plans for the respective realisation measures and the actual implementation shall be presented. This will enable the Commission to assess the national contributions to the common 2030 targets (Council of the European Union 2015, p. 9). This assessment of progress shall occur from 2021 every second year (European Commission 2016c, p. 41).

The need for gap-avoiding and gap-filling instruments

In terms of the RE target, eventually the sum of all member states' pledges within the national plans will have to sum up to the binding EU wide RE share of 27 %. Therefore ambitious national pledges are required that will also be reliable regarding the final compliance. Measures that help to avoid a gap between the sum of the national targets and the EU targets shall be called **gap-avoiders**.

> *The question arises by help of which gap-avoiding instruments the EU could enhance its member states to **pledge high national contributions** to the EU target in their national plans. Three of such gap-avoiders are addressed within the present report.*

The assessment of the national plans shall also enable the Commission to monitor and evaluate the progress made at EU level. In case the sum of the nationally pledged contributions does not lead to the fulfilment of the common 27 % share (pledging gap) or the actually realised deployment will not fit to the national pledges (compliance gap), **gap-fillers** will be needed. Those aim at **incentivising further deployment of RE**, in order to help realising the member states pledges or to go beyond them. Gap-filling instruments are mentioned within the respective EU documents, e.g. by the Council of the European Union (2015) and the European Commission (2016c).

> *Once a gap between national contributions and the common EU RE target is identified, a policy instrument is needed to close this gap by enhancing (more) deployment of RE installations. Three of such gap-fillers are discussed within this report.*

[1] The Commission understands governance as "rules, processes and behaviour that affect the way in which powers are exercised at European level, particularly as regards openness, participation, accountability, effectiveness and coherence." (Commission of the European Communities 2001, p. 8)

The Commission proposes that itself "shall take measures at Union level to ensure the collective achievement" (European Commission 2016b, p. 43) in such case. It also foresees different measures to be taken by the member states when a collective gap will be detected in 2023. Such measures shall be undertaken e.g. within the heating and cooling sector or by contributing to a financing platform set up at EU level. These measures are not further specified yet.

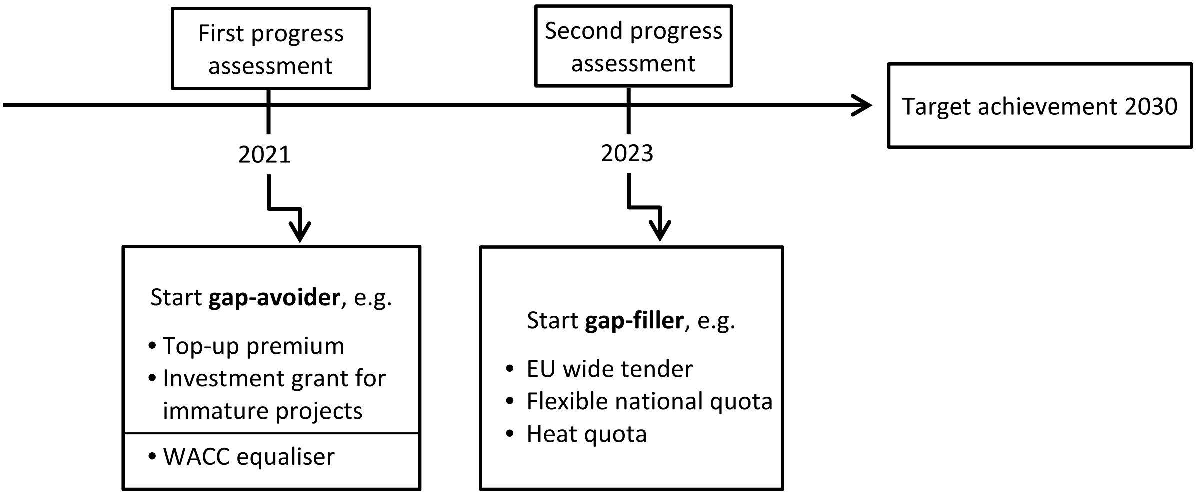

Figure 1 Potential timeline for introducing gap-avoider and gap-filler instruments.

Figure 1 shows the timeline as assumed by now. The proposed gap-avoiders could become operational as soon as a first review of the National Climate and Energy Plans is completed. However, a WACC equaliser could be implemented earlier than that as it does not depend on the assessment of the national contribution (see chapter 3.3). A later progress assessment could then trigger potentially the start of the gap-filler instrument, in case a gap between national contributions and the EU target was detected. In order to avoid strategic behaviour, not only the pledges of the member states should be reviewed, but their compliance should be gradually included in the assessment. Good compliance means that the implemented and planned national measures are leading to the achievement of the national contribution, and can be quantified by the extrapolation of their actual RE deployment.

Benchmarks enable fair effort sharing

As described above, the proposal for a Governance Regulation entails what shall happen in case of insufficient ambition regarding the national energy and climate plans and a resulting insufficient progress towards the set targets: Measures at Union level – here called gap-fillers – shall be taken, however, considering "the level of contributions […] by Member States" (European Commission 2016c, p. 42). The Commission shall also issue recommendations to member states which do only show insufficient progress, again considering "ambitious early efforts by Member States" (ibid.). This aspect was already highlighted by the Council: Any additional action to address a gap shall take into account "how much a Member State reliably contributes in its plan to this EU target" (Council of the European Union 2015, p. 11).

This shows clearly, that a fair effort sharing among member states is envisaged: Member states with high contributions and/ or early ambitiousness shall not be punished when implementing a gap-filling measure. A prerequisite for such differentiation between member states contributions is the introduction of so called **benchmarks**. These benchmarks indicate for every member state the required and adequate level of contribution to the common RE target. With such predefined benchmarks, the Commission could assess the national contributions, and distribute any additional effort required to close a gap in a more transparent and equitable way. Furthermore, the sole existence of benchmarks could also provide an orientation for member states and encourage sufficiently ambitious pledges regarding the national contributions. This aspect was also discussed in the **towards2030**-*dialogue* Issue paper No. 6 (Tesnière et al. 2015, p. 6). Without public benchmarks, member states would not be able to evaluate what their fair share in the common effort is.

Mechanisms to define national benchmarks

The **towards2030**-*dialogue* Issue paper No. 2 proposed to set benchmarks based on the same logic that was used within the 2020 framework (Held et al. 2015, pp. 6–7). This mechanism combined a flat-rate increase (all member states have to increase their RE share by a fixed percentage) with an increase based on the member state's economic strength (GDP per capita). Applying this logic to the 2030 RE target translates into a range of increases between up to +9 % for Denmark compared to the 2020 target, and +5 to 6 % for Bulgaria and Latvia. Total values of such benchmarks would then range between 56 % for Sweden and 18 % for Malta and Luxembourg.

Within the **towards2030**-*dialogue* Issue paper No. 4 (Zehetner et al. 2015) other allocation methods were introduced in order to also account for potential availability of renewable resources, related costs or energy intensity. Benchmarks for all member states were calculated for a default and a modified GDP-based approach (the first including the gross final energy consumption, the latter not), a pure flat-rate approach, a potentials-based approach and a combination of the latter two.

Figure 2 indicates the calculated ranges of increases compared to the 2020 targets for each member state. The dark red bars show the values of already known approaches (2020 logic, flat-rate and default GDP) whereas the light red bars indicate newly proposed methods (modified GDP, potentials-based and combined). As can be seen, the new allocation methods result in a much wider spread of efforts among the member states, which will potentially be less acceptable from a political perspective than the approaches resulting in the dark red bar values.

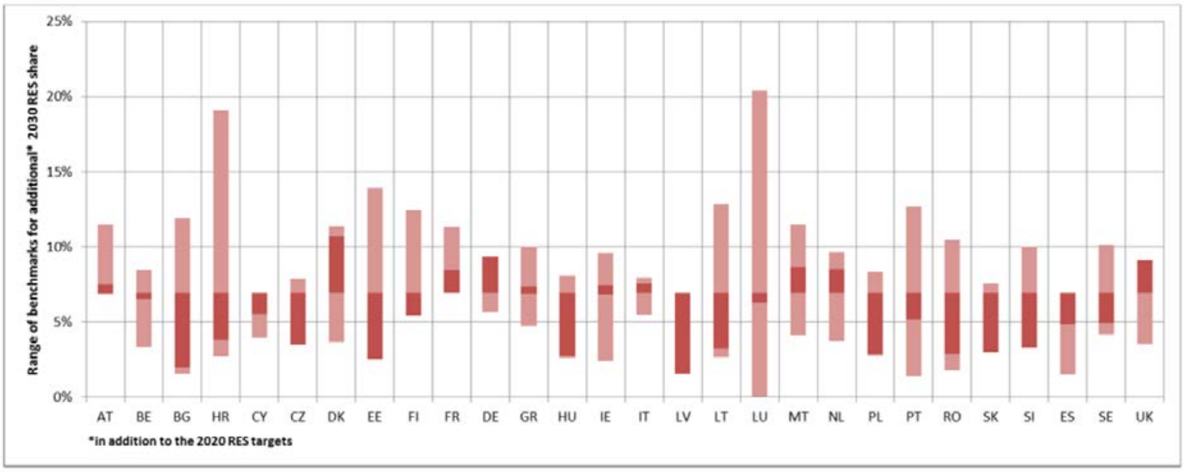

Figure 2 Range of all benchmark allocation options discussed in Zehetner et al. 2015

Benchmarks – challenging to introduce but highly relevant

Benchmarks are an important prerequisite in order to ensure the achievement of the 2030 target. Without the possibility to assess the contributions of the individual member states against known thresholds, and sound agreements on what will happen in case of identified gaps, the claim for and enforcement of sufficient national contributions seems difficult. Especially for the realisation of a gap-filler and the respective (financial) effort-sharing, national benchmarks are required. But also for gap-avoiding measures, benchmarks would be useful given the aim of incentivising early efforts.

This is why the introduction of such benchmarks was assumed when selecting and discussing the policy instruments for this report. Some of them rely on national benchmarks and are difficult to implement without them.

On the other side, it is very unclear whether the required majority of member states would accept the definition of benchmarks. Eventually, they can be seen as ‘targets through the backdoor’ as they contradict conclusions of the European Council and the Council to not introduce national mandatory targets. Especially for the gap-filler, a dilemma becomes visible: A gap-filler instrument taking the ambitiousness of the national contribution into account at the point of the pledges’ assessment would put certain (financial) burden on the countries with identified gaps. Although it would be the most equitable solution, it would not be politically accepted by many member states. Mainly those countries who do not show much political will for the deployment of RE would refer to the Council’s decision against binding national targets, and would prevent being drawn in a situation that would be quite similar to such national targets.

This low political acceptability will be considered when assessing and discussing the proposed policy instrument within this report (cf. chapter 4.1.3).

2 Background: RE policy in the EU

This chapter provides first an overview on the objectives of EU energy policy, the involved institutions and their standpoints. In the second part, former, current and potential future versions of the RE directive are compared to each other in order to show the mechanisms applied to fulfil European RE targets.

2.1 Primary Law

Objectives of European energy policy are difficult to reconcile

For a long time energy policy was seen as one of the least communitarised policy fields within the European Union (Pollak et al. 2010, p. 105). The competence on energy issues was not conferred to the EC, or later EU level within the Single European Act or the Treaty on the European Union (TEU, as of 1992). Therefore its institutions acted referring to other treaty foundations, such as the realisation of the internal market, competition politics, the flexibility clause[2], and environmental politics (Pollak et al. 2010, p. 105; Schubert et al. 2016, pp. 104–105). Only with the Treaty of Lisbon in 2007 a separate chapter for energy was introduced within primary law, namely Article 194 of the Treaty on the Functioning of the European Union (TFEU). The three main aims of the EU's energy policy – sustainability, competitiveness and security of supply (Commission of the European Communities 2006, p. 17) – have therewith been included into primary law. Accordingly, EU energy policy shall aim "to

(a) ensure the functioning of the energy market;
(b) ensure security of energy supply in the Union;
(c) promote energy efficiency and energy saving and the development of new and renewable forms of energy; and
(d) promote the interconnection of energy networks." (Art. 194(1) TFEU)

However, any measures to be implemented

> "shall not affect a Member State's right to determine the conditions for exploiting its energy resources, its choice between different energy sources and the general structure of its energy supply" (Art. 194(2) TFEU).

Taken together, the different parts of Article 194 result in significant tensions between its objectives (Schubert et al. 2016, p. 118; Kahles et al. 2016, p. 17). The right to determine the energy supply structure might conflict with the realisation of the internal market and the interconnection of networks, and the right to determine the national energy mix might clash with the EU's aim to promote energy efficiency and renewable energy. The "tension between national sovereignty over the energy sector and a community perspective based on solidarity, cooperation and scale" (Szulecki et al. 2016, p. 548) is thus perceived as the main paradox of EU energy policy. Kahles et al. (2016, p. 17) also see a contradiction between the national sovereignty reserve and the aim of coherence of member states' national policies regarding the common EU target.

Shared competence of EU and member states

Since the adoption of the Lisbon Treaty, the EU and its member states share competence on energy issues (Art. 4(2)(i) TFEU). This means that both the EU and the member states can legislate, however the member states may only "exercise their competence to the extent that the Union has not exercised its competence" (Art. 2(2) TFEU). Still, Schubert et al. (2016, p. 127) see the primary responsibility for energy policy with the member states.

[2] Pursuant to Article 308 TEC (now Art. 352 TFEU) in order to obtain objectives set out in the Treaties the Council shall decide (unanimously) on such measures even when the Treaties have not provided the necessary powers.

2.2 EU institutions

The European Council integrates diverging national interests to policy directions

At EU level, the member states are represented in two institutions: the Council of the European Union (Council) and the European Council, the latter assembling the heads of state and government. The European Council has gained influence in energy and climate policy since the 2000s by setting overall political directions (Pollak et al. 2010, p. 99). However, the **unanimous decision-making** often results in rather vague and not specified statements and target-setting (ibid.). National interests in energy issues are often diverging and contradicting as energy supply systems, resource availability and import dependency of the member states differ (Pollak et al. 2010).

The Council and the Parliament share legislative competences

The Council of the European Union consists of the relevant ministers of the member states. Energy issues are discussed within the Transport, Telecommunications and Energy Council (TTE). Before the actual Council meets, proposals are dealt within so called working parties (Schubert et al. 2016, p. 133). According to the ordinary legislative procedure, which is also applied in energy policy (Art. 194(2) TFEU), the Council and the European Parliament are co-legislators. The **Council decides with a qualified majority**[3] (Art. 16(3) TEU). However in order to adopt measures “significantly affecting a Member State’s choice between different energy sources and the general structure of its energy supply” (Art. 192(2)(c) TFEU) the Council has to decide unanimously. The European Parliament has the same weight as the Council in the ordinary legislative procedure. Its committees, e.g. the Committee on Industry, Research and Energy, provide the main legislative work resolving differences in positions towards legislative proposals (Schubert et al. 2016, p. 134). **Regarding energy issues no uniform position of the European Parliament** can be detected, but it generally focuses more on environmental and consumer rights related aspects than the Council or the Commission (Pollak et al. 2010, p. 100).

The Commission advocates for further integration in the energy field

The European Commission as a supranational EU institution acts independently from the member states. It has the exclusive right of **initiating EU legislation** and is responsible for ensuring its implementation by the member states. Schubert et al. (2016, p. 125) assign an important role to the Commission with regards to the progress in building an European energy policy, e.g. by pushing for the **realisation of the internal energy market**. Main pillars of its power are competition policy and the fact that it can conduct infringement procedure[4] in case member states do not implement adopted EU legislation (Pollak et al. 2010, p. 100). Directorate-Generals (DG) are the administrative divisions of the Commission, the most relevant for energy policy being DG Energy (ENER), DG Climate Action (CLIMA), DG Competition (COMP), DG Mobility and Transport (MOVE), and DG Environment (ENV) (Schubert et al. 2016, pp. 128–129).

In the current Commission under Jean-Claude Juncker (2014-2019) Miguel Arias Cañete has been assigned to be Commissioner for energy and climate action. Furthermore, cooperation across portfolios has been enhanced, so called project teams have been formed related to ten political priorities. Vice-president Maroš Šefčovič is now responsible for the realisation of ‘A resilient **Energy Union** with a Forward Looking Climate Change Policy’ (ibid.: 29). The ‘Energy Union’ is a policy concept introduced by the at that time Polish Prime Minister Donald Tusk in 2013, focusing on stronger solidarity among member states with regards to energy (mainly gas) supply in order to increase supply security. The Juncker-Commission extended this idea, and presented in 2015 its ‘Energy Union Package’ encompassing five dimensions: (i) energy security, solidarity and

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[3] Qualified majority is defined as “at least 55 % of the members of the Council, comprising at least fifteen of them and representing Member States comprising at least 65 % of the population of the Union” (Art. 16(4) TEU).

[4] If a member state has not fulfilled its obligation resulting from EU legislation, the Commission states and reasons such failure and gives the member state the opportunity to take respective measures. In case the failure persists, the case is brought before the CJEU (Art. 258 and 260 TFEU).

trust, (ii) fully-integrated internal energy market, (iii) energy efficiency, (iv) decarbonisation of the economy, (v) research, innovation and competitiveness (cf. Szulecki et al. 2016). The 2030 governance system forms a part of this policy concept.

The Court of Justice confirmed national approaches regarding RE support

The Court of Justice of the European Union (CJEU) is also a "decisive player" (Schubert et al. 2016, p. 136) regarding European energy policy, overall when it comes to the operationalisation of EU regulation (Steinhilber 2016, p. 86). When defining electricity and gas as a good, the CJEU facilitated the internal energy market (Schubert et al. 2016, p. 136). With its rulings, e.g. in the Ålands Vindkraft conflict, it also confirmed the principle of nationally limited subsidies for RE, thus the existence of different support schemes in each member state, although this contents the internal electricity market and the free movement of goods (Steinhilber 2016, p. 86). This was justified by the fact that EU institutions have not enacted so far any legislation concerning EU wide harmonisation[5] of RE support yet (Schubert et al. 2016, p. 136). However, regarding the interpretation of the reservation of powers in Article 194 TFEU, the CJEU has not taken any decision yet, so there is wide interpretation on this issue until now.

2.3 Secondary Law

In order to meet its objectives in the energy field, the EU has relied on the approach of target-setting. Already in 1974 the Council of the European Communities agreed on a resolution as response to the first oil crisis including an absolute target for the contribution of electricity generated by hydro and geothermal power and the reduction of the growth rate in energy consumption, among others (Schubert et al. 2016, p. 112). With the Kyoto Protocol in 1997, the EU agreed to reduce its greenhouse gas (GHG) emissions by eight percent by 2012. At the same time the Commission proposed to double the share of RE in total energy consumption to 12 % by 2010 (ibid., p. 113).

National indicative targets within RE directive as of 2001

This target was later confirmed within the Renewable Energy Directive of 2001 (Dir. 2001/77/EC). It was the first time, a political RE target was translated into legislation. The directive referred to a **global indicative target of 12 %** of gross domestic energy consumption being renewable by 2010 (cf. recital 7 Dir. 2001/77/EC). Furthermore it introduced **national indicative targets** for the generation of renewable electricity within the EU. These national targets **ranged from 5.7 % for Luxembourg to 60 % for Sweden**, resulting to an average value of 22 % for the entire EU (Annex Dir. 2001/77/EC). Furthermore, it obliged the member states to report every two years on their success in meeting those targets, and to evaluate the measures they take to accomplish with the commitment (Art. 3(3) Dir. 2001/77/EC). To sum up, the national targets were not binding, though the member states were obliged to take action in order to achieve them (Kahles et al. 2016, p. 22). This means the non-achievement of targets could not be claimed. Still, the Commission started 61 infringement procedures, based on the opinion the member states did not take appropriate measures to ensure the achievement of their target. However, those were stopped, as a new RE directive was about to be introduced (ibid., p. 23).

National mandatory targets within RE directive as of 2009

The new and currently effective RED (Dir. 2009/28/EC) created a new legal structure. It referred to the Renewable Energy Roadmap published by the Commission in 2007, being confirmed by conclusions of the Council: Amongst other targets, a 20 % share of RE in overall EU consumption by 2020 was endorsed (Council of the European Union 2007). With the new RED for the first time **mandatory national targets** have been introduced.

[5] Such harmonisation of national RE support schemes has often been called for, but not been realised until now. Its proponents highlight that it would lead to more deployment on low-cost sites (increasing the efficiency), and would suit better to the internal market that is to be realised (Steinhilber 2016, p. 2).

This means they are legally binding for all member states. They also include all sectors, being electricity, heating and cooling, and transportation. Annex I of the RED determines these targets **ranging from 10 % for Malta to 49 % for Sweden** to reflect the countries' different starting points and abilities for RE production. It also explains how the indicative trajectories shall be calculated, against which the performance of the member states shall be assessed. Summed up, these national targets are consistent with the 20 % target at EU level. Similar to the earlier directive, the new RED obliges the member states to report biannually on their national targets and measures taken to achieve them within so called **National renewable energy action plans**, following a template provided by the Commission (Art. 4(1) Dir. 2009/28/EC). According to the Renewable Energy Progress Report of 2015, several countries face difficulties in reaching the 2020 target (European Commission 2015, p. 5). Therefore they have to present amended action plans. In case they will not reach their national targets, the Commission may start infringement procedures which are expected to be promising (Kahles et al. 2016, p. 22).

The new level of ambitiousness of the 2020 framework – characterised by the binding force of the targets and their level – can be explained by favourable context conditions. At that time the EU was regarded as a leader in the international efforts to combat climate change, and had to stick to its commitments (Bürgin 2014). Furthermore, national political leaders engaged very strongly in the debate, such as the German government who pushed for legally binding targets during its presidency of the European Council in 2007 (Bürgin 2014, p. 696).

Proposal for an amended RE directive and new Governance regulation (11/2016): A mandatory EU target

In contrast to the 2020 framework, there are no national binding targets, but a binding target on EU level. Bürgin (2014, p. 703) explains this with different intra-Commission dynamics and less external expectations regarding the EU as international climate policy leader. The **common target of 27%** for the entire EU was also confirmed by the Commission in its winter package as of November 2016, namely the proposals for the amendment of the RE directive (European Commission 2016b) and on a new Governance regulation (European Commission 2016c). Until mid-2020s, a 'laissez-faire approach' will be followed, relying on voluntary contributions of the member states to the binding common target, to be announced within their Integrated National Energy and Climate Plans (European Commission 2016b, p. 67). However, they "cannot go below the 2020 national targets" (European Commission 2016b, p. 21). If this happens, those member states shall close any gap to this baseline share by contributing to a "financing platform set up at Union level" (European Commission 2016c, p. 43). This platform shall be established and (in-)directly be managed by the Commission and contribute to RE projetcs. It is also proposed as a possible measure for all member states in case the Commission identifies a gap in 2023 (member states being not on track with the linear Union trajectory towards their common 27% target). Other suggestions are adjusting the share of RE in the heating and cooling sector respectively the transport sector, or any other measures to increase RE deployment (ibid.).

3 EU Policy Instruments to reach the 27% target

In this chapter, various policy instruments will be presented that are currently being debated within the European Commission, research institutes, consultancies, NGOs etc. These instruments shall help the member states to fulfil their common RE target for 2030. Their basic concepts are described and explained in the following chapters. Regarding their design, many elements are still to be elaborated.

The main working mechanism of the options discussed so far is to improve financing conditions for investments into RE as those are crucial for the further deployment of RE (Noothout et al. 2016, p. 1). This mirrors a general trend towards **market-based policy instruments** also stated by Braun, Giraud (2014, p. 199), especially in environmental politics. Compared to regulative instruments which face a lack of knowledge and information at the decision-making level, problems of legitimacy and high transactions costs in their implementation, market-based instruments relying on incentives are considered to be more effective.

Classification of policy instruments aiming at the support of RE

Economic policy instruments supporting RE can be further divided into supply-push and demand-pull approaches. Other authors, such as Ragwitz, Steinhilber (2014, p. 216) use the terms price-driven and quantity-driven instruments, but mean eventually the same differentiation. With **supply-push or price-driven instruments** the amount of new generation capacity or additional generated energy still results from processes on the market and is not steered directly (Enzensberger et al. 2002, p. 794). The most common of these instruments are feed-in tariffs (FIT) which guarantee a certain minimum price per amount of RE being fed into the grid. Feed-in premiums (FIP) represent a (smaller) support depending on the price the investors can achieve at the market (Held et al. 2014, IV). Direct subsidies or tax exemptions are also supply-push instruments.

Demand-pull or quantity-driven instruments on the other side fix the demand of RE, and oblige market players to supply respective quantities (Enzensberger et al. 2002, p. 794). Quota models represent an example for this kind of instrument, as described in detail in chapter 3.5.

A further classification refers to the difference between **construction incentives** and **production incentives** (Enzensberger et al. 2002, p. 794), also called **capacity- and generation based support** (Ragwitz, Steinhilber 2014, p. 217). The first incentivises the construction of RE facilities, thus the capacity as such e.g. with investment grants, whereas the latter rewards the generation of energy, e.g. with a FIT being paid per kWh of produced energy.

Regarding the 2030 Governance, three instruments are considered to be suited as gap-avoiders: top-up premium, EU investment grants for immature technologies and the WACC equaliser (chapters 3.1 - 3.3). The EU wide tender, a national obligation to introduce a quota and a specific heat quota (chapters 3.4 - 3.6) are discussed as suitable gap-fillers.

For instruments that have already been applied in a different context, an overview on their main advantages and disadvantages and some empirical evidence will be presented.

Table 2 Overview of analysed instruments

Category \ Instrument		Top-up premium	Investment Grant	WACC equaliser	EU wide Tender	Flexible national quota	Heat quota
Market mechanism	Supply-push	x	x	x	x		
	Demand-pull					x	x
Support based on	Generation	x			x	x	x

	Capacity		x	x			
Technology	Neutral	x		x		To be decided	
	Specific		x				
Addressing	Selected MS	x	x	x		x	x
	All MS				x		
Within 2030 Governance (proposed)	Gap-avoider	x	x	x			
	Gap-filler				x	x	x

3.1 Top-up premium

The idea of a top-up premium is to **provide additional support** to one already existing, referring to different administrative levels. It originates in the support system of the USA. State and federal level policies exist in parallel there, consisting of Renewable Portfolio Standards (RPS), a quota scheme applied in 30 states, and **tax credits on US federal level** (Lantz et al. 2014, p. 2). The federal production tax credit (PTC) is provided since 1992, mainly supporting the deployment of wind energy. An investment tax credit (ITC) is provided since 2005 aiming at solar projects (Mai et al. 2016, p. 1). The production tax credits are earned per kWh produced and then used to defray tax bills, thus guaranteeing a certain revenue (Connor et al. 2013, p. 10).

Regarding wind energy, the effectiveness of both support instruments remains ambiguous. Lantz et al. (2014) state that PTC has supported the US wind industry well by increasing their cost-competitiveness. In some states such as Texas, the federal tax incentives have made wind energy so cheap that by far more capacity is operated than the state RPS demands (Lantz et al. 2014, p. 4). However, considering the "on-again, off-again historical policy environment" (ibid., p. 3) of extensions and expirations of the PTC, it has also created a lot of uncertainty and deployment volatility over the last years. Therefore, and due to the fact that currently in the EU there are mainly FIT/ FIP schemes with tendering mechanisms applied to support RE, it seems difficult to transfer the experiences made in the USA to the European context.

The proposed instrument in the present study consists of a **fixed additional payment** given by the EU on top of the respective national support. It is a generation-based production incentive meaning support is paid per amount of energy generated, such as in the US case. The premium will be assigned to any RE technology. Following the logic of the gap-avoider, such a top-up premium will only be paid to investors from **member states who have made ambitious pledges** regarding their contribution to the EU 2030 target. This will also keep the otherwise high financial requirements reasonably small. The level of this premium is to be set by the European Commission. Potentially it could be extended to a gap-filler and be later on adjusted to the identified gap(s) in an iterative process.

Top-up premium

- Generation-based additional payment on top of national support
- Paid to investors from member states who contribute ambitiously to 2030 target
- Technology-neutral
- Level of premium set by EC

3.2 Investment Grants for Immature Technologies

Investment grants are capital transfers from governments to firms in order to help them finance the acquisition of fixed assets (Organisation for Economic Co-operation and Development 2001). They represent a supply-push construction incentive. This kind of support instrument exists in many EU member states, however, mostly supplementary to other instruments and mainly in the RE heating and cooling sector (Klessmann 2012, p. 26; Haas et al. 2011; Held et al. 2014, p. 82). del Río, Mir-Artigues (2014) classify investment subsidies (used synonymous with grants) as **secondary instruments** that are applied in combination with primary instruments such as FIT or quota schemes. Three quarters of all EU member states had investment subsidies for RE in place in 2013 (del Río, Mir-Artigues 2014, p. 294). However, there is a research gap regarding the evaluation of investment grants in combination with primary support schemes (ibid., p. 287).

Only few countries have offered investment grants as main RE support. An example is Finland which has implemented state subsidies for wind power in 2002 (Eclareon 2016). However, the resulting market growth was reported as slow (Lund 2007, p. 629). Since 2011 a FIP has been the main support instrument for RE technologies in Finland, both schemes exist now in parallel (Eclareon 2016).

Investment grants are often meant to **enhance less mature technologies**, which are still more costly and are not widespread yet compared to other RE technologies (Held et al. 2014, p. 82). In the current Finish support system, the subsidy can increase from 30 % to 40 % of the overall project cost, if a new, hence immature technology is applied (Eclareon 2016).

Costs of renewable electricity, usually presented as LCOE[6], vary among regions and technologies (Kost, Mayer 2013, p. 6). The International Renewable Energy Agency (IRENA) found Concentrated Solar Power (CSP) and wind off-shore technologies to be the most expensive ones in 2013/2014 within Europe (Taylor et al. 2015, p. 14). Growing markets and technological learning – in terms of system efficiency, reduced production and operation costs – have already resulted in a rapid decline of costs with regards to solar PV and to certain extent also to wind power (Taylor et al. 2016, p. 21; Kost, Mayer 2013, p. 8). In contrast, **CSP and wind off-shore** technologies are still seen “in their infancy in terms of deployment” (Taylor et al. 2015, p. 13). Still, given an adequate policy framework, these technologies are expected to also become cheaper. IRENA estimates cost reductions of 35% in terms of LCOE between 2015 and 2025 for wind off-shore, and of 37 % to 43 % regarding CSP (Taylor et al. 2016, p. 10).

Hence, the instrument proposed in the present study aims at supporting this kind of immature technologies. This helps also to avoid interactions with existing primary national support schemes for RE electricity, which often focus on cheaper and/ or broadly applied technologies such as PV, wind on-shore and biomass.

Investment grants are meant to help co-financing RE projects. Designed as up-front payment they improve the equity ratio, thus the financing conditions of the respective project. The access to the proposed instrument shall be limited to investors from **member states that have pledged high contributions** to the common EU target. The level or amount of the investment grant can be set relative to the level of ambition shown in the pledges.

Investment Grants

- Capacity-based support
- Paid to investors from member states who contribute ambitiously to 2030 target
- For immature technologies, e.g. CSP and wind off-shore

[6] Levelised Cost of Electricity (in €/kWh), a value enabling the comparison of different generation technologies or individual power plants, representing the ratio of accumulated costs over lifetime over the sum of generated electricity, based on net present values (cf. Kost, Mayer 2013, p. 36).

Investment grants are quite similar to the proposed top-up premium, only that the first is a capacity-based payment, whereas the latter is generation-based. The main difference is that the investment grants proposed here aim to support only immature technologies.

3.3 WACC equaliser

The further deployment of RE projects and thus achievement of any respective targets depends on the amount of investments taken in this area by investors, banks and equity providers. **Costs of capital** are a crucial criterion regarding the investor's decision to realise such a project or not (Angelopoulos et al. 2016, p. 84). Costs of capital are the sum of all expenses and interests required to obtain capital for the project (ibid.). As those costs have to be covered by the revenues of the project, they directly influence the business case of the project. This is especially true for RE projects, as those are characterised by relatively high up-front investments and rather low operating costs (Noothout et al. 2016, 1, 71). The aim of the instrument proposed here is to **lower the capital costs** in member states where they are especially high.

High costs of capital occur when the **risk associated to the investment** is perceived as being high (Klessmann et al. 2011, p. 7651) and might differ regarding different technologies or countries. Lower perception of risks translate to lower cost of capital (Mitchell et al. 2006, p. 297). With other words, costs of capital reflect the risks attached to the RE technology as seen by the investor. The list of risks associated to the planning, construction and operation of RE projects is long, and includes the categories listed in Table 3. Risk is understood here as uncertainty regarding a value.

Table 3 Risks associated with RE investments (Angelopoulos et al. 2016, p. 89)

Risk	Influencing factors
Country risk	Political stability, economic development, legal system, corruption
Social acceptance	Public/ community opposition
Administrative risks	Permits required, lead times to acquire them
Financing risks	State of national financing sector
Technical and management risks	Local experience, technological maturity
Grid access risk	Grid access and its costs
Policy design	Impact of existing policies on quantity and price of energy
Market design and regulatory risks	Market deregulation, governmental energy strategy
Sudden policy design change risk	Sudden, retroactive, unexpected changes regarding support scheme

There is no widely acknowledged methodology to calculate the costs of capital for different energy conversion technologies in the EU member states (Alberici et al. 2014b, p. 17). In general, it refers to the two main sources of capital for project developers: debt, provided by banks and financial institutions, and equity, provided by investors (Noothout et al. 2016, p. 21). The ratio between those two elements can vary. 70 % debt and 30 % equity is a common debt-to-equity ratio, e.g. for wind on-shore projects in Germany. **Cost of equity** shows the minimum return the equity investor expects from the investment, **cost of debt** represents the interest a firm has to pay when borrowing capital (Angelopoulos et al. 2016, pp. 84–86). Both indicate the level of risks the equity respectively debt providers associate with the investment (ibid.). The sum of costs of equity and costs of debt, each multiplied by its proportional share, gives the **Weighted Average Cost of Capital (WACC)**, a tool used to quantify the cost of capital related to the assessed investment risks (ibid., pp. 83-84).

The value represents commercially sensitive data which is not generally accessible. This results in uncertainty with regards to the level of WACC for different member states of the EU and different RE technologies (Alberici et al. 2014a, p. 18). Angelopoulos et al. (2016) conducted a study based on interviews with project developers and financers showing that **WACC values vary widely among EU member states** for wind on-shore projects, from 3.5 -4.5 % in Germany to 12 % in Greece. This means that the costs of similar RE projects vary within the EU. This makes it costlier for some member states to contribute to the EU 2030 target compared to others.

The proposed instrument aims at **equalising the different costs of capital** within the EU, meaning to lower the WACC in the countries with the highest values. This can be done by offering to the investors of those countries directly soft loans, thus providing them with cheaper capital then the market offers, potentially with longer repayment periods or interest holidays (Held et al. 2014, p. 82). However, the possibility chosen here is to **offer guarantees** covering partial or total default of the investors' repayments to the debt provider. In case the investors cannot pay back the loans they obtained, in certain cases the proposed instrument shall stand in. This way they can obtain cheaper credits at their national banks or other financial institutes. When the European Commission or any assigned institution (e.g. the EIB) guarantees the repayment of loans to the giving financial institutes, this lowers their risk of loss with regards to renewable energy projects and encourages them to offer lower interest rates (Vedung 1998, p. 45). It shall cover mature technologies, such as wind on-shore, PV and biomass.

WACC equaliser

- WACC depends on risks associated to investment
- There are different WACC values within EU
- Equalise highest WACC by offering guarantees that cover default of investors' repayment regarding certain risks

As the WACC equaliser aims at eventually reducing the price of RE, it is a supply-push instrument. It further represents a construction incentive not awarding generated energy but facilitating the investment into a new RE facility, such as investment grants.

3.4 EU wide Tender

Tenders[7] are not a support scheme per se but rather a **mechanism to allocate financial support** (Held et al. 2014, p. 44), being feed-in tariffs or premiums, certificate prices in quota schemes or investment grants (Ragwitz et al. 2014, p. 6). The determination of the level of support occurs by a competitive bidding procedure. True generation costs are detected better by the competition of the bidders than when set administratively, preventing an overcompensation of RE producers (del Río, Linares 2014, p. 43). This results in the main advantage of tenders, at least in theory: **the reduction of support costs**. Furthermore, tenders allow for setting easily a cap to the amount of energy generation, capacity to be deployed or budget to be spent, which makes the total support costs much more predictable than for feed-in tariff schemes (ibid.). Some disadvantages are higher transactions costs due to more complex bureaucratic procedures and planning requirements, opening the stage for rather bigger actors and potentially decreasing the overall efficiency (ibid.). In case all technologies compete with each other in the same tender, this results in low technological diversity (ibid.). Still, as the European Commission is aiming for the improvement of cost-competitiveness in RE support, it promotes strongly tenders. Since 2015 all member states have been requested to introduce competitive tenders in their support schemes (Ragwitz et al. 2014, p. 5).

[7] The term *auction* is often used as a synonym, although it can relate to proceedings in which the price is the only award criterion, whereas 'tender' refers to multi-criteria based decisions (Held et al. 2014, p. 44).

Tenders can be designed in different ways. One common form is the sealed bid auction in which both an amount of energy and the premium demanded for its generation are included in the bidder's offer (Ragwitz et al. 2014, p. 17). The lowest bid prices are selected until the desired amount is reached. There are various price setting mechanisms: pay-as-bid, uniform pricing/ pay-as-cleared defined by the last bid to be awarded, and others. Another form is the descending clock auction, in which bidders announce how much energy they would generate for a given premium. The auctioneer then decreases the premium until the offered amount of energy equals the desired one (ibid.). Apart from that penalties for non-compliance and not reaching deadlines can be defined (del Río, Linares 2014, p. 48). Tenders can be technology-neutral (all technologies compete with each other) or banded, this means technology-specific. Other design elements are pre-qualification requirements (such as permits), project sizes, local content rules or a tender schedule (del Río, Linares 2014, p. 48).

Several countries have already implemented tendering schemes for RE support (mainly for the allocation of FIT/P) in the last 20 years, such as UK, Ireland (operating in the 1990s), France, Brazil and South Africa (del Río, Linares 2014, p. 44). In general, achieved support levels have been low and could be further reduced over time (ibid.; p. 48; (Winkler et al. 2016). However, effectiveness in the sense of achievement of targets set beforehand and realisation rates of the projects, is rather mixed (Winkler et al. 2016). The reasons for this include underbidding of the project developers which overestimated capacity factors and the reduction of technology costs, and unviable financing of the projects (del Río, Linares 2014, p. 51). Low technological diversity, low social acceptability and high transaction and administrative costs have also been detected in some cases (ibid.).

Incentivised by the European Commission, tendering schemes are being more and more applied in EU member states, e.g. in Germany with the Renewable Energy Sources Act as of 2017. However, what shall be discussed within the study in hand is a tender that will **cover all (or a range of multiple) member states** respectively their investors. The European Commission is to design the tendering scheme, including details on prequalification criteria, technologies, quantities of auctioned RE energy etc. Project developers from different countries will then compete with each other for a FIP. The amount of capacity/ **energy to be auctioned** shall **correspond to the identified gap** and can be adjusted within different rounds of tenders. In this form, the allocation of FIP via an EU wide tender is a supply-push production incentive. As financing requirements are relatively high (a full support in form of a premium would be paid), the member states with an identified gap shall bear the main part of the financing costs of this tender.

EU wide Tender

- Open to investors from all member states
- Designed/ realised by European Commission
- Auctioned amount equals identified gap to 27% target
- Member states take part in financing

3.5 Flexible National Obligation for Energy Suppliers

In contrast to the previous instruments presented, quota systems are **demand-pull instruments**, meaning the amount of RE to be produced is fixed. In Europe known as Tradable Green Certificate (TGC) systems, in the US and Japan as Renewable Portfolio Standard (RPS), quota schemes have been widely applied for RE support, mainly in the electricity sector. The core principle is the **obligation of energy generators**, wholesalers, distributors or retailers to supply or purchase a certain percentage of RE (Haas et al. 2011, p. 1012). The operators of power plants receive so called green certificates for the RE they produce, which they sell to the obliged parties and thus generate additional income (Held et al. 2014, p. 74). Those certificates can be traded connected to the associated amount of energy, or independently (Haas et al. 2011, p. 1012). This system is usually enforced by fines to be paid in case of non-fulfilment of the required quota (Connor et al. 2013, p. 6). Thus the demand for RE is fixed by the respective authority and enforced to be delivered, this is why Fouquet, Johansson (2008, p. 4082) call quota schemes "direct interventional measures".

On the other side, both the price for the generated energy and the price for the certificates are determined on the market. This competitive price determination leads theoretically to **low generation costs for RE** (Haas et al. 2011, p. 1012) as the cheapest technologies are deployed (Espey 2001, p. 61). However, it also results in uncertainty with regards to income which investors translate in higher risk premiums (Held et al. 2014, p. 74). Furthermore, windfall profits can occur when generation costs of the technologies diverge but the respective certificates are traded equally, as happened in UK and Italy (ibid., p. 75). Such a neutrality regarding the types of supported technology also results in low technological diversity (ibid., p. 74). As a quantity-driven mechanism, quota systems aim at high effectiveness in the sense of **exact achievement of targets** (ibid.). Another big advantage is that it does not burden the state budget, except for administrative costs (Espey 2001, p. 61).

As for every other support instrument, its success depends on the concretisation of its design elements. Regarding a quota system, there are variations for enhancing technological diversity. The system can be technology-neutral, banded (assignment of different amounts of certificates to different technologies) or there can be technology-specific targets with sub-markets for each (Held et al. 2014, p. 75). However, this increases the complexity of the system regarding implementation and administration. Furthermore, banding reduces the ability to control the quantity of deployment (effectiveness), and sub-targets reduce market size and thus might lead to higher costs (ibid., p. 81). An approach to reduce the risk for investors is to define floor prices. To help achieving the target, maximum prices or penalties can be set, which has happened in almost all quota systems so far (ibid., p. 75).

In general, **empirical evidence** of the last years has **challenged the theoretical advantages** of quota schemes (ibid., p. 81). Regarding effectiveness, in reality either over-achievement of targets as in the case of Texas, or under-achievement due to windfall profits as in UK and Italy occurred (ibid., pp. 79-80). High static efficiency was achieved in Sweden, mainly due to a technology-neutral design and the availability of large low-cost potentials, whereas in Italy the certificate prices were relatively high (ibid., pp. 76-79).

The instrument proposed here shall **force member states with identified gaps to introduce such a quota system** with tradable certificates. An EU wide obligation of energy suppliers would not be viable as it might not be compatible with national support schemes. This is why the proposed instrument is called *national* obligation of energy suppliers.

The level of the national quotas will be set at EU level. The responsibility for the concrete design of the national scheme lies with the member states, in order to ensure their flexibility, e.g. regarding the choice of sectors, the exemption of certain actors or the decision on the obliged party, be it fuel or final energy

National Obligation for Energy Suppliers

- Member states with identified gaps have to introduce a quota scheme
- Energy suppliers will be obliged to deliver certain share of RE/ green certificates
- Flexible – member states are free to design national schemes respective-

suppliers. Theoretically all sectors – electricity, heating and cooling, transport – could be included in the quota scheme by the member states.

A possibility to realise flexibility at supplier level would be to allow the obliged parties to buy themselves out in case they are not willing or able to deploy or buy the amount of RE (or the respective certificates) required. These payments can then be used to finance other RE support instruments, such as an EU wide tender.

3.6 Quota for the Heat Sector

Most of the efforts on supporting renewable energy have been realised so far in the electricity sector, and to certain extent in the transport sector (Connor et al. 2013, p. 3). Although heating accounts for almost half of the final energy consumption in Europe and there is considerable potential for renewable heat generation, policy instruments aiming at renewable heat support are not widely developed and applied yet (Connor et al. 2013, p. 3). On the EU level, focus was more set on energy efficiency measures, e.g. in the building sector (Kranzl et al. 2013, p. 44). Still, with the RE directive from 2009 the heating sector has gained relevance (Kranzl et al. 2013, p. 44). Possible renewable heat support mechanisms include: investment grants, public procurement (heating public buildings with RE), quota schemes, tariff/ bonus mechanisms, tax related instruments and soft loans (Connor et al. 2013).

The proposed instrument is a **quota mechanism in the heating sector**, to be **introduced by member states with an identified gap**. The **level** of the quota should be **set at EU level** according to the identified gap. Parallel to schemes applied in the electricity sector, all heating fuel suppliers shall be obliged to submit a certain amount of certificates proving the production of renewable heat. However, the different characteristics of heat and heating fuels compared to electricity have some implications for such a quota system (Connor et al. 2013, p. 8). Renewable heat technologies are mostly of small-scale nature, which requires different approaches in licensing renewable heat producers in order to keep transaction and administration costs within certain limits (Connor et al. 2013, p. 8).

Quota for the Heat Sector

- Member states with identified gaps have to introduce a quota scheme in the heat sector
- Level of quota equals identified national gap
- Heating fuel suppliers will be obliged to deliver certain share of RE/ green certificates

4 Methodology

Studies on renewable electricity support schemes use mostly "econometric modelling, model simulations and case studies" (del Rio et al. 2012, p. 16), mainly to assess effectiveness and efficiency of a policy instrument. Quantitative studies are predominant, such as Lund (2007), Klessmann et al. (2011) or Ragwitz, Steinhilber (2014). However, quantitative methods cannot be applied in the present study, as the instruments of interest are not yet well enough developed. Many design options of the instruments are possible, so modelling would prove too extensive. Case studies cannot be conducted as the number of instruments to be assessed is too high to include detailed case studies for all of them into the research work in hand. Furthermore, some instruments to be discussed have not been implemented yet at all (e.g. WACC equaliser), and for others, the results can hardly be transferred due to the different context (e.g. top-up premium).

Therefore, the policy instruments are to **be assessed in an ex-ante and qualitative way**. To make this possible, the assessment criteria have to be further defined and operationalised by developing sub-criteria, which is done in chapter 4.1. Referring to these sub-criteria, the performance of each instrument can then be assessed qualitatively, summing up to a comprehensive assessment. The assessment is based on RE policy experts' opinions and evaluations, collected within a group discussion and several interviews as described in chapter 4.2. Figure 1 gives on overview on the applied approach.

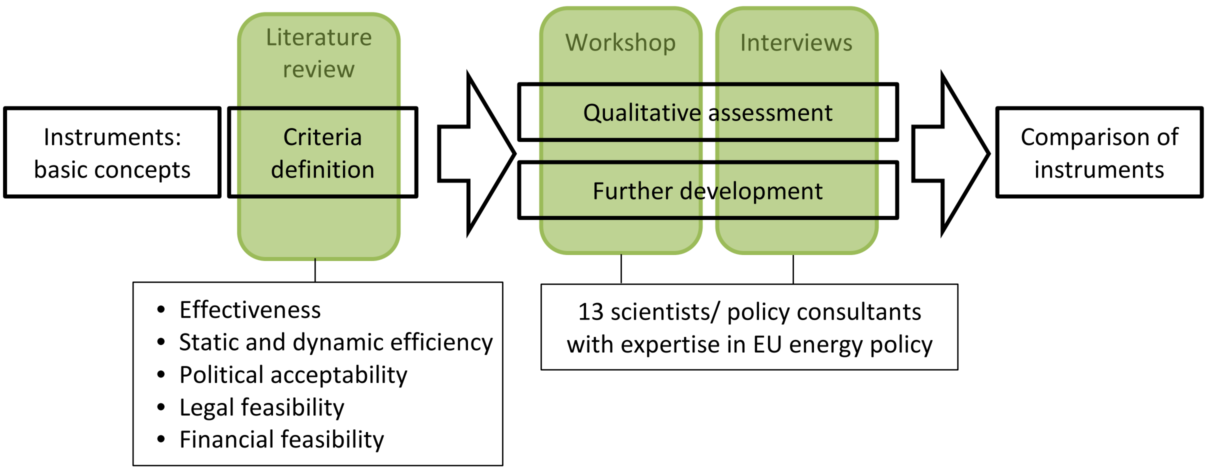

Figure 3 Overview on applied approach

4.1 Definition of applied assessment criteria

According to Knüppel (1989, p. 75) all criteria chosen for the assessment of (environmental) policy instruments have to be independent from each other, the list of criteria has to be comprehensive and valid. To fulfil this aim a **literature review** was conducted with regards to the assessment of policy instruments that support the deployment of RE. This review included amongst others: Nicholls et al. (2014), del Rio et al. (2012), Wietschel, Enzensberger (2002), and Verbruggen, Lauber (2012). However, not all the criteria mentioned in these studies can be applied in the present report. Partly this is due to time restrictions in the workshop and the interviews, the methods used for data collection. Environmental effects, market conformity and implementation will be omitted here as they have only been applied in few of the reviewed studies. Table 4 gives an overview on the selected criteria.

Table 4 Applied assessment criteria

Criteria	Sub-criteria
Effectiveness	Favourable investment conditions
	Incentive for high pledges (gap-avoider)
	Incentive for additional RE deployment (gap-filler)
	Suitable to national support schemes
	Rate of target achievement
Static efficiency	Generation costs: allocation of projects, choice of technology, capital costs
	Costs of support: producers' revenues
Dynamic efficiency	Support of immature technologies
Political acceptability	Equity among member states, distribution of costs and benefits
	Dependence on predefined benchmarks
	Preferences of member states and Commission
	Flexibility to member states
Legal feasibility	Competence to introduce instrument
Financial feasibility	Level of financial requirements

4.1.1 Effectiveness

Effectiveness is often portrayed as "the most obvious criterion of policy instrument evaluation" (Enzensberger et al. 2002, p. 796). The effectiveness of political actions depends on the targets that have been set, and **the actual outcomes compared to those targets** (Espey 2001, p. 81). It has two dimensions: the **degree** to which a politically defined target is achieved, and the **rate** of this achievement (Wietschel, Enzensberger 2002, p. 41). Usually it is assessed in quantitative terms using indicators such as the increase of generated renewable electricity or heat in absolute terms (in kWh or PJ), or as the increase of the RE share regarding the energy generation (in %).

In the present report, instead of these quantitative indicators, qualitative factors are used that enhance the member states' common achievement of the 2030 RE target. In general, to address private investors and incentivise them to large RE deployment, it is crucial for any support scheme to provide them with **favourable investment conditions** (Klessmann 2009, p. 4970). Investors in RE projects need a comparatively high level of planning security, as their investments are usually high and long-term – for windmills or PV modules life time is expected to be around 20 years (Wietschel, Enzensberger 2002, p. 46). del Rio et al. (2012, p. 21) specify further good investment conditions: "Reaching the target depends on the level of support, as well as the stability (continuity) and the degree of security associated with the support system scheme." Thus, continuous support at a high level, and reduction of risks associated to the investment will lead to high deployment rates. The level of support cannot be assessed here as it is not set in most cases, however stability and security of the support the policy instruments offer will be analysed.

As described in chapter 1 gap-avoiding instruments shall **incentivise high national pledges**, assuming that member states will then comply with their pledges and realise deployment by pursuing an adequate national support policy that might be accompanied by some EU support. Therefore it is important that national schemes are not affected in a negative way by any EU instrument to be introduced. The latter shall be a **suitable supplement to the existing national schemes**, be it FIT or quota systems.

Gap-filling instruments aim at **incentivising additional RE deployment** in case the national support schemes are not effective enough to help achieve the 2030 target. It is important to avoid at this point double support and competition between national and EU wide support schemes.

4.1.2 Efficiency

Efficiency or cost-effectiveness is another important and widely applied criterion. When it comes to the choice of instruments, classical administrative theory has for a long time highlighted efficiency (Bemelmans-Videc, Vedung 1998, p. 268). It considers the effort in monetary or other terms to reach a certain level of effectiveness (Dunn 2004, p. 224). Efficiency in terms of RE deployment means to reach a certain RE target at the lowest cost to society possible. However, there is no consensus on which costs are meant (Cerdá, del Río 2015, p. 286). Some authors define efficiency with regards to RE deployment as minimisation of *generation costs*, others as minimisation of *consumer costs* or *costs of support*.

Generation costs consist of investment, capital and variable (fuel/ maintenance) costs (del Rio et al. 2012, p. 22). In order to assess and compare the generation costs of different technologies in different countries, many studies apply levelised costs of electricity generation (LCOE) as an indicator (Cerdá, del Río 2015, p. 286). As the *choice of technology*, and *size and location of their RE projects* influence generation costs of individual companies (ibid.), in the present qualitative assessment these factors are analysed.

Some authors suggest including the **costs of support** or consumer costs to the analysis of efficiency which equal the producers' revenues plus the generation costs (Cerdá, del Río 2015, p. 286). A 'good' return can be seen as a compensation for investors to contribute to the set policy goals (Verbruggen, Lauber 2012, p. 641) and as a reflection of relatively high investment risks. Excessive profits on the other side lower the efficiency of the support scheme as well as the acceptance of the policy (ibid.), and need to be avoided.

No absolute values are expected regarding all these sub-criteria, but the revelation of general impacts of the instruments, and their direction.

Efficiency is mostly understood as a static concept (Verbruggen, Lauber 2012, p. 640). A slightly different perspective is opened by the idea of **dynamic efficiency**: Today's (technological) innovations reduce the costs that will occur in the future to achieve certain policy goals (Verbruggen, Lauber 2012, p. 640). Only when expensive technologies are further developed and commercialised nowadays, can they be applied widely in future, when other, cheaper possibilities are not sufficient enough to reach the determined targets (del Rio et al. 2012, p. 26). Dynamic efficiency thus offers an intertemporal perspective on costs (ibid.). The consideration of longer terms is key when addressing issues such as climate change and CO_2 emission reduction (ibid., p. 25). Hence, RE support schemes need to **stimulate innovation** (Enzensberger et al. 2002, p. 796) especially regarding **immature technologies such as CSP or wind off-shore**. For the assessment of dynamic efficiency it will be differentiated between instruments that specifically support innovative, thus expensive and immature technologies on one side and, on the other side, technology-neutral instruments which prefer the cheapest technologies.

4.1.3 Political Acceptability

The attractiveness of a policy instrument to decision-makers depends on the perception of equity and social acceptability (del Rio et al. 2012, p. 32). Although sometimes described and applied separately, the criteria political acceptability, social acceptability and equity interrelate quite strongly (cf. (del Rio et al. 2012, p. 31). There is no common definition of **equity**, it differs widely within literature and studies (IRENA 2012, p. 10). Still, it usually refers to the **distribution of costs/ burdens** on the one side, **and benefits/ monetary profits** on the other side. Usually, different groups of society are compared to each other when analysing this distribution of efforts and benefits implied by an instrument, such as energy consumers or business sectors. Eventually, the social acceptability shown by these groups is translated to political acceptability, as politicians respond to their electorate (Steinhilber 2016, p. 56).

However, within this report, the focus shall be on the EU level of decision-making, for which the relation between the member states is relevant. Therefore the **equity among member states** shall be used as an indicator for political acceptability of the proposed policy instruments. It has to be evaluated which countries benefit from a certain EU policy instrument to higher extent than others, e.g. when the instrument results in a concentration of RE deployment in certain member states (del Rio et al. 2012, p. 31). RE deployment can provide local benefits regarding job/ industry creation, environment/ air quality, security of supply (Klessmann 2009, p. 4971). The distribution of costs or any other efforts among the member states is also relevant. Hence, the instruments shall also be assessed regarding a fair distribution of costs for the common instrument, e.g. with regards to GDP per capita, and the efforts already taken by the member states.

As described in section 1.2, benchmarks could allow for an identification of national lack of contribution to the common target and be used for a fair and equal distribution of efforts to close a potential gap – given the benchmarks themselves are perceived as fair. However, the political acceptability of such benchmarks is rather low. This is why the **dependence of each instrument on such predefined benchmarks** shall be assessed in this report, too. If an instrument does not rely on the definition of benchmarks, its political acceptability is higher.

Special for the EU context is the interrelation of different political levels: The European Commission prepares policy proposals, but eventually it is representatives of the member states' governments who vote within the Council (together with direct representatives within the European Parliament). Eventually many different national contexts resulting in varying interests of the national governments have to be considered. Given this central role of member states and Commission, a further sub-criterion covers **preferences of member states** regarding any EU instrument of discussion, as known so far or estimated by the interview partners.

Their statements may reveal the position of national governments and implicitly also what national actors such as ministries, political parties, NGOs etc. lobby for. Hence national social acceptability can also be covered to some extent within the sub-criterion national preferences. Furthermore, historic preferences and known political pathways which also influence the political feasibility (Steinhilber 2016, p. 57) can be considered within this sub-criterion regarding preferences. When conducting the interviews, the Commission's proposals on the RE directive and a new regulation for the governance of the Energy Union have not been published yet. Therefore **preferences of the Commission** regarding the proposed instruments have been anticipated.

Another important sub-criterion in the EU context is the sovereignty the national governments want to keep to a certain extent on their RE policy, referring to the principle of subsidiarity[8] and Article 174 TFEU (cf. chapter 2). The design of their RE support schemes and the control of their own RE potentials is essential (Klessmann 2009, p. 4971). This is acknowledged when an instrument provides enough **flexibility to the member states** regarding the design of their RE support schemes or any other support measures to be introduced, which shall be assessed here.

The **dependence of the single policy instruments on** the introduction of **national benchmarks** shall also be analysed for the purpose of predicting the political acceptability. It is a major assumption of this report that such quantified recommendations will be provided by the Commission (cf. chapter1.2) in order to enable the evaluation of national contributions to the common 27% target. However, this assumption is questioned by many, referring mainly to its low political feasibility. This means, if a policy instrument depends on the existence of benchmarks, its political feasibility becomes lower.

[8] In policy areas with shared competence the EU shall only take action if "the objectives of the proposed action cannot be sufficiently achieved by the Member States" and "be better achieved at Union level" (Art. 5(3) TEU).

4.1.4 Legal Feasibility

In the context of EU energy policy two aspects are relevant regarding legal feasibility: the **legislative competence of the EU** and the member states, which they share in this field (cf. chapter 2.1) and **the compatibility with other EU law** (Wietschel, Enzensberger 2002; del Rio et al. 2012, p. 33). According to Article 7 TFEU, “the Union shall ensure consistency between its policies and activities”. Each legal act has to be reviewed regarding its conformity with other already existing regulations. In the case of RE support policy, rules regarding the internal market, the free movement of goods, and competition are of special relevance (del Rio et al. 2012, p. 34).

Within this report, the assessment shall focus on the question of whether the EU has the competence to introduce the given instrument. The verification of compatibility with other primary and secondary law would prove too extensive for all instruments and is therefore be omitted here as did Steinhilber (2016, p. 57) in her analysis of harmonisation options on European RE support after 2020. She stated a strong correlation between the question of competence and the compatibility with other EU law and also concentrated on the competence criterion.

4.1.5 Financial Feasibility

This is a criterion that was not mentioned in the studies revised in chapter 4, which in our opinion represents a gap. A quantified financial feasibility analysis of each instrument is not feasible within the present study as it would require large calculations on cost estimates. This cannot be done as long as the policy instruments are not more concretely described in their design elements. Still, rough estimations, e.g. comparisons of the different instruments with regards to the level of financing required, can be asked for. The required financing level refers to the **total costs of support**, thus the amount that die EU (or the member states) would have to provide for the instrument in case it is a fiscal instrument financed from public budget. This level depends on the type of instrument and its size and scope.

Financial feasibility is seen in the present study as related to static efficiency. However, the latter represents a relative value (generation or support costs to generated energy amount), whereas financial feasibility as understood here aims at indicating the total costs in absolute terms.

4.2 Interviews with EU Energy Policy Experts

The methods used for data collection and analysis within the present study are introduced in this chapter. The first part describes how the assessment of the policy instruments outlined in chapter 3 with regards to the criteria presented in chapter 4.1 was carried out within a group discussion and in-depth interviews. The second part justifies the selection of RE policy experts made for the workshop and the interviews.

Workshop and in-depth interviews were conducted

As first source of data, a workshop was conducted with RE policy experts at Fraunhofer ISI on July 28th 2016. The aim was to assess the policy instruments with regards to all criteria selected in chapter 4.1. In addition, further design elements (apart from those presented in chapter 3.2) and possible options regarding those elements should be identified. Building up on the results of the workshop, interviews with individual policy experts were conducted in the following. Seven in-depth interviews were held with additional RE policy experts between 18/08/2016 and 21/09/2016. Each interview had a slightly different focus, either on one or on a combination of different policy instruments or on legal aspects of the 2030 governance debate. In this way, interviews were adapted to the interviewee’s field of expertise. Interview guidelines were prepared to best explore in depth issues raised during the workshop. The interviews were also used to follow up on the assessment of the instruments along the criteria pattern. In addition questions arising from literature research with regards to potential design elements of the instruments were included in the interview guidelines. Eventually, a simplified structuring content analysis was applied to the workshop minutes and the interview transcripts.

Scientists and policy consultants as experts

Regarding the selection of experts to be interviewed for the assessment of the policy instruments, policy consultants and scientists were relied upon. Designing policies, including the choice on policy instruments, requires policy field specific information and an understanding of scientific findings, especially in technical, complex, health or security related topics (Knill, Tosun 2015, p. 96). Such expertise cannot be provided to full extent by existing administrational structures, such as national governments or the European Commission. These institutions rely more and more on external policy consultancy therefor. Bogumil, Jann (2009, p. 183) differentiate between commercial consultants (consultancy as main revenue), potential providers (consultancy as additional revenue for scientific institutions), specialized public institutions (public basic funding) and independent think tanks (private basic funding).

Among such scientific policy consultants with specialized expertise in EU (renewable) energy politics, workshop participants and **interviewees were selected according to the following criteria**:

- Scientists working in research institutes, universities, think tanks or consultancies related to RE policy
- With knowledge on EU energy and climate politics, especially RE support
- Being familiar with the 2030 governance debate
- Having worked in more depth on at least one of the instruments being debated or other aspects related to the 2030 governance (mainly within ongoing research projects for the European Commission or national governments/ ministries)

These scientific experts were chosen to cover all criteria and all discussed instruments within one range of interviews. Still, this selection of experts is a compromise. Regarding the criterion of political acceptability, the assessment occurred in an indirect way when relying on those policy experts. Including political decision-makers from various levels, such as the Commission and national governments, would have been of advantage. However, due to time and resource restrictions conducting additional interviews for only one criterion would have been beyond the scope of this work, especially with the aim of covering all member states' interests and standpoints. Furthermore, at the time of data collection, the preparation of the Commission's proposal regarding the 2030 Governance was still ongoing, so that accessing EU officials seemed to not be feasible.

Still, some of the interviewed policy experts do have good insights into the ongoing decision-making processes, via consultancy projects they conduct for the Commission or national governments, or previous working experience within the Commission. Furthermore, with interviewed scientists from Germany, Austria, the Netherlands and Hungary at least a certain range of member states could be covered.

Statements of investors are also missing (within the criterion of effectiveness/ favourable investment conditions). Still, we assume that the interviewed policy experts are able to take over their perspective, too.

Table 5 Overview on conducted workshop and interviews

		Description of organization	Country	Main topic
WORKSHOP		Consultancy for renewable energy policy	Germany, Netherlands	All proposed instruments
		Public university, department with research focus on European energy policy, global energy security challenges and EU climate policy	Switzerland	
		Public university, department with research focus on (economic) framework conditions for renewable energy	Austria	
		Public research institute, business unit with focus on renewable energies	Germany	
INTERVIEWS	I1	Research institute with focus on environmental and climate issues	Germany	Quota schemes
	I2	Institute providing research, consultation and teaching on electricity, gas and CO_2 markets	Hungary	Top-up premium, investment grants
	I3	Policy and business consultancy related to renewable energy and energy efficiency	Germany	WACC equaliser
	I4	Think tank for the energy transition	Germany	WACC equaliser, EU wide tender, quota
	I5	Research institute focused on energy, department policy studies	Netherlands	EU wide tender
	I6	Think tank for the legal framework of the energy transition	Germany	Legal aspects
	I7	Law firm and consultancy for energy and infrastructure issues	Germany, Belgium	Legal aspects

5 Ex-ante qualitative assessment of proposed instruments

The data obtained in the workshop (cited as WS) and in the interviews (cited as I1, I2, etc.) is combined here. The workshop and the interviews I1, I3, I4, I6, I7 were conducted in German, the direct citations given in the following chapters are own translations.

Mainly, the assessments presented here refer to basic concepts of the policy instruments as described in chapter 3. However, during the workshop and the interviews several changes and further design details regarding the initial concepts have been suggested. When suitable, these amendments are included in the following assessment.

5.1 Top-up premium

The **effectiveness** of the top-up premium depends on the level of the premium to be paid (I2), and thus on the amount of financing that can be realised (WS). With regards to **incentivising member states to make high pledges** the instrument is assessed very well (WS, I2) as it is directly connected to it. However, giving an administratively set premium on top of the national support "will have a quite significant and might be even **negative influence on the national schemes**" (I2). As the national support schemes will be mainly based on tendering by then (I2), two different price setting mechanisms would clash, and lead to "serious interactions" (I2). In case this instrument is extended to a gap-filler, one interviewee expects reduced effectiveness for the later period. When such a support is conditional (e.g. depending on the size of the identified gap), then it is more difficult for investors to base their calculations on it, thus it is less attractive to them, which results in lower effectiveness (I2). At the same time, only paying the top-up premium when member states are on their path towards ambitious contributions (to be shown by the review of pledges and/ or real deployment) is assessed as good (I2).

Results for static efficiency are very mixed. On one side, the capital costs of some member states might be slightly reduced when they are assigned to get the **European premium** (I2) due to **lower risks** perceived. Furthermore the competition of locations within the EU might become stronger if the top-up premium would be high enough to cover certain parts of the investment costs, such as high grid connection costs in some countries (I2). This would motivate investors to choose countries with high potential but bad grid availability (I2), and help to **realise new low-cost potentials**.

On the other side, the administratively set premium encompasses the danger of **overcompensation of the producers**, as has already happened for many such schemes due to lacking information and tools (I7). The high costs of support influence negatively the static efficiency. This is why another interviewee suggested a different approach: The top-up premium should rather be tendered, this means the market should decide the level of the support, then it "would work the best way" (I2). Still, a top-up premium designed in such way represents rather a gap-filler, incentivising the deployment of the missing capacities (I2), and rather not helping to increase member states' pledges.

Dynamic efficiency is lower here than for the suggested investment grant (WS), as there is no specific focus on immature instruments within the top-up premium.

The **political acceptability** was perceived to be **low for this instrument** due to the unequal distribution of support, as it is only "for strivers" (WS), the ambitious member states pledging high contributions to the common target. But this means also that this instrument **depends highly on the introduction of benchmarks** regarding national contributions to the 2030 target. What is more "quasi-interim targets" (I2) or "indicative trajectories" (I6) are required, e.g. in the form of a linear pathway towards the national contribution to the 2030 target.

Alternatives to the proposed structure of the gap-avoider were also given, such as a scattergun approach, hence not excluding any member states from the gap-avoider (WS). However, EU budget would not allow for such a large scale RE support via a top-up premium (WS). Assigning such investment grants to "special RE projects" (I6) or to countries with difficult circumstances such as Spain (WS) would be another possibility.

The top-up premium still **leaves much flexibility to the member states** and does not put any pressure on them to act (WS), which increases political acceptability. However, when looking at the policy line of the European Commission which sees cost-orientation of RE support as the "the holy grail" (I7), it is difficult to assume any preference for this instrument from the Commission, at least when the premium is set administratively.

From the **legal** standpoint, one interviewee confirmed that the EU is able to define certain conditions – e.g. related to the level of the national pledges – as prerequisite to the distribution of the top-up premium (I7). The **competence** to introduce such additional support is **not questioned**.

Another drawback of the instrument is its financial feasibility, as the **financial requirements** are assumed to be **relatively high**, though the concrete level depends on the ambitiousness of the member states' contributions and is difficult to estimate (WS). Still, it would be less expensive per supported amount of energy than the EU wide tender which pays a full support (WS).

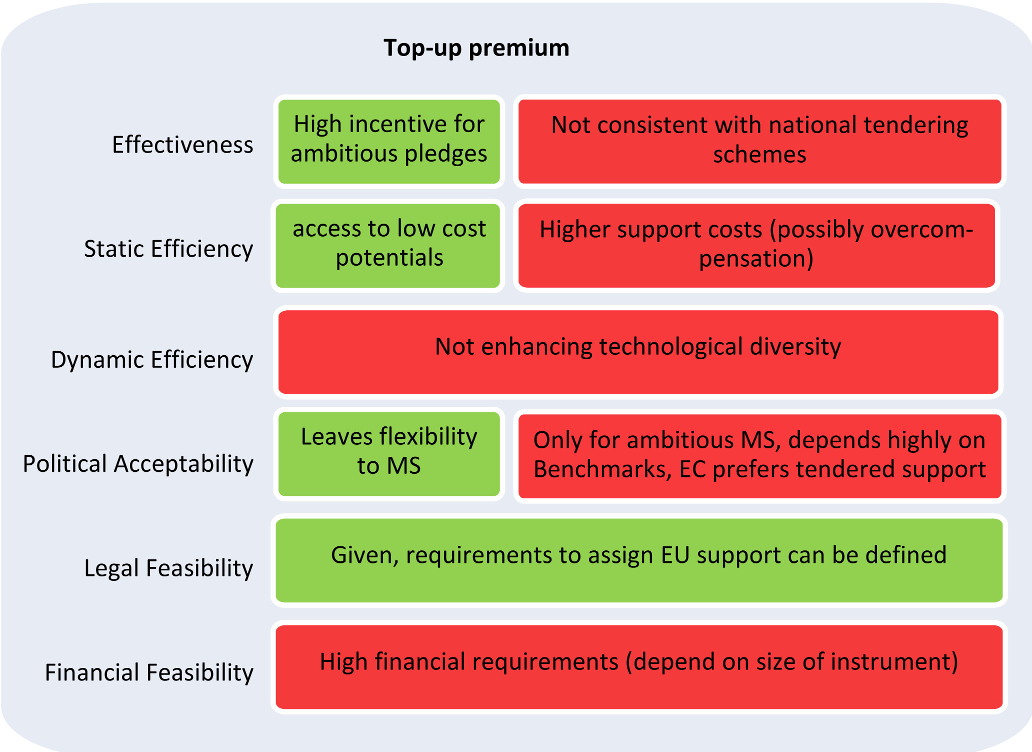

Figure 4 Assessment results for top-up premium

5.2 Investment Grant

The proposed investment grants are considered to be quite similar to the top-up premium, the one being capacity-, the other generation-based support. The main difference is that the investment grants are meant to be only for immature technologies. That is why less emphasis was put on the assessment of investment grants; the interview with I2 covered both top-up premium and investment grant. Most of the statements presented in the last chapter do also apply for investment grants.

As for the top-up premium the **effectiveness** of such an investment grant depends on its level (WS). The scope of the instrument **depends** not only **on the pledging behaviour** of the member states (WS) but also **on the**

availability of projects in immature technologies (I2). If only few member states pledged ambitious contributions to the common target and not many opportunities to invest in immature technologies were available, the effectiveness would be rather low.

Static efficiency is comparatively low, as the immature technologies that the investment grant focuses on do have higher generation costs (WS). Due to this focus **dynamic efficiency is very high** on the other side (WS).

In terms of **political acceptability**, the same **equity concerns** are raised for the proposed investment grant as for the top-up premium (WS) and even perceived as worse. Participants of the workshop stated that only double ambitiousness of pledging high and also being willing to enhance the support of immature, expensive technologies is rewarded (WS). One interviewee raised the point that diversification of technologies is not that relevant for all member states. Some should have the right to focus on higher static efficiency instead (I2). Accordingly, one suggestion was to assign such investment grants not to overly ambitious member states, but to those who struggle to comply with the EU target, e.g. due to low available budget (WS). However, this would contradict the aim of ensuring equity among the member states and the political idea of rewarding ambitious early efforts (cf. chapter 1.2).

Regarding **financial feasibility**, it was argued that in contrast to a generation based top-up premium the investment grant is paid up front, which makes conditions better for the investors but is more difficult to finance (WS).

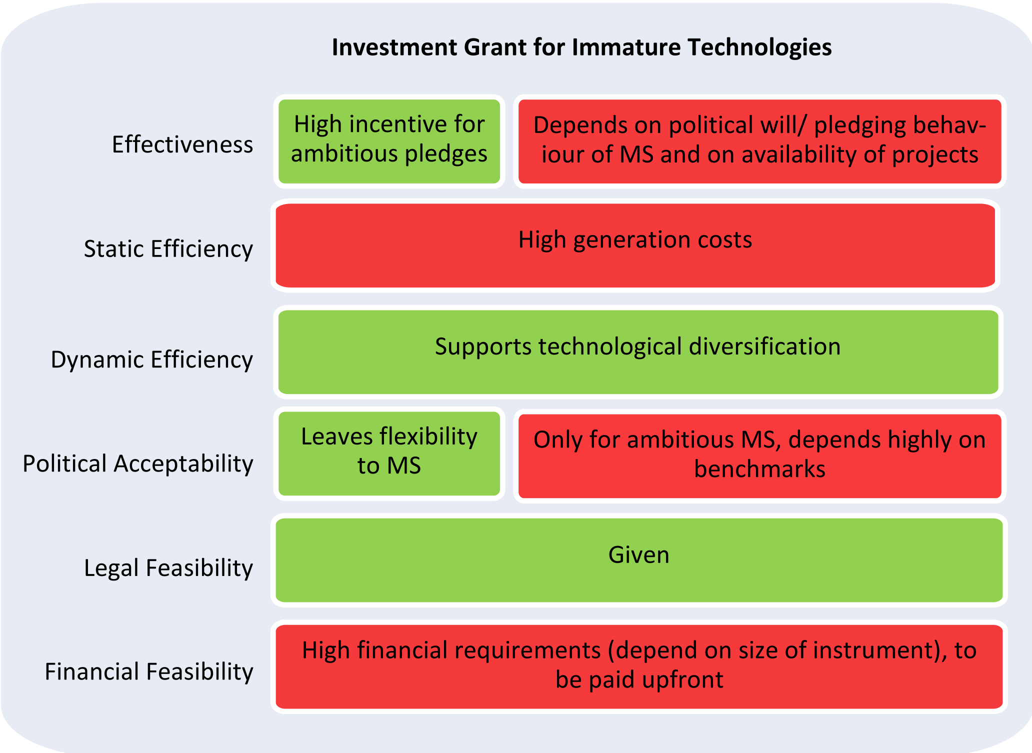

Figure 5 Assessment results for investment grant

5.3 WACC equaliser

Regarding **effectiveness**, different opinions were raised: some **rather sceptical**, others highlighting relevant **indirect effects** of such an instrument. A participant of the workshop described it as “signal effect” (WS) for the discourse on RE support in member states with high capital costs. It is an instrument that aims at incentivising these countries to pledge on a “reasonable” (I4) level, and is expected to be effective in that sense (I4). For such countries (given national political support) the WACC equaliser would be sufficient as a gap-avoider (I4). Still, one interviewee stated he is not sure about the real effects of particular risks being covered by the instrument, as many correlations between investment risks and actual deployment cannot be quantified exactly (I3). Also during the workshop, negative opinions prevailed: it was called a “placebo instrument” (WS) that camouflages but does not solve the underlying problem of investment risks and the related high capital costs.

Furthermore, the **effectiveness also depends on the political will**. Some member states are and will stay sceptical towards RE, even when good conditions for deployment are provided (I3). Countries with both high WACC and the required political will for supporting RE are for example Portugal, Greece and to a certain extent Bulgaria (I3). The credibility of an EU instrument can help at this point to reduce capital costs (I4). Once successful in these countries, meaning the reduction of generation and support costs for RE, this could help to increase the attractiveness of RE (support) in other countries (I3).

Regarding the existing national support schemes, no negative interactions are expected with the WACC equaliser. It would even strengthen the existing national schemes, as one of the risks to be covered by the EU guarantee, as suggested by the policy experts, is the retroactive change of support policies (I3, I4). This would work very well for contracts resulting from tenders as those are individualised, but also for FIT or FIP schemes (I3).

In general, to design a successful WACC equaliser, one interviewee suggests covering tariff-related risks such as changes to the support tariffs, introduction of new taxes, or non-payments (I4). The EU would then act as an intermediary between the national governments and the investors. Other non-tariff risks such as grid access or permits can be addressed by setting up appropriate (country specific) requirements for the member states who want to participate in the instrument. This could be done by means of best practice or benchmark approaches (I4).

The **static efficiency** of the WACC equaliser is **expected to be very high**, when considering only member states with high WACC and good RE potential: “I would not know which other instruments with a similarly low use of funds should result in a comparable incentive” (I4). The support costs for any other (national) instrument would be much higher (I4). When looking at generation costs, the core of the instrument being the reduced capital costs (I3) would contribute to high static efficiency in this regard. Furthermore, the WACC equaliser would help to access low cost potentials in those countries that have high potentials but also severe risks associated to (RE) investments, such as PV in Greece (WS). Dynamic efficiency is not addressed by the instrument and thus dependent on the national support scheme (WS).

The WACC equaliser is expected to have a **high political acceptability**, at least for the member states with high costs of capital (WS). It **contributes to more equity**, when equity means that member states with low financial capabilities (which are the ones with high capital costs) shall not pay more for the same contribution to the common target as others (I4). Countries such as Greece or Bulgaria face a “southern risk” (I4), a specifically high country risk that they cannot reduce on their own. Moreover, the **participation in this scheme is voluntary**, it is a political decision of every member state (I4). Still, the concern was raised that the addressed member states would perceive the WACC equaliser as interference into their domestic energy politics or paternalism by richer member states (WS) but this depends on the framing and communication (I3). On the other side, countries with rather low capital costs that would hence not profit from the WACC equaliser, might demand additional EU support (in form of another instrument) they would benefit from (I3). Furthermore, the “communitarisation of risks” (WS) might not be well accepted by those countries, as can be seen in the debate on Eurobonds[9] (WS). In total, national preferences are difficult to assess, as there is not much knowledge and awareness yet within the member states on the relevance of capital costs for the support of RE (I3).

Still, the WACC equaliser was named a “no-regret option” (I3) that **can be applied independent from benchmarks** being agreed upon or not (I3, I4). No “failure of member states” (I3) has to be assessed, which is seen as one of the advantages of the WACC equaliser (I3).

[9] Eurobonds (or Stability Bonds as called by the European Commission) refer to the “common issuance of bonds by the euro-area Member States” European Commission 11/23/2011) helping certain member states who can benefit from the creditworthiness of other member states.

Regarding the **legal competence** of the EU to introduce such an instrument, the opinions were ambivalent. The **intervention in national RE support** might be “difficult” (I6) as it has a “certain steering effect” (I6). Still, Article 194 TFEU can be interpreted very widely, and there was no case yet brought to the CJEU concerning this aspect (I6). Plus, every member state decides on its own whether to participate or not as it is a **voluntary instrument** (I6). From a pragmatic perspective, when all member states agree on such an instrument with qualified majority, “then it should be ok” (I7). If any member state perceives it as not being consistent with Article 194 TFEU, then it can call the CJEU (I7).

The **financial feasibility** of the WACC equaliser is **quite high**, as the financing required is rather low (WS). One interviewee stated “it actually does not cost anything” (I4) as only a certain sum has to be assigned for the guarantee financing once, and then stays “without impact on the budget” (I4).

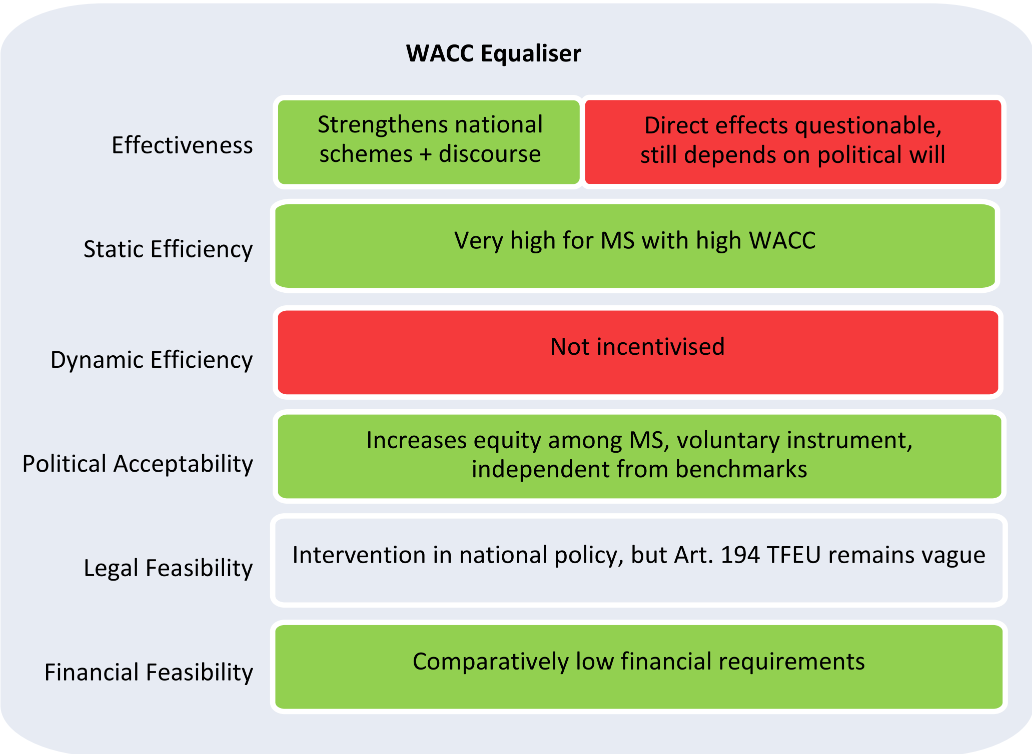

Figure 6 Assessment results for WACC equaliser

5.4 EU wide Tender

For an EU wide tender **certain effectiveness is expected** (WS, I5) – but only on condition that the instrument actually will be implemented, which was seen very sceptically. Questions were raised how to level the playing field for such a tender (I5). As conditions for the deployment of RE vary among the member states, it seems difficult to design it in a way that offers equal chances to all countries and investors. It would require quite some harmonisation efforts with regards to the support, but also to other aspects such as the grid and the financing of its extension (I5).

At this point, a **combination of EU wide tender and WACC** equaliser was suggested. The WACC equaliser builds up more convergence among the member states so their investors can bid under same conditions, which makes it easier to realise tenders (I4). Another proposition was a **regional scope of the tender**, covering only a selection of member states. This would rely on a technology specific “regional convergence or harmonisation of support schemes” (I5), which would be easier to realise than an EU wide approach. However, one interviewee reported on the difficulties that already two countries, Germany and Denmark, faced when opening mutually their national PV tenders to the investors of the other country (I6). If at all, he saw only the political will and capability of some countries for bilateral cooperation (I6).

For the EU wide tender, the **interaction with national support schemes has to be considered carefully** (I5), but can be addressed by a “pre-distribution” (I4) of generation or capacity amounts among member states and the EU wide tender. The national support schemes need to stay in place to ensure the national contribution to the target (I5). The realisation of the awarded projects, thus the rate of effectiveness, depends on the attractiveness for investors which is based on the level of support, but also legal and policy certainty (I5). One participant of the workshop feared delays but another stated that realisation can be more easily enforced for tenders than for other schemes (WS).

Tendering of support leads to **high levels of static efficiency** (WS). It results in the choice of “the best resources at the lowest costs” (I5). If no pre-distribution of the projects to be awarded is made with regards to their allocation, the deployment will occur where the cheapest projects are (I4).

Within the workshop and one interview, it was suggested to **focus the tender on wind off-shore and CSP projects**. This would lead to **high dynamic efficiency**, as these are both technologies that are “still high on the learning curve” (I5), meaning that costs can still be reduced when further developed. Both coastal countries and Southern/ South-Eastern member states could profit from this selection of technologies (I5). Other RE technologies such as PV or wind onshore do not seem to be suitable for EU tenders, also for lack of political acceptance (I5).

Political agreement seems to be difficult to obtain on this instrument (I5). “That is the big issue” as one interviewee stated (I5). It depends strongly on the distribution of both costs of support related to RE deployment.

On the one hand, **when costs for filling a gap are distributed flat** over all member states or paid from the general budget this would **not be equitable**, as member states who conducted early efforts or made ambitious pledges would be disadvantaged (WS). In such a case, this would give a negative incentive for member states to wait with their deployment until EU support would be available (I4).

On the other hand, one interviewee **doubted that the obligation for member states with identified gaps to finance the instrument** referring to pre-defined benchmarks **would be acceptable** as financial capabilities and political priorities are different (I5). Moreover, forcing member states with identified gaps to finance an adequate share of the gap-filler instrument is assessed as “contestable” (I7). According to the treaties (Art. 311 TFEU) the EU has to reach its targets with its own resources. If a member state would not agree with the proposed instrument or the financing scheme, it could always refer to this principle (I7).

The **distribution of benefits** implied by the realisation of projects is also an issue. Member states paying but not necessarily benefiting from the deployment – this would be difficult to “reconcile” (I5). A possibility would be to assign those projects to the countries that have to pay for their support (I4). However, this would again decrease the static efficiency of the instrument, and should not be done according to the interviewee (I4).

From a **legal** perspective, the **enforcement of similar conditions** for RE deployment throughout the participating member states **seems difficult**. However, as this instrument is of incentivising nature, the EU can set up certain requirements for all member states who want to participate, e.g. concerning grid access or permit procedures and rely on the internal pressure that would arise in member states who do not meet or realise these requirements. Such a parallel and voluntary instrument would reflect a “classical approach of the EU” (I7) in case of disagreement among the member states.

Regarding the financial feasibility, this instrument was assessed rather badly, as the **financial requirements are quite high** (WS). One interviewee argues that the EU cannot afford to pay a full premium via the tender and therefore most of the support costs have to be provided by the member states (I5).

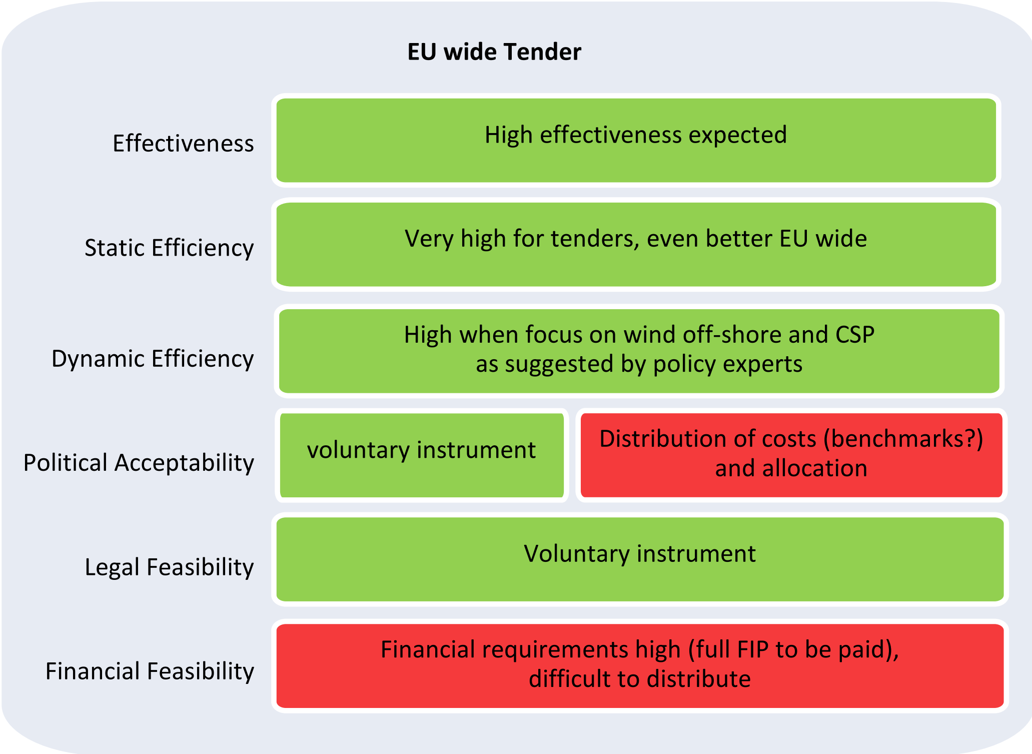

Figure 7 Assessment results for EU wide tender

5.5 National Obligation for Energy Suppliers

Opinions regarding the mandatory introduction of a quota scheme in member states with identified gaps were rather **negative as to its effectiveness**. It was stated that previous experiences with quota schemes were not good (WS). An interviewee also questioned the suitability with existing national support schemes (I4). The most highlighted argument referred to the short time frame of the planned gap-filler quota: when starting in 2025 "there won't be the expected effects until 2030" (I1). The **short time period is not functional** for a quota which requires long-term obligation periods (WS). Thus the rate of implementation of such a quota scheme is expected to be rather low, as agreed to by one of the interviewees (I1).

The workshop participants claimed that a **national approach** such as the quota which shall be introduced by the member states will in general result in **lower static efficiency** (seen at EU level) compared to instruments that lead to EU wide competition of the cheapest sites for RE deployment (WS). When looking at country level, an interviewee stated that leaving the decision on which sector (electricity, heat, transport) to be obliged to the member state will lead to more static efficiency as the sector with the lowest generation costs will be chosen (I2). Between heat and transport this would be usually heat (I1).

Similar as with the financing of the EU wide tender, the **perceived equity among member states**, an indicator for political acceptability, **depends on the benchmarks** (WS) as the national quotas shall be set according to the identified gaps. Any other case, such as a general quota for all countries, would be "unfair to all those member states who are on track" (I1). The announcement of such a flat increase could prevent member states from making high pledges and conduct early efforts (WS). If certain countries shall be picked out for the gap-filler (as proposed here for the quota as gap-filler) this requires benchmarks (I1).

The **flexibility the member states have is higher** when they decide on the sector to obligate, as proposed here (I2). However, another interviewee did not think that this free choice of the sector will be implemented (I1). Still he stated that the design of such a quota will and should be left to the member states, to ensure their flexibility (I1). This includes the choice on the obliged party, the options for proving the fulfilment of the quota amongst other (I1). A possibility to further increase flexibility of the member states would be to **allow also for alternative schemes** as fulfilment of the quota requirements as long as it leads to the same results, taking on the principle of Article 7 of the Energy Efficiency Directive (WS, I1). The quota would then be the "core or leading instrument" (I1) but member states would have the possibility to also introduce alternative measure to achieve the given target.

Opinions regarding EU's competence to oblige member states to introduce such a quota differed. One interviewee did not see any problem with Article 194 TFEU as long as the member states agree to the instrument in the legislative process beforehand (I7). Should any member state disagree, the CJEU can be called, to clarify the status of shared competence in this field (I7). Another interviewee however highlighted the right to the choice on the usage of energy resources and the right to determine the general structure of the energy system might be violated, especially in the electricity sector (I6).

As the quota scheme does actually not burden the public budget (I1), the **financial feasibility of this instrument is high.** This increases as well the political acceptance (I1), at least at EU level. One interviewee argued that the quota is only being discussed because the EU budget is too small to cover other instruments (I4). With a quota the financing question is transferred to the national domestic politics (I4).

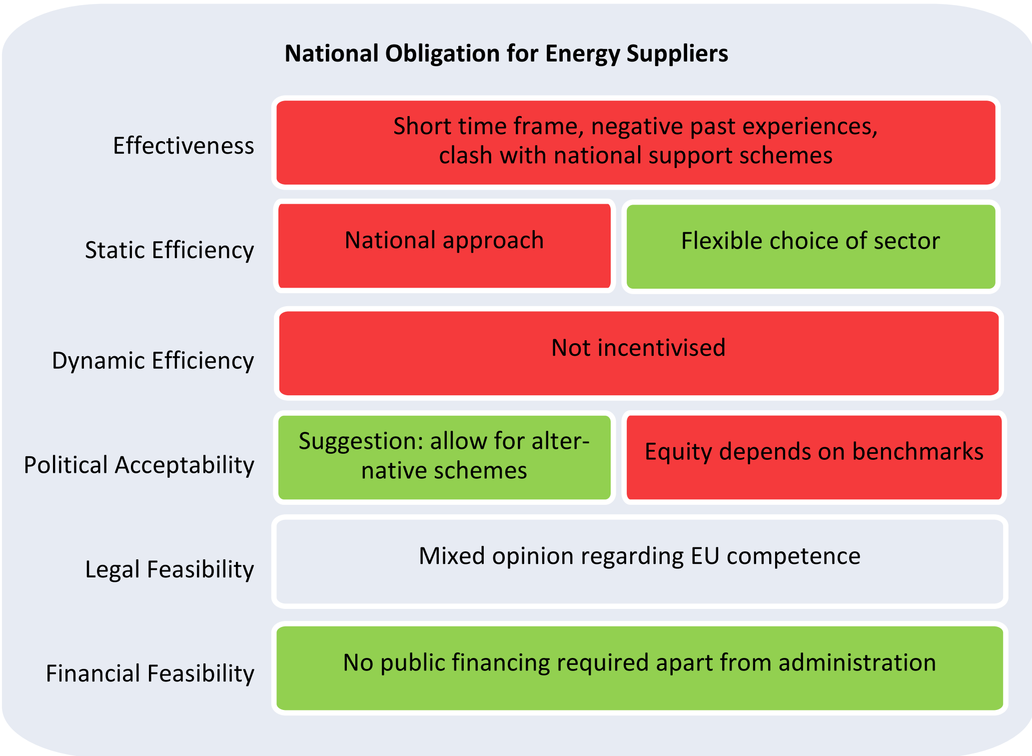

Figure 8 Assessment results for national obligation

5.6 Quota for the Heat Sector

Most of the statements presented in the previous chapter do also apply to the heat quota (apart from those referring to the choice of sectors). In the following only statements are presented that focus on specific characteristics and requirements of a quota in the heat sector.

An additional **instrument in the heat sector is required to achieve the 2030 target**, as national targets so far are not very ambitious, e.g. in Germany (I1). If carefully designed, a quota scheme can be applied in this sector too, although this has not been done so far (I1). Still, the suitability depends on the heat supply structure, which varies among the member states regarding the level of centralisation among others (I1).

As a demand-pull instrument, the quota influences relatively strongly the market players. In case of heat and the obligation of fuel/ gas suppliers, the latter would have to invest into new infrastructure such as heat networks. This would **affect negatively their actual business** (I1). The interference with national support scheme is not as relevant as in other sectors, it "just has to be regulated" (I1). The interviewee refers for example to obligations to use a certain percentage of renewable heat in new buildings to be constructed, which could or could not be accounted for fulfilment of the quota by the respective energy supplier (I1). However, a **low effectiveness rate is expected**, for the heat sector even more than for other sectors, because local heat networks (which are of need for a renewable heat supply) do have very long planning periods (I1).

This is why for the heat quota it was suggested to **introduce it as a gap-avoider**, mandatory for all member states (WS, I1). Such a "base obligation" could have the same level for all countries (WS). This way the time period it would cover until 2030 (or beyond) would be longer, increasing the effectiveness of the instrument (WS, I1). Political acceptability would be higher, too (WS), as the dependence on benchmarks could be evaded.

To achieve **higher dynamic efficiency**, one interviewee opted for an **extra support of heat pumps and local heat networks** due to missing alternatives in the urban area (I1). He wants to restrict the use of biomass in the heat sector (although it would be in most cases the cheapest option) as it is rather needed in the transport sector (I1). This could be done through the definition of weighting factors or technology-specific sub-quotas (I1).

Referring to a specific heat instrument, the interviewee did not see any country taking the lead and advocating for the heat quota (I1). He related this to the fact that it is **not part of any national discourse**. In some countries, e.g. Lithuania, the political focus lies much more on the efficiency of buildings and heat networks than on the generation of renewable heat by (partly unknown) technologies. Furthermore, **national governments will face a strong resistance of the obliged actors** (respectively their industrial associations) as they will bear the main burden (I1). Such signals from the market directly influence the political acceptability (I1).

Regarding the legal feasibility it was stated that the concerns raised for a quota in the electricity sector apply much less for a heat quota, as the share of RE in this sector is not as high as in electricity, and a **heat quota would probably not restrict the member states' choice on energy sources** (I6).

The **low financing requirements of quota schemes are especially important in the heating sector**. Regarding the huge number of building owners, at least for countries with highly decentralised heat generation structures such as Germany, a quota scheme relying on regulation, not monetary incentives, is a good way to achieve a higher share of renewable heat. "To allure them all with banknotes" (I1) would not be possible.

Heat Quota

Effectiveness	Instrument in heat sector required, less conflictual with national schemes, when early introduced: time period ok
Static Efficiency	National approach
Dynamic Efficiency	Given if designed in a way to support heat pumps and local heat networks as suggested by policy expert
Political Acceptability	Suggested equal quota for all MS ok as long as it is introduced early as gap-avoider
Legal Feasibility	Mixed opinion regarding EU competence
Financial Feasibility	No public financing required apart from administration

Figure 9 Assessment results for heat quota

6 Comparison of Instruments and Conclusion

The policy instruments described and assessed in the previous chapters are compared in the following. As gap-avoiders and gap-fillers do have different aims, they will be discussed separately. Still, the differentiation between them is not explicit. The heat quota, as suggested by the interviewed policy experts equal for all member states, will now be regarded as gap-avoider.

Table 6 and Table 7 give an overview on the main advantages, drawbacks and challenges of the analysed gap-avoiders respectively gap-fillers.

Table 6 Comparison of gap-avoiding instruments

<table>
<tr><th></th><th>Top-up premium</th><th>Investment Grant for Immature Technologies</th><th>WACC Equaliser</th><th>Equal Heat Quota for all</th></tr>
<tr><td rowspan="2">Main advantages</td><td colspan="2">Good incentive for high national pledges</td><td rowspan="2">Strengthens national support schemes + discourses on RE
increases equity among MS</td><td rowspan="2">Very low financial requirements
Independent of benchmarks
in general: heat instrument needed within 2030 Governance</td></tr>
<tr><td></td><td>Supports diversification of RE technologies
less interference with national support schemes</td></tr>
<tr><td>Main drawbacks</td><td colspan="2">Depends on benchmarks + political will of MS
high financial requirements
Low static efficiency
High support costs / High generation costs</td><td>Voluntary → depends on political will
Direct effects questioned</td><td>National approach → lower efficiency
political resistance by obliged parties</td></tr>
<tr><td>Main challenges</td><td>How to set level of premium?</td><td></td><td>How to raise awareness for relevance of capital costs?</td><td>How to adjust a quota scheme to the heat sector?
How to account for technological diversity/ prevent domination of biomass use?</td></tr>
</table>

Regarding the aim of any gap-avoider, to incentivise ambitious pledges of the member states, top-up premium and investment grants would have the most direct influence. The WACC equaliser would be a sufficient gap-avoider for the member states with high capital costs and enough political will to improve their national support schemes. The heat quota as a specific instrument for the heat sector might be helpful in a more general sense to achieve the 2030 RE target.

At the same time, top-up premium and investment grant are more costly compared to WACC equaliser and heat quota, and depend on the uncertain introduction of benchmarks.

The WACC equaliser as 'no-regret-measure' (tackling the problem of varying capital costs within the EU with low financial burden) and the heat quota as 'entry' instrument to the 2030 Governance (covering all member states) are hence the best available gap-avoiders at a first glance.

Table 7 Comparison of gap-filling instruments

	EU wide tender	National obligation for energy suppliers
Main advantages	Effectiveness and high static efficiency expected	No public financing required
Main drawbacks	Financial requirements very high Implementation very difficult	Time period 2024-30 too short for quota scheme
Main challenges	How to achieve political acceptance for benchmarks that are related to punishment (financing/ level of quota) in case of non-compliance?	
	How to otherwise distribute financing? How to harmonise support schemes among MS/ create a common new one?	How to design quota scheme in a way existing support schemes are not affected?

When comparing EU wide tender and the flexible national obligation with each other, effectiveness is one of the crucial contrasts: Results of the national obligation in terms of additional deployment of RE is highly questioned due to the rather short time period until 2030 and previous bad experiences with quota schemes, whereas the tender is expected to show not only high effectiveness but also high efficiency. Financing requirements are one another such contrast, and show the exact opposite picture: For the EU wide tender paying a full support (FIP over a certain time period) results in high financial requirements, on the other side, a quota system would mean relatively low administrative costs for the member states.

Both instruments depend on the introduction for benchmarks when financing and setting of the quota level depend on the member states' contributions. However, for the EU wide tender also other financing options could be discussed, e.g. via the general budget or not used structural funds. This would decrease equity among member states, but omit the discussion on the introduction of benchmarks to certain extent.

In total, the EU wide tender seems to be a more appropriate gap-filling instrument than the quota scheme according to this rough comparison.

Weighting of criteria

As can be seen in the comparison above, none of the instruments is clearly assessed as positive with regards to all criteria. The WACC equaliser is the only one to be evaluated as good in many terms; however its effectiveness was questioned. Similarly, the EU wide tender was judged relatively positive in most categories, but not for financial feasibility and implementation. The question arises how important the individual criteria are in relation to each other. For a real comparison of the instruments a weighting of the criteria is required.

Such weighting of criteria can be based on decision makers' preferences, as did Steinhilber (2016). She developed the following decision maker prototypes (Steinhilber 2016, p. 106):

- 'the cost-conscious' whose most important criteria are static efficiency with 45 % and dynamic efficiency with 30 %
- 'the pragmatic' focusing on socio-political and legal feasibility with each 30 %
- 'the environmentalist' highlighting dynamic efficiency (40 %), environmental effects (25 %) and the only one to consider effectiveness with 20 %

As the list of criteria she applied is not exactly the same as used for the work in hand and Steinhilber relied on quantitative data, these prototypes cannot provide more than rough indications. For data that has not been quantified, exact weighting of criteria does not seem to be possible nor appropriate. Still, when highlighting the above mentioned criteria, one can detect preferences the three decision maker prototypes would have regarding the proposed policy instruments.

Figure 10 shows which of the discussed instruments (including design elements as suggested by the policy instruments) fits to which group of criteria. The potential preferences the three decision maker prototypes lay within the circles.

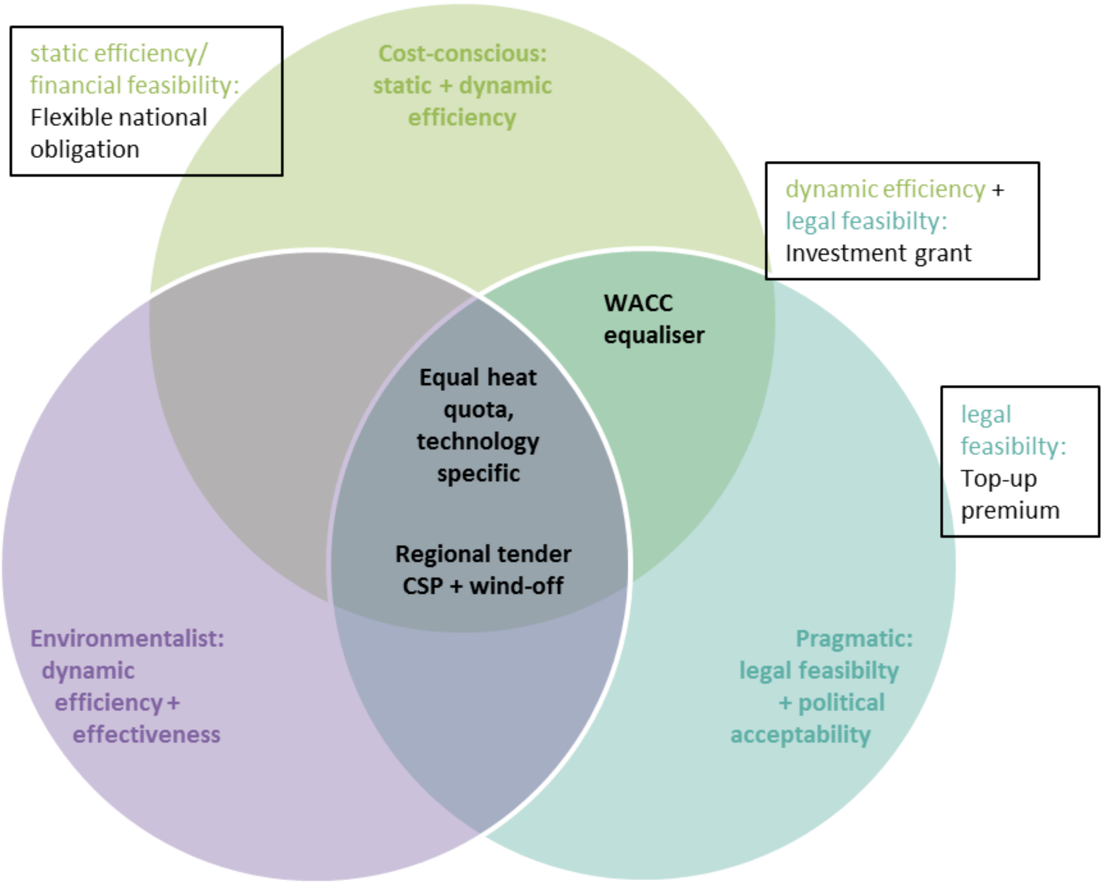

Figure 10 Decision makers' preferences, own elaboration based on Steinhilber 2016

The 'cost-conscious' actor (taking into account both current and long-term costs) would go for the heat quota and the EU wide tender, if both were designed in a technology-specific way. This could be the proposed tender for CSP and wind off-shore, or the heat quota with banding. As another gap-avoider the WACC equaliser could be considered, however, dynamic efficiency could not be achieved with this instrument.

The 'environmentalist' perspective it is difficult to transfer to this work, as the criterion environmental effects has not been considered here. Still, with regards to dynamic efficiency and effectiveness, the EU wide tender for immature technologies and a technology specific heat quota would fit the environmentalist's preferences best. Regarding the tender, an EU wide approach seems difficult to implement, hence in order to ensure effectiveness, a regional tender is suggested.

The 'pragmatic' decision-maker would go for the WACC equaliser as gap-avoider; however only in case it would be available for investors in all member states to ensure equity among the countries. A heat quota would also be politically acceptable when introduced as gap-avoider and equal for all. Regarding the gap-filler, the tender seems to be more acceptable to politicians than the flexible national obligation. However, the financing/ effort sharing question is the crucial point here. If solved in a simple and equitable way – which is seen as very unlikely by the interviewees - the EU wide tender would be acceptable to the 'pragmatic'.

The other instruments do perform well regarding only one or two criteria, which do are unequal the criteria highlighted by the individual decision-maker prototypes. The top-up premium does not face legal competence issues, but lacks political acceptability to please the pragmatic actor. Same applies for the investment grant. The latter would offer high dynamic efficiency, but misses static efficiency (high generation costs) to fit to the cost-conscious perspective and effectiveness (depends on political will) to suit to the environmentalist. Finally, the flexible national obligation's only advantage, high financial feasibility is not included in Steinhilber's matrix. Still, it can be related to static efficiency when the latter is understood in a narrower sense, this means in terms of total costs. Then the national obligation would partly fit to the cost-conscious decision-maker.

It becomes visible that the same three instruments are preferred by all decision-maker types: WACC equaliser, heat quota, EU wide/ regional tender.

They also happen to be a **suitable combination of instruments for the 2030 Governance** related to renewable energy. WACC equaliser and heat quota can be implemented early as gap-avoiders, whereas the tender can be opened in case of an identified gap. These instruments to not rely on the uncertain introduction of benchmarks, if the financing of the EU wide tender is solved differently (e.g. general EU budget). Furthermore, they address a wide range of member states, covering countries with high capital costs on the one hand, but also others with interest in developing still immature technologies on the other hand. Additionally, WACC equaliser and EU wide tender fit very well together, as was stated by several of the interviewed policy experts. The WACC equaliser builds up more convergence among the member states so their investors can bid under same conditions, which makes it easier to realise regional or EU wide tenders.

Table 8 summarises the suggested designs of these three recommended policy instruments as far as discussed and indicates the aspects that have to be further elaborated on.

Table 8 Design and further elaboration of recommended policy instruments

	WACC equaliser	**Heat quota**	**EU wide/ regional tender**
Initial design	Equalise highest WACC by offering guarantees that cover default of investors' repayment regarding certain risks	Member states with identified gaps have to introduce a quota scheme in the heat sector Level of quota equals identified national gap Heating fuel suppliers will be obliged to deliver certain share of RE/ green certificates	Open to investors from all member states Designed/ realised by European Commission Auctioned amount equals identified gap to 27% target Member states take part in financing
Changes/ elements suggested by experts	Cover policy change/ tariff-related risks Define non-tariff risks as requirements to participate	To be introduced as gap-avoider: equal + mandatory quota for all member states	Rather binational or regional scope Focus on wind off-shore + CSP
Covered by EC proposal (11/2016)	Retroactive changes shall be prohibited	Member states shall undertake measures in the heating & cooling sector (apart from measures at EU level) in case of gap	Further opening of national auctions: 15% in 2030
To be further elaborated	Specification of covered risks Definition of tasks for implementing agency (e.g. EIB) Definition of conditions for participation	Adapt quota scheme to heat sector Set level of quota	Define role of EC (top-down possible?)

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