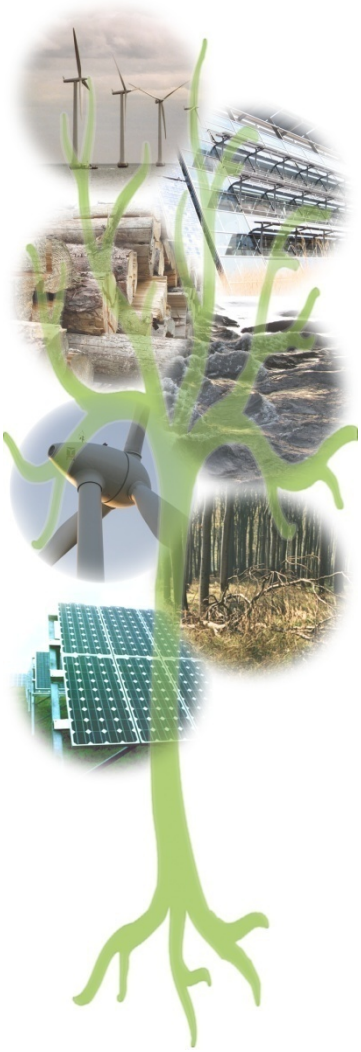
Design and impact of
a harmonised policy for
renewable electricity in Europe

beyond 2020

Report (D7.2)

Roadmaps for practical implementation

of a harmonisation of RES(-E) support in Europe



Authors:

Pablo del Rio, CSIC

Gustav Resch, André Ortner, Sebastian Busch, Lukas Liebmann, TU Vienna / EEG

Mario Ragwitz, Simone Steinhilber, Marian Klobasa, Jenny Winkler, Fraunhofer ISI

Malte Gephart, Corinna Klessmann, Isabelle de Lovinfosse, Georgios Papaefthymiou, Ecofys

Jana V. Nysten, Dörte Fouquet, BBH

Angus Johnston, Eva van der Marel, UOXF

Fernando Bañez, Carlos Batlle, Camila Fernandes, Pablo Frías, Pedro Linares, Luis Olmos, Michel Rivier, Comillas

Jaroslav Knapek, Tomas Kralik, CVUT

Thomas Faber, Sylvia Steinbaecker, AXPO

Bugra Borasoy, EnBW

Felipe Toro, Luis Plascencia, IREES

February 2014

A report compiled within the European
IEE project beyond*2020* (work package 7, deliverable 7.2)

www.res-policy-beyond2020.eu

Intelligent Energy – Europe (IEE), ALTENER
(Grant Agreement no. IEE/10/437/SI2.589880)

Co-funded by the Intelligent Energy Europe
Programme of the European Union

The beyond*2020* *project*

Year of implementation:	July 2011 – December 2013
Funding programme:	European Commission, EACI; Intelligent Energy – Europe (IEE) - Programme, Contract No. IEE/10/437/SI2.589880
Web:	www.res-policy-beyond2020.eu
General contact:	beyond2020@eeg.tuwien.ac.at

Project consortium:

Energy Economics Group	Vienna University of Technology, Institute of Energy Systems and Electrical Drives, Energy Economics Group (EEG), Austria *(Project coordinator)*
Fraunhofer ISI	Fraunhofer Institute for Systems and Innovation Research (ISI), Germany
CSIC Consejo Superior de Investigaciones Científicas	Consejo Superior de Investigagiones Cientificas (CSIC), Spain
University of Oxford	University of Oxford, United Kingdom
BBH Becker Büttner Held Rechtsanwälte · Wirtschaftsprüfer · Steuerberater	Becker Büttner Held (BBH), Belgium
	Czech Technical University in Prague (CVUT in Prague), Czech Republic
axpo	AXPO Austria GmbH (AXPO), Austria
ECOFYS	Ecofys b.v. (Ecofys), The Netherlands
Universidad Pontificia ICAI ICADE Comillas Madrid	Comillas Universidad Pontificia Madrid (Comillas), Spain
IREES Institute for Resource Efficiency and Energy Strategies	Institute for Resource Efficiency and Energy Strategies (IREES), Germany
EnBW	Energie Baden-Württemberg AG (EnBW), Germany

The beyond*2020* project *at a glance*

With Directive 2009/28/EC, the European Parliament and Council have laid the grounds for the policy framework for renewable energies until 2020. The **aim of this project** is to **look more closely *beyond 2020*** by designing and evaluating feasible pathways for a harmonised European policy framework for supporting an enhanced exploitation of renewable electricity in particular, and RES in general. Strategic objectives are to contribute to the forming of a European vision of a joint future RES policy framework in the mid- to long-term and to provide guidance on improving policy design.

The work comprises a detailed elaboration of feasible policy approaches for possible harmonisation of RES support in Europe, involving five different policy paths: i.e. uniform quota, quota with technology banding, fixed feed-in tariff, feed-in premium, or no further dedicated RES support besides the ETS. A thorough impact assessment is undertaken to assess and contrast different instruments as well as corresponding design elements. This involves: a quantitative model-based analysis of future RES deployment and corresponding cost and expenditures based on the Green-X model; and a detailed qualitative analysis, focusing on strategic impacts, as well as political practicability and guidelines for juridical implementation. Aspects of policy design are assessed in a broader context by deriving prerequisites for and trade-offs with the future European electricity market. The overall assessment focuses on the period beyond 2020; however, a closer look is also taken at the transition phase before 2020.

The final outcome will be a finely-tailored policy package, offering a concise representation of key outcomes, a detailed comparison of the pros and cons of each policy pathway and roadmaps for practical implementation. The project is embedded in an intense and interactive dissemination framework consisting of regional and topical workshops, stakeholder consultation and a final conference.

Contact details:

<< Project coordinator >>

Gustav Resch
Vienna University of Technology, Institute of Energy Systems and Electrical Drives, Energy Economics Group (EEG)
Gusshausstrasse 25/370-3
A-1040 Vienna
Austria
Phone: +43(0)1/58801-370354
Fax: +43(0)1/58801-370397
Email: resch@eeg.tuwien.ac.at

<< Lead author of this report >>

Pablo del Río
Consejo Superior de Investigagiones Cientificas (CSIC)
C/Albasanz, 26-28
28037 Madrid
Spain
Phone: +34 91 602 2560
Fax: +34 91 602 29 71
Email: pablo.delrio@cchs.csic.es

This report

provides roadmaps for assessed policy pathways of harmonisation of RES(-E) support across Europe, including guidelines for the detailed design suitable for practical policy implementation as well as recommendations on the steps to be taken in the transition phase.

Authors:
Pablo del Rio, CSIC
Gustav Resch, André Ortner, Sebastian Busch, Lukas Liebmann, TU Vienna / EEG
Mario Ragwitz, Simone Steinhilber, Marian Klobasa, Jenny Winkler, Fraunhofer ISI
Malte Gephart, Corinna Klessmann, Isabelle de Lovinfosse, Georgios Papaefthymiou, Ecofys
Jana V. Nysten, Dörte Fouquet, BBH
Angus Johnston, Eva van der Marel, UOXF
Fernando Bañez, Carlos Batlle, Camila Fernandes, Pablo Frías, Pedro Linares, Luis Olmos, Michel Rivier, Comillas
Jaroslav Knapek, Tomas Kralik, CVUT
Thomas Faber, Sylvia Steinbaecker, AXPO
Bugra Borasoy, EnBW
Felipe Toro, Luis Plascencia, IREES

Acknowledgement:

The authors and the whole project consortium gratefully acknowledge the financial and intellectual support of this work provided by the Intelligent Energy Europe (IEE) Programme.

Co-funded by the Intelligent Energy Europe Programme of the European Union

with the support of the
EUROPEAN COMMISSION

Executive Agency for Small and Medium-sized Enterprises (EASME)

Intelligent Energy Europe

Table of contents

Tables

Abbreviations

BAU	business as usual
EC	European Commission
ETS	emission trading system
EU-27	European Union comprising 27 Member States
FIP	feed-in premium
FIT	feed-in tariff
GC	generation costs
GDP	gross domestic product
GHG	greenhouse gas
MC	marginal cost
MS	Member State
NIMBY	not in my backyard
p_c	electricity price
PS	producer surplus
PV	photovoltaics
q_{el}	quantity of electricity generation
S	supply curve
p_F	feed-in tariff
p_I	investment subsidy
p_Q	penalty
PT	payback time
RES	renewable energy sources
RES-E	electricity generation from renewable energy sources
RES-H	heat generation from renewable energy sources
RES-T	renewable energy sources in the transport sector
SNP	strengthened national policies
TGC	tradable green certificate
TFEU	Treaty on the Functioning of the European Union
WACC	weighted average cost of capital

1 Introduction

The objective of this report is to consolidate and structure important findings from the beyond*2020* project in order to translate them into roadmaps for the evaluated policy pathways.

The definition of policy pathways beyond 2020 requires us to make decisions on several elements. In particular the following criteria need to be decided:

- the degree of harmonisation distinguishing between "full", "medium", "soft" and "minimum";
- The choice of the particular support instrument;
- the choice of specific design elements for the support instruments;

In addition to that, several "who", "when" and "what" decisions have to be taken with respect to the components and framework conditions of the policy pathways in order to translate them into a roadmap.

The outline for this report is as follows:

- Building on the results of inception phase of this project, chapter 2 describes the different policy pathways that have been identified, designed and evaluated in this project;
- Chapter 3 proposes a structure for the transition phase from national support instruments towards an EU wide support instrument RES(-E). Therefore, the components that need to be decided on are identified and a feasible timeline to organise the transition is developed;
- Chapter 4 reviews the different elements that constitute a policy pathway. Building on the outcomes of the other work packages in this project, possible trade-offs between and implications of different design choices are discussed, and, where suitable, robust recommendation-specific design criteria are developed.
- In combination, the different chapters in this report provide a toolbox for the design of roadmaps for the different policy pathways proposed and evaluated in this project.

2 Policy pathways for a harmonisation of RES(-E) support in Europe

This section summarises the outcomes of the detailed elaboration of feasible pathways for the harmonisation of RES(-E) support in Europe. In order to define the policy pathways, we conducted an extensive literature review, including work already performed by the members of the research team, as well as a stakeholder consultation and a consortium-internal cross-check.

Pathways are defined at two levels. A first level involves degrees of harmonisation: i.e. at which legislative/administrative level the decisions on instruments and design elements are taken, and whether there are national RES-E targets in addition to a European target. On a second level, there are some components of the pathways that need to be harmonised: instruments, design elements, framework conditions and other elements, including the use of cooperation mechanisms and cost-allocation alternatives. The combination of all these components under different degrees of harmonisation results in a broad set of different pathways for analysis and evaluation.

2.1 Classification of policy concepts

In the debate on the convergence of support schemes for RES, different concepts such as "convergence", "coordination", "cooperation", and "harmonisation" are used and sometimes conflated. As a result, we have aimed to provide further clarification on the terminology, in accordance with Gephart *et al* (2012), classifying and defining the meanings of the different concepts:

- *"Convergence"* simply means that policies (and possibly related regulations) are becoming similar in different Member States (MSs). Thus, the following concepts can be classified as means to achieve the overarching goal of convergence;
- *"Coordination"* might refer to knowledge exchange between governments and possible alignment of certain elements of a support scheme;
- *"Cooperation"* either refers to governments loosely working together or it might refer to the RES Directive (2009/28/EC) and its inherent possibilities to establish statistical transfers of renewable energy, joint renewable energy projects (among MSs or with third countries) or joint support schemes (that is, merged support schemes) as specified in Articles 6, 7, 9 and 11 of the Directive. All of these concepts have different implications: e.g. regarding who initiates the convergence (top-down or bottom-up), regarding different levels of the binding nature of a given instrument and different levels of detail;
- *"Harmonisation"* is generally regarded as a top-down implementation of common, binding provisions concerning the support of RES-E throughout the EU (Bergmann *et al* 2008). However, harmonisation admits many possibilities concerning what needs to be harmonised and how, along a continuum from "Full" to "Minimum" harmonisation, depending on the combination of "what" options (i.e., targets, support scheme, design elements, support level) and "how" options (i.e., whether decisions are taken at EU or MS level). Different levels of harmonisation can, in principle, be combined within the same instrument.

2.2 Degrees of harmonisation

In order to keep the discussion on the pathways manageable, we consider four alternatives here, as illustrated in Table 1. We focus on several critical aspects, which from our work in this project have

been useful for the definition of pathways: i.e. whether there are MS targets in addition to the EU-wide target, and at what administrative level the decision on instruments and design elements (and, particularly, support levels) is taken (EU or MS). A brief description of the different alternatives follows.[1] We have considered four major degrees of harmonisation. Obviously, there might be other possibilities within the wide range of alternatives, but we believe that the ones selected cover the major aspects of harmonisation.[2]

Table 1 Degrees of harmonisation considered in this report.

Degree of harmonisation	MS targets	Support scheme	Decision on design elements	Decision on support level
Full	No	EU-wide	EU	EU
Medium	No	EU-wide	EU	EU (plus additional MS support)
Soft	Yes	Same instrument used in MS, not uniform	MS (some imposed by EU)	MS
Minimum	Yes	MS decision.	MS (some imposed by EU)	MS

- *Full harmonisation* involves the setting up of EU-wide targets (no MS targets), an EU-wide support scheme, harmonisation of framework conditions and harmonisation of the design elements of the support scheme selected. There is a very limited role to be played by the MSs. Full harmonisation involves harmonisation of: the *level* of support; support *schemes*; and the *legal framework* as a whole, including regulatory issues. An EU-wide socialisation of the costs of support takes place. The focus on Full harmonisation is justified because this seems to have been a long-term aspiration of the European Commission. As observed by Guillon (2010), the European Commission has repeatedly mentioned that harmonisation remains a long-term goal (European Parliament and Council, 2001 and/or European Commission 2005, 2008). Notwithstanding this, while Full harmonisation remains a long-term aspiration, lower degrees of harmonisation are also possible and it is very difficult at this stage to tell what will be the final degree of harmonisation. Thus, we also consider softer degrees of harmonisation.
- *Medium harmonisation* would be very close to Full harmonisation. There is also one EU-wide instrument and EU support level, but countries may provide additional (albeit limited) support for specific technologies, either within the EU-wide support scheme (i.e., additional remuneration based on local benefits under feed-in tariffs or premia) or as an additional instrument to the EU-wide support scheme (i.e., investment subsidies or soft loans). The latter option would be more feasible in the case of quotas with TGC or tendering schemes, since it would be very difficult or even impossible for MSs to provide additional support directly incorporated into an EU-wide TGC or tendering scheme. Countries may be willing to provide additional support depending upon the local benefits of RES-E. It should be taken into account that having additional support per country would mean that the EU target may be exceeded (since the EU-support level is set to reach those targets). Alternatively, the EU support level may be set taking into account the amount of RES-E that MSs are willing to have and may inform the Commission on the level of support and amount of RES-E that it would like to promote. The level of EU-wide support would thus be set interactively. Another option would be to have (indicative) national targets and use Art. 6 cooperation mechanisms (statistical transfers) to redistribute the additional RES-E capacity across countries.

[1] For a discussion on different degrees of harmonisation, see Bergmann *et al* (2008) and Guillon (2010).

[2] In particular, an alternative which has not been discussed is the possibility to combine an EU-wide support level (as in Full and Medium harmonisation) with MS targets (as in Soft and Minimum harmonisation).

But no MS targets have been assumed in this scenario because an EU-wide support scheme with a single support level would render MS targets meaningless.

- *Soft harmonisation*. This harmonisation alternative would be closer to Minimum harmonisation than to Full harmonisation. There is an EU-wide target, but also national targets consistent with the EU target. Countries have to implement domestically the support scheme that has been decided at EU level. However, countries may use whatever design element they deem best and support levels may differ across countries.[3] There might be some design elements imposed at the EU level.

- At the other end of the spectrum, under *Minimum harmonisation*, EU-wide targets as well as national targets are set by the EU. MSs decide on both the type of support scheme that they apply and its design elements. MSs may set whatever support level they deem most appropriate. There might be minimum design elements set by the EU (e.g. authorisation procedures and an obligation to support different technologies).

2.3 Policy instruments

RES-E promotion has traditionally been based on three main (primary) mechanisms: feed-in tariffs (FITs), quotas with tradable green certificates (TGCs) and tendering (see del Río and Gual 2004, Ragwitz *et al* 2007, Schaeffer *et al* 2000, and Huber *et al* 2004 for further details).

- *Feed-in tariffs* offer financial support per kWh generated, paid in the form of guaranteed (premium) prices and combined with a purchase obligation by the utilities. The costs are usually borne by consumers. The most relevant distinction is between fixed feed-in tariff (FITs) and fixed premium (FIP) systems. The former provides total payments per kWh of electricity of renewable origin while the latter provides a payment per kWh on top of the electricity wholesale-market price (Sijm 2002). Each has its pros and cons: in general, while FIPs are usually considered more market-compatible, FITs provide greater certainty for investors.

- *TGCs* are certificates that can be sold in the market, allowing RES-E generators to obtain revenue. This is additional to the revenue from their sales of electricity fed into the grid. Therefore, RES-E generators benefit from two streams of revenue from two different markets: the market price of electricity, plus the market price of TGCs multiplied by the number of kWh of renewable electricity fed into the grid (Schaefer *et al* 2000). The issuing (supply) of TGCs takes place for every MWh of RES-E, while demand generally originates from an obligation. Electricity distribution companies must surrender a number of TGCs as a share of their annual consumption. Otherwise, they will have to pay a penalty. The TGC price results from the interaction of supply and demand, and depends on the level of the quota (Q) and the marginal costs of RES-E generation (MC_{RE}). The expected TGC price (P_{TGC}) covers the gap between the marginal cost of renewable electricity generation at the quota level and the price of electricity (P_e). P_e and P_{TGC} move in opposite directions: an increase in P_e reduces the TGC price accordingly.

- *Tendering.* The government invites RES-E generators to compete for either a certain financial budget or a certain capacity of RES-E generation. Within each technology band the cheapest bids per kWh are awarded contracts and receive the guaranteed remuneration (Schaeffer *et al.*, 2000). The operator pays the bid price per kWh. A fund financed by a levy

[3] There is no possible combination of the key elements of the medium and soft alternatives, since having national targets is incompatible with support levels being decided at EU level. This is because there is no possibility for countries to do anything extra themselves to reach those targets: i.e., they cannot change the support level to reach those targets. National targets only make sense if countries have an instrument in their hands to reach them (i.e., support levels).

on electricity consumers or taxpayers covers the difference between this bid price and the market price of electricity.

2.4 Identified policy pathways

Combining the degrees of harmonisation with the instruments and relevant design elements leads to several policy paths for a harmonisation of RES(-E) support in Europe. Banded and unbanded TGCs, premium and fixed FITs are currently widely-used instruments in the EU MSs. Tendering schemes are not widespread, but there is a trend in some countries to use them for large-scale RES projects. Unbanded TGCs were initially adopted in the U.K. and Italy, but concerns about the lack of incentives for the deployment of less mature technologies led to a shift to banded TGCs. Unbanded TGCs are still present in Belgium, Poland, Romania and Sweden. A uniform quota is still proposed by those arguing in favour of inter-technology competition (i.e., competition between different renewable energy technologies to meet the target, even if this means technologies with different maturity levels). However, it is widely acknowledged that this technology neutrality would involve the dominance of mature technologies without allowing immature technologies to penetrate the market. The costs of immature technologies (partly) depend on their diffusion; this would mean that their costs would make them unattractive for adoption, since these technologies will be needed in the future for cost-effective compliance with RES-E (and CO_2) targets. Their advancement along their learning curves (through diffusion) is required, which calls for technological diversity and, thus, justifies a banded TGC.

Table 2 summarises the policy pathways considered that have been analysed in a detailed manner within the course of this project. The list of identified pathways has become significantly longer than initially proposed: taking into account the aforementioned policy paths and the design elements, their combination may lead to several alternatives for the design of the pathway. In this section, we consider the possible combinations in greater depth.

Accordingly, 16 policy pathways are proposed, taking into account the main RES-E support instruments (TGCs, FITs and tendering), their main design elements and different degrees of harmonisation. Within those policy packages, further choices have to be made regarding some design elements and the role of MSs: see subsequent sections for our recommendations in this respect.

Table 2 Overview on proposed policy pathways

Overview on RES(-E) policy pathways beyond*2020*			*Instrument*					
Degree of harmonisation	*Characterisation*		**FIT** (feed-in tariff)	**FIP** (feed-in premium)	**QUO** (quota system with uniform TGC)	**QUO banding** (quota system with banded TGC)	**ETS** (no dedicated RES support)	**TEN** (Tendering for large scale RES)
Full	• EU target • One instrument		1a	2a	3a	4a	5	6 Sensitivity to 7 (national support, but harmonisation for selected technologies)
Medium	• EU target • One instrument • Additional (limited) support allowed		1b	2b	3b	4b		
Soft	• EU & National targets • One instrument • MS can decide on various design elements incl. support levels		1c	2c	3c	4c		
Minimum	• With minimum design standards for support instruments	• EU & National targets • Cooperation mechanism (with or w/o increased cooperation)	7d **Reference with minimum design criteria** (national RES support with increased cooperation and *with minimum design standards)*					
No	• No minimum design standards for support instruments		7 **Reference** (national RES support w/o increased cooperation and *w/o minimum design standards*)					

3 Structuring the transitional phase: Roadmaps for practical implementation of policy pathways

When considering the implementation of a European-wide harmonised support policy, the transition from a nationally-based support framework to an international policy model has a vital role to play. A poorly-designed transitional phase may disrupt those national support schemes that have performed well in terms of successfully promoting renewable energy sources. The question of how a smooth transition to a harmonised support scheme can be achieved without disturbing nationally successful support policies is addressed in this section. Prerequisites for a harmonisation of RES(-E) support as identified within the thematic work packages within this project, as well as the related findings from the synoptic integrated assessment, provide the complete picture in this respect. Based on these findings, it is the aim of below to summarise and structure these prerequisites in an integrated manner.

The outcome of this represents **an indicative roadmap for the transitional period**, showing what a possible transition could look like. A related objective here is the identification of prerequisites for a successful harmonisation. These preconditions are generally the same for all policy paths – e.g. a removal of non-economic RES barriers – but it can be expected that they acquire different importance under each of the assessed policy environments. Accordingly, specific attention will be paid to the identification of such specific needs arising for each policy pathway.

Thus, **milestones and objectives** for different phases of the transition (near-term, mid-term and long-term) will be defined. The roadmap for the transitional period will assist in understanding the issues on which key actions are required to achieve a smooth transition and may be used for the monitoring of the political implementation process. In this context, the role that flexible mechanisms may play in the transition to a harmonised support scheme will also be analysed.

3.1 The components of policy pathways

Some crucial decisions have to be taken in order to implement the policy pathways. The section below lists the most relevant "what"-decisions that need to be taken. The question of "who" should take the decision on these "what"-issues is relevant for the degrees of harmonisation. Some components should be made part of the legislative proposal, whereas the implementation of others may be decided after the legislative proposal has been adopted and published.

3.1.1 What needs to be decided and at which level <u>before</u> the adoption of the legislative proposal?

- *EU and MS targets.* A decision on the EU targets should be taken at the EU level, as under the current 2020 RES Directive. This is common to all pathways. In addition, there might also be MS targets, according to the principle of subsidiarity. All pathways except the ones leading to full and medium harmonisation also require the definition of national RES targets. Under full and medium harmonisation, targets are set at EU level and there is only an EU-wide target. Under soft harmonisation, the EU-wide target coexists with national targets set by the EU.
- *Authorisation procedures for new installations.* Administrative authorizations for the installation of RES-E plants may be granted at the EU or the MS level. Currently, in some countries, this competence even falls on sub-national entities, i.e. it is exercised at regional level. The higher the degree of harmonisation, the more likely the authorization should be

provided at EU level, whereas under the lower degrees this competence would fall on the MS level. Granting of permits could be made uniform at the EU level under the full and medium degrees of harmonisation. It would involve the setting of some minimum EU standards in the other two degrees of harmonisation: for example, by setting a maximum time limit within which permits should be granted (all administrative levels). This should provide a homogenous (and short) lead time for RES-E investors all over Europe. Establishing such decision-making power (and the body to exercise it) at EU (under full or medium harmonisation) level would prove challenging under the current legal framework, due in part to the competence implications of Article 194 TFEU (discussed in report D3.2, §1.2 (Fouquet et al, 2014)) and in part to non-delegation doctrines with regard to power conferred upon the Commission (see the *Meroni* judgments of the Court of Justice: Cases 9 and 10/56 [1957-1958] ECR 133 and 157, respectively). Provided that a part of the Commission itself could exercise this function, and provided that the competence difficulties can be managed, this could be achieved.

- *Grid-access conditions.* Conditions for the grant of grid access would ideally be made uniform at the EU level under the full and medium degrees of harmonisation. It would fall within the competence of the MS (maybe with some minimum EU standards) in the soft and minimum degrees of harmonisation.
- *Distribution of grid connection costs.* A crucial aspect is how the grid connection costs are distributed. There are basically three alternatives: deep connection charging, shallow connection charging and super-shallow connection charging. Only the latter two are favourable for RES-E plants (Guillon 2010, Klein et al 2010) and, thus, either one or the other should be implemented. This should be harmonised across the EU in all harmonisation degrees (although, again, Article 194 TFEU may pose difficulties in achieving this).
- *Top–up of primary instrument / use of secondary instruments by MSs.* Secondary instruments (investment subsidies and fiscal incentives) may be used by MSs *either* to (a) provide additional support for specific technologies (additional to the EU or MS support) *or* (b) to support specific technologies which are not supported by the EU or MS scheme. In order to avoid distortions between MSs, the possibility of using secondary instruments should be decided at EU level. Under full harmonisation, neither possibility a) nor (b) would be allowed. Under medium harmonisation, MSs could provide additional (albeit limited) support (option (a)), and support for technologies which are not supported by the EU-wide scheme (option (b)) where they are eligible for support (on the basis of an EU decision, probably under State aid law). Support by secondary instruments is allowed in the case of a soft *and* minimum harmonisation.
- *Cost allocation.* Different alternatives exist for sharing the burden of costs between MSs. However, a crucial distinction here is between, on the one hand, full and medium harmonisation and, on the other, soft and minimum. In the latter two cases, there are MS targets which already constitute a form of burden-sharing, as efforts for each MS differ depending on which formula is used to allocate the targets. Each country then either applies its own instrument (minimum harmonisation) or sets the support level (among other design elements) within an EU-imposed support scheme in order to fulfil its national RES-E target (soft *harmonisation*). There is no additional requirement to share the cost burden in these two cases. Countries set whatever support level they deem best to support their RES-E resources. Of course, some MSs may not comply with their targets and some may over-comply. In principle, and only for the surplus/shortage of RES-E (i.e., only for the country-specific deployment of new RES-E installations which is not needed for target-fulfilment in the country of origin), a methodology for the country-specific allocations of the resulting transfer cost could be devised. This could take the form of average premiums for surplus or marginal premiums for surplus, as argued in Resch *et al* (2008). But, since the trade of sur-

plus/shortages is likely to be the result of bilateral negotiations, prices for sales/purchases would be determined bilaterally and cannot be known beforehand. They fall within the range of the marginal costs of the last unit needed by the exporting country to comply with its target (lower boundary) and the last unit needed by the importing country to comply with its target. But it is simply impossible to tell *ex ante* what the resulting price from those transactions will be. All in all, as mentioned above, burden-sharing would not be appropriate in these two cases, since countries fulfil their targets purely at the national level, but costs would have to be borne elsewhere.

In contrast, under full and medium harmonisation, there are no national targets, only an EU-wide target, and the issue of who pays for renewable energy sources deployed all over Europe is one which goes beyond national borders. A common fund paid for by European consumers or taxpayers is needed in this case.[4] How consumers and taxpayers contribute to this fund is a crucial issue. The common fund needs to be agreed between countries. Two alternatives for burden-sharing are discussed: "equal payment" and "proportional payment" (see D2.1 report). Both equal and proportional payment can be applied in the full and medium harmonisation alternatives. However, in the medium harmonisation alternative, this approach should be applied for the EU-wide support, but the costs of the additional support provided by each country should fall on the country providing the support. Thus, in the medium harmonisation option, consumers would have two types of costs: the EU-wide support (calculated according to the equal or proportional payment) and the additional, country-specific support.

- *Use of cooperation mechanisms.* Under full harmonisation, with EU-wide targets and a uniform support scheme applied all over the EU, there is no role for cooperation mechanisms except for joint project between MSs and third countries (Article 9). The other cooperation mechanisms would not have a role to play since there are no national targets and nationally-differentiated support levels. This is also the case with medium harmonisation. In contrast, the use of all cooperation mechanisms is possible under soft harmonisation. Although the same support scheme is prescribed for all MSs, countries may decide on the support levels and other design elements in order to comply with their national target. This opens the door for "where"-flexibility to achieve the national target at lower cost, as provided by the cooperation mechanisms. Similarly, all cooperation mechanisms may be used under minimum harmonisation.
- *Eligibility of plants in other countries.* The eligibility of RES plants in *non-EU* countries should be decided at EU level. This is only relevant as long as there are national targets and national RES-E support schemes, but is obviously not relevant when an EU-wide support scheme is implemented: i.e., with full and medium harmonisation. The decision is relevant under soft harmonisation or in the case of minimum harmonisation. In these latter two options, countries may allow all third country plants to be eligible to receive domestic support (if allowed by the EU: given the EU's WTO law obligations, in particular under the Anti-Subsidies and Countervailing Measures Agreement, it seems likely that (at least *prima facie*) the EU would need to allow this, unless clear evidence justifying the restriction of such third country plants could be provided).
- *Choice of instruments.* If it is decided at EU level that an EU-wide instrument should be implemented (i.e., under the full, medium and soft degrees of harmonisation), then the choice of this instrument should be within the legislative proposal, and would be likely to be a directive. However, the more prescriptive the measure, the stronger the case would be –

[4] There is one exception to this general rule: in the case of quota systems based on tradable green certificates (obviously assuming EU-wide trade of such certificates), the instrument would by itself already redistribute the cost (and RES deployment, which would be relevant for target accounting by MSs), since certificate prices would be identical across Europe in that case.

particularly under full harmonisation) for the adoption of a regulation. This would be particularly the case where EU-level bodies and instruments were to be created (by way of illustration from current practice, see Regulation 389/2013/EU [2013] OJ L122/1, establishing the EU ETS Registry to enable the proper functioning of the EU's ETS Directive 2003/87/EC). Of course, such more far-reaching EU-level measures are also more susceptible to the competence difficulties under Article 194 TFEU.

- *Decision on design elements.* Similarly to the previous point, if it is decided at EU level that an EU-wide instrument should be implemented (i.e., under the full and medium degrees of harmonisation), then it should be decided which design elements are to be implemented, and this should also be part of the legislative proposal. Design elements might be:
    - common to all instruments (eligibility of plants (new vs. existing), constant or decreasing support level during support period, eligibility of technologies (i.e., which technologies are included or excluded), the duration of support, the cost burden of RES-E support, whether there is technology-specific support, whether there is a size-specific support level, and whether there is location-specific support); or
    - instrument-specific (see section 4 of the present report)..
- *Certain common legal elements.* Beyond obvious points (such as the requirement to specify and justify a legal basis for any EU-level measure), there is also a strong need to ensure compatibility with – or to make concomitant amendments to – pre-existing EU legislation, and not to create problems with regard to directly effective EU Treaty-level rules (e.g. on free movement and State aid law). Specific details on these points are provided in report D3.2 (Fouquet et al, 2014: see, in particular, §§3.1 to 3.3). Thus, any future EU measure on renewables should make clear:
    - the goals it seeks to achieve, the reasons for doing so and the evidence upon which pursuit of those goals is based. All of this will make defending any such measure against various possible future legal challenges much more straightforward, thereby reducing potential uncertainty as to the stability and terms of any future EU renewables regime;
    - its relationship with those other rules, whether at EU level (in terms, e.g., of the role of the Commission when operating under both the renewables measure and its State aid law powers) or national level (e.g. reminding MSs of their obligations under free movement and/or State aid law, clarifying that the EU measure does not seek to affect EU law in other areas *or* that this EU measure specifically aims to provide legislation which would justify MS action which would otherwise be a *prima facie* breach of such EU law rules).

Also, any such proposed measure should be careful to take into account the following considerations:

- the need to secure strong and wide-ranging agreement among the Member States, due to the implications of Article 194 TFEU (see further, §4.2, below);
- the importance of protecting pre-existing investments in any transitional phase: failure to do so could leave such an EU measure (or national implementation thereof) vulnerable to challenges by private operators on fundamental rights grounds (e.g. concerning the right to property and associated legitimate expectations). Even if such legal challenges were ultimately to prove unsuccessful, the very fact that there is at least a plausible basis upon which they might be brought could serve to damage confidence in both the transition and the new renewables regime, thereby discouraging both new, and jeopardising ongoing, investments and projects.

3.1.2 What needs to be decided and at which level after the adoption of the legislative proposal?

- *Adaptation of ten-year network-development-plan.* Soon after the 2030 RES legislation is adopted, an adaptation of the 10-year network development plan according to the expected RES deployment under the legislative proposal may be needed. This is caused by the fact that a certain spatial distribution of RES deployment will result from the type of RES policy, which has implications for the required grid development. If needed, a negotiation on revised burden-sharing regulations for RES-E driven grid extensions would need to be commenced.
- *EU-wide RES plant registry.* The development of technically and legally robust RES plant registry will be necessary for medium and full harmonisation. This is based on the fact that plants which are supported by a harmonised support scheme will also need a harmonised monitoring and registration regime. Just to mention one example, the exact installation date of each plant needs to be known in order to determine the duration of support payments. As discussed above (under §4.1.1), the appropriate instrument for setting up such a registry would be likely to be a regulation. Under soft and minimum harmonisation, national plant registries will fulfil this objective.
- *The process of setting remuneration / penalty levels.* In any type of full or medium harmonisation, a process of setting (technology-specific) remuneration levels or penalty levels (in case of quota schemes) needs to be established. This is due to the fact that these tariff-setting procedures need to be flexible enough to allow for possible adjustments to changing market conditions. Therefore the technical details of tariff setting procedure should be separated from the legislative proposal, whereas the methodology should be defined in the legislation. Possibly the establishment of new authority on RES tariff setting will be necessary.
- *Fully liquid wholesale markets.* A fully liquid wholesale electricity market needs to be accomplished as the underpinning for any type of premium system or quota system. For feed-in premium systems and quota systems, a transparent reference price will be needed. Therefore, liquid wholesale markets are an important condition, which account for the major share of traded power. Since this condition is not fulfilled in all EU electricity markets, further adjustments will be needed before introducing such RES policies under full or medium harmonisation.
- *Integrated balancing markets.* Adapting market rules for balancing to accommodate high shares of fluctuating RES-E beyond the steps already taken will be another important component. This concerns particularly the international coordination of balancing markets as well as increasing liquidity of intra-day markets. This component will be relevant for all degrees of harmonisation.
- *Stronger coordination of spatial planning.* In particular for the cases of full and medium harmonisation, a stronger coordination of spatial planning will be necessary to provide transparency and certainty for investors, and to minimise distortions between EU Member States, which are related to the availability of land for RES plant installations. Only if least cost resource allocation of a harmonised policy is undistorted by non-economic barriers, can the benefits of harmonisation be realised. At the same time, it should be acknowledged that this EU policy area falls within those subject to unanimous voting requirements in Council, under Article 192(2) TFEU: while the EU has succeeded in adopting some planning-related measures in the past (such as Directive 85/337/EEC on environmental impact assessment), it should be acknowledged that achieving agreement from all Member States on such matters could prove challenging.

- *Coordination with ETS.* Where the evidence shows that emission allocations under the ETS should be dynamically adjusted with RES-deployment, coordination between RES policy and ETS needs specific technical implementation, either by the establishment of strict quantitative corridors for RES generation or by dynamic adjustments of the amount of certificates auctioned under the ETS.

3.2 Putting policy pathways into practice: Timing of the practical implementation of components and related legal aspects

The ***degree*** of harmonisation is a major dimension in defining policy pathways. In turn, each degree of harmonisation requires the adoption of important measures: i.e., the components mentioned in the previous section. Indeed, the implementation of each component is more or less important depending on the degree of harmonisation. The following paragraphs provide details on this question of the relevance of the components. This is complemented with an analysis of the legal aspects that pertain to different degrees of harmonisation.

3.2.1 Full harmonisation

- *Components.* The adoption of many of the aforementioned pre-RES legislation components is vital under full harmonisation. Apart from a decision on an EU-level target (which is also relevant for the other degrees of harmonisation), an EU-wide procedure to coordinate the authorisations for new installations should be implemented. Grid access conditions should be harmonised, with shallow or super-shallow grid connection charging for all RES-E. The use of secondary instruments by MSs should also be coordinated. Effort-sharing / cost allocation will need to be defined. A main pre-legislative requirement is the adoption of an EU-wide instrument and the corresponding design elements.

  Several post-legislative components are crucial for this degree of harmonisation. A critical and differentiating element with respect to other degrees of harmonisation is the adaptation of 10-year network development plan according to the expected RES deployment. Other main components include the development of a RES plant registry and setting remuneration levels. Fully liquid wholesale markets need to be accomplished for any type of premium system or quota system: beyond the steps already taken, the market rules for balancing to accommodate for high shares of fluctuating RES-E need to be adopted. Finally, coordination of RES-E support with an ETS needs to be defined, dynamically adjusting the amount of ETS allowances, as suggested in the BEYOND2020 report on interactions between RES-E support and ETS (see del Río et al 2014).

- *Legal aspects.* The crucial difficulty with the adoption of a full harmonisation measure concerns the limitations imposed by Article 194 TFEU on the EU's competence to legislate in the field of energy (see Report D3.2 (Fouquet et al, 2014), §1.2). This is in part due to the uncertainty in interpreting Article 194(2) TFEU, and in part due to the consequences that would flow from any of the plausible interpretations of its meaning. At best, it seems that a MS might agree to a full harmonisation measure but still be able to derogate from it subsequently, or else demand the inclusion of opt-out mechanisms within that measure itself; at worst, Article 194(2) implies a form of veto against EU-level measures which touch upon MSs' 'energy rights', either procedurally during the legislative process or even as a matter of substance which restricts the EU's competence to act. One highly beneficial amendment which could facilitate EU-level measures on renewables would thus be to clarify the meaning and implications of Article 194, whether by Treaty amendment (not something considered in this project) or via litigation to generate authoritative judgments from the Court of Justice on these questions. Declarations or statements by Member States and/or the Com-

mission might provide some guidance and reassurance, but would ultimately not be binding or authoritative, and so of relatively limited impact and utility.

Beyond these considerations, many of the other elements of a full harmonisation measure would relatively easily be compatible with TFEU rules concerning (e.g.) free movement. The trickier questions to answer would concern justifying the subsidiarity and particularly the proportionality of a full harmonisation measure insofar as it excludes numerous possible alternative policy approaches by MSs and may have strong impacts upon the position of consumers (e.g. by imposing significant costs upon them). There would need to be strong evidence to justify such effects.

- *Particularities per instrument implemented (policy pathways).* Many components of the transition process also depend upon the specific instrument/pathway. We refer to chapter 4 for specific design elements of pathways, which covers detailed implementation differences per pathway. One important difference between price-driven and quantity-driven instruments must be highlighted at this stage, because it concerns the process of target-setting and the long-term nature of the targets needed. In the case of price-driven strategies such as feed-in tariffs, the European Commission or another competent organisation needs to suggest tariff levels, which might be technology-specific and dependent upon the quality of the RES resource potential. In quantity-driven strategies like quota systems, (technology-specific) quantities need to be set on an annual basis. It is important in this case that quota targets need to be defined beyond the target horizon in order to provide investment security for the entire economic lifetime of the plant. For example, if the economic lifetime of the plant is 15 years and the target horizon is 2030, one needs to define quota levels until 2045. This shows that under a quota system one needs an early agreement on longer-term targets (comparable to the linear reduction factor agreed upon for the ETS until 2050) than under other instruments such as feed-in tariff and feed-in premium schemes. Tender schemes can be considered to function like feed-in tariffs in this respect, as the remuneration level is fixed at the start of the project.

3.2.2 Medium harmonisation

- *Components.* Virtually all of the components under full harmonisation are also relevant under medium harmonisation. This due to the fact that it would be very close to full harmonisation, with similar features except for the fact that under medium harmonisation additional (limited) support would be allowed. Only one post-legislative component (the adaptation of 10-year network development plan according to the expected RES deployment) would be slightly less relevant under medium than under full harmonisation. As under full harmonisation, this is also the case with the use of cooperation mechanisms and deciding on the eligibility of plants in other countries.
- *Legal aspects.* The same legal concerns apply here under medium harmonisation as discussed above under full harmonisation, which, given their strong similarity and sharing of most key components, is unsurprising.
- *Particularities per instrument implemented (policy pathways).* The same arguments apply as above for full harmonisation.

3.2.3 Soft harmonisation

- *Components.* The relevance of most components changes significantly under soft harmonisation compared with medium and full harmonisation. While setting an EU-target continues to be a key decision under this degree of harmonisation, as it was the case under the others degrees of harmonisation, MS targets should also be set: this is a major component under

soft harmonisation and a key differentiating factor from the other degrees of harmonisation already considered above. Additional main components under this degree of harmonisation include the use of cooperation mechanisms, the decision on the eligibility of plants in other countries and the choice of design elements (recall that the decision on which type of instrument is to be implemented by MSs is taken at EU level). Coordination of RES-E support with the ETS is still important under this degree of harmonisation. The rest of the components are less relevant than under the previous two degrees of harmonisation. The only exception is defining a process for setting remuneration levels, which is not relevant at all under this degree of harmonisation, since MS can decide on various design elements including support levels.

- *Legal aspects.* Under the current legal arrangements, this degree of harmonisation seems legally feasible and capable of being designed compatibly with other EU law requirements, provided that care is taken in the definition of objectives and the marshalling of supporting information and evidence. Particular areas where care will be needed include: justifying the impact upon the interests of consumers (especially where the necessary consequence of the EU measure would be a significant energy price increase); justifying the *prima facie* restrictive impact of such measures upon the free movement of goods; and the co-ordination of any new RES measure with the terms of pre-existing EU legislation affecting (renewable) energy, to ensure consistency and coherence.

  Such a future EU renewables measure should be adopted in the form of a directive, due to its suitability for accommodating some fairly detailed obligations, while on other topics leaving significant leeway to Member States about how to achieve the required results within their national system. At the same time, it is acknowledged that various 'soft law' instruments could prove beneficial in accompanying any future directive, in that further co-ordination, information- and experience-sharing could be facilitated and encouraged through such non-binding mechanisms.

  The role of MS implementation under soft harmonisation will clearly be critical to the success of such EU legislation. Part of this, of course, concerns prompt and effective MS implementation action (and Commission scrutiny thereof); but the ongoing applicability of the TFEU rules on free movement and State aid has the potential to create delays and difficulties for MSs, if those rules are not carefully and sensitively managed and applied by the Commission and (national) courts alike. Thus, thought should be given to guidance and even legislation on State aid in this area (taking care itself not to fall foul of Article 194(2) TFEU problems, as discussed above); and the EU renewables measure itself could seek to provide stronger provisions, seeking to protect national implementing measures from the uncertainties of potential challenges under Article 34 TFEU.

- *Particularities per instrument implemented (policy pathways).* The same arguments apply as above for full harmonisation.

3.2.4 Minimum harmonisation

- *Components.* Finally, the relevance of the components under minimum harmonisation is very similar to their role under soft harmonisation. The crucial difference here lies in the fact that MSs retain even greater competences under soft and minimum harmonisation and, more specifically, MSs have targets and they can set the support level (although under soft harmonisation the type of instrument that they can adopt is decided at EU level). In particular, as under soft harmonisation, defining a process for setting remuneration levels has a low relevance, but developing a technically and legally robust RES plant registry has an even lower relevance under minimum than under soft harmonisation.

- *Legal aspects.* The legal issues raised by a minimum harmonisation measure are substantively very similar to those discussed above concerning soft harmonisation, so those elements need not be repeated here, except to emphasise that, given that minimum harmonisation offers choice to MSs as to the type of instrument, clear guidance and timely action by the Commission with regard to State aid law will perhaps be even more important here. In that regard, it should be noted that the draft Guidelines on State aid concerning renewables support run the risk of trying to achieve via 'soft law' what it seems could not be reached via harmonising legislation, in that those Guidelines seem to show a preference for one particular type of instrument (tendering). Such an approach risks undermining MS agreement on any harmonising measure and raises the prospect of legal challenges on grounds of competence (Article 194 TFEU) and proportionality.
- *Particularities per instrument implemented (policy pathways).* In the case of minimum harmonisation the choice of instruments is up to the member states and therefore no instrument specific aspects can be given here.

An overall picture of the above paragraphs shows that the relevance of the components increases in importance with the degree of harmonisation. Most of the components are certainly very relevant for full harmonisation, whereas their relevance diminishes for minimum harmonisation. The following table summarises the above discussion on the relevance of different components for the different degrees of harmonisation. It also includes a time dimension, since the implementation of each component requires a different time-frame.

Table 3 Relevant components on the road to harmonisation.

Overview on relevant components on the road to harmonisation

Year		Degree of harmonisation: Minimum	Soft	Medium	Full
	Pre-RES-legislation components				
n-2	Define **EU targets**	X	X	X	X
n-1	Define **MS targets**	X	X		
n-1	Define **measures to coordinate authorisation procedures** for new installations.	x	x	X	X
n-1	Harmonise **grid-access conditions**	x	x	X	X
n-1	*Distribution of **grid connection costs**:* implement shallow or super-shallow connection charging for all RES-E.	x	x	X	X
n-1	Coordinate / restrict the **use of secondary instruments by MS**	x	x	X	X
n-1	Define **effort sharing / cost allocation**	x	x	X	X
n-1	Clarify on the **use of cooperation mechanisms**	X	X	x	x
n-1	Decide on **eligibility of plants in other countries**	X	X	x	x
n-1	**Choice of instruments**	x	x	X	X
n-1	Decision on **design elements**	x	X	X	X
N	Legislative proposal published and adopted				
	Post-RES-legislation components				
n+1	Adaptation of 10 year network development plan according to the expected RES deployment under legislative proposal. If necessary, a negotiation on revised burden sharing regulations for RES-E driven grid extensions needs to be started.	x	x	x	X
n+1	Development of technically and legally robust RES plant registry.		x	X	X
n+2	Defining process for setting remuneration levels; possibly establishment of new authority on RES tariff setting in case of FIT or FIP schemes, or annual quota, penalty level and banding factors in case of quota schemes.			X	X
n+2	Fully liquid wholesale markets need to be accomplished for any type of premium system or quota system.	x	x	X	X
n+2	Adapting market rules for balancing to accommodate for high shares of fluctuating RES-E beyond the steps already taken. This concerns particularly the international coordination of balancing markets.	x	x	X	X
n+2	Coordination with ETS: Dynamic adjustments of RES deployment or amounts of ETS allowances	x	x	X	X

Legend for the table above:

High relevance	X
Medium relevance	x
Low relevance	

4 Implications of the design of policy pathways for RES(-E)

The definition of policy pathways beyond 2020 requires us to make decisions on several design criteria. In particular the following criteria need to be decided:

- the degree of harmonisation distinguishing between "full", "medium", "soft" and "minimum";
- the choice of the particular support instrument;
- the choice of design specific design elements for the support instruments.

Making decisions on each of these design criteria constitutes a particular pathway as shown in Table 1. The objective of this section is to consolidate the findings of this project with respect to the different design criteria that constitute a pathway, in order to draw practical conclusions with regards to their possible advantages and drawbacks. In the following, the different elements are discussed in reverse order.

4.1 The choice of design elements for support instruments

This subsection discusses design choices that have to be made for implementing a policy pathway.

Some design elements are common to different instruments, although the specific form that they may take may differ between instruments. Other design elements are clearly instrument-specific. This subsection discusses the former, whereas the latter are discussed in the next subsection.

- *Eligibility of plants (new vs. existing).* Only *new plants* are eligible. The aim of support schemes is mainly to promote new capacity. The harmonised support scheme should not apply to existing capacity. However, following the principle of non-retroactivity, existing plants would continue to operate under current (national) RES-E support schemes until these are phased-out (i.e. until the guaranteed period for support ends).
- *Constant or decreasing support level during support period.* Support for existing plants may be greater at the start of the period and be reduced over time (either an annual percentage reduction or a stepped reduction after some years) or support may be constant over time. All in all, the terms and conditions of this reduction should be known beforehand.
- *Eligibility of technologies* (i.e., which technologies are included or excluded) is also an EU prerogative, as is currently the case under the RES Directive (Directive 2009/28/EC (European Parliament and Council (2009)), where the eligible technologies are defined. We also assume that these are the technologies included.
- *Cost burden of RES-E support.* The cost burden for RES-E support may fall on either electricity consumers or taxpayers (i.e., the public budget).[5] However, since the costs of the main instrument in the relevant MS fall on consumers, this is also assumed here. Furthermore, it needs to be decided whether an equal or an uneven distribution among consumers is to be used.
- The *duration of support* is a crucial element in all instruments and should be homogeneous at EU level (in order to avoid distortions between MSs). The specialised literature shows that long (but not over-long) duration periods of between 15 and 20 years provide low risks

[5] Eventually, RES-E support could also be financed by all energy consumers, as with the Green cent proposals in Spain.

for investors and, thus, comply with the effectiveness and efficiency criteria (low risk premia make projects more bankable and reduce the financial costs of the project). Duration in a TGC scheme refers to the period over which plants may expect to receive certificates. Long-term contracts in TGC schemes are assumed (making this instrument closer to a tender scheme). With FITs, the duration of support refers to the period over which the plants will receive the premium or the tariff.

- *Technology-specific support.* A similar support level might be provided for all technologies (regardless of their generation costs) or support could be modulated according to those costs. The manner in which support is provided to specific technologies is clearly very different under different support schemes. Thus, a more detailed discussion of this design element will be provided under the heading "instrument-specific design elements".
- *Size-specific support level.* Support may be differentiated according to the size of the installation, taking into account that: generally, the generation costs (€/MWh) of larger installations are lower since they benefit from economies of scale; and governments may want to promote small-scale installations for a number of reasons (decentralised generation and social acceptability).
- *Location-specific support.* Support levels might be modulated according to the location of the plant (e.g. built-in, stand-alone), with greater support levels provided for plants deployed in places with greater costs. At first, this may seem at odds with economic efficiency, since installations would not be promoted where generation costs are minimised. However, this is not always the case since, if the good sites are limited, the producer surplus could be excessive. All in all, this disincentive may be eliminated by making the differential support (i.e. support levels minus support costs) still greater at places with the best renewable resource. The rationale behind location-specific support is to avoid concentration of renewable energy projects in a few locations.

Some of the aforementioned common design elements may take different forms under different support schemes. Table 4, below, shows these commonalities and differences, and provides a brief assessment of each design element.

Not all of these design elements have the same degree of relevance for the purposes of this project. In TGCs, a crucial distinction is to be drawn between uniform quotas and banding (through carve-outs or credit multipliers). In FITs a similar distinction should be drawn between uniform FITs (technology-neutrality within renewable energy technologies) and technology-specific FITs (allowing for the deployment of different technologies). An even more crucial choice in FITs is between fixed tariffs and premia. Accordingly, these design elements provide the justification for the main distinctions between pathways.

On the other hand, the poor results from the assessment of some design options rules out their use. For instance, this is the case with support linked to the electricity price in FIT schemes or with borrowing in TGC schemes. Therefore, these have not been considered in the pathways. At the other end of the spectrum, there are some design options which are crucial, such as penalties in quotas with TGC schemes.

This leaves a set of alternatives in the middle, for which no unambiguous score on its assessment can be given and whose relevance may quite strongly depend on the specific context. For these, no generic implications are discussed here, but it is rather assumed that "best practice" criteria will emerge that will gradually lead to a convergence of certain design elements.

Thus, the major design elements that will be discussed in the following are: the degree of harmonisation; the choice of the support instrument; and technology-neutral vs. technology-specific support.

Table 4 Common design elements under different support schemes and brief assessment

Design element	FIT	FIP	TGC	Tendering	Assessment
Eligibility of plants (new vs. existing).	Only new plants commissioned after a specific date are eligible for support				In most cases only new plants are eligible, with some grand-fathering or transitional arrangements for non competitive existing plants
Flow of support (constant or decreasing support level during support period)	FIT level constant during the duration of the support or "front loading", i.e. reductions of FIT over time	FIP level or sum of FIP + electricity price (in case of sliding premium) constant during the duration of the support or "front loading", i.e. reductions of FIP over time	Constant support over time or more TGC per MWh generated in the first years of operation or for a fixed quantity of generation, and less TGC/MWh thereafter or equal number of TGCs per MWh generated over time.	Constant support over time or pre-established % reduction over time (previous to the bidding procedure)	Given the capital-intensity and high up-front costs of RES-E plants, providing greater support levels at the beginning of their lifetime ("front-loading") helps their financing compared to the same overall amount of support constantly granted over time. In practice, however, this might create a complex system that lacks of transparency and comprehensibility. For supply driven RES-E, increasing weather and revenue risk.
Eligibility of technologies	Decided at EU level. Current Directive				The Directive includes a sufficiently broad definition of RES eligible for support
Cost burden of RES-E support (taxpayers vs. consumers)	FIT systems can be funded by public budget or charge on electricity bills	FIP systems can be funded by public budget or charge on electricity bills	Cost of TGC system usually borne by electricity consumers via charge on electricity bill but may also be funded by the public budget.	Public budget or electricity bill	Consumer-financed support is generally considered more stable than budget financed support.
Duration of support	Period during which support is guaranteed (e.g.15,20,25 years)				The longer the duration, the more certainty to the investors

Table 4 (continued) Common design elements under different support schemes and brief assessment

Design element	FIT	FIP	TGC	Tendering	Assessment
Technology-specific support	FIT is differentiated across technologies to reflect technology-specific generation costs. The alternative is to have a uniform fixed tariff for all technologies	FIP is differentiated across technologies to reflect technology-specific generation costs. The alternative is to have a uniform premium for all technologies	Banding can be implemented through carve-outs or through credit multipliers. Under carve-outs, targets for different technologies exist, leading to a fragmentation of the TGC market, with one quota for the mature and another for the non-mature technologies. Under credit multipliers, more TGCs are granted per unit of MWh generated for immature technologies compared to mature technologies. The alternative is no use of carve-outs or credit multipliers, such as in the Swedish and Polish TGC schemes.	Banding	Technological neutrality leads to static efficiency, but technology-specific support allows for technology diversity, which could be superior in the long term. In TGCs, carve-outs may lead to narrow markets (i.e., it narrows the tradable volume within each sub-quota) if implemented for one technology in one country, but may be interesting if implemented at EU level. Credit multipliers may lead to the problem of "net neutrality"/TGC vs. electricity accounting. In the 2007 reform of the U.K. RO, the U.K. Department for Business, Enterprise & Regulatory Reform (BERR) decided to implement credit multipliers rather than carve-outs (Bergmann *et al* 2008).
Size-specific support level.	FIT level modulated according to the plant size. Smaller FIT for large-scale and higher tariffs for small-scale plants. Only installations below a certain capacity threshold would receive the support (stepped FIT)	FIP level modulated according to the plant size. Smaller premiums for large-scale and higher premiums for small-scale plants. Only installations below a certain capacity threshold would receive the support	Small-scale installations receive more TGCs than large-scale installations Only installations below a certain capacity threshold are eligible to receive TGCs	Size-differentiated tendering procedures. Instrument mostly for large scale RES	Stepped tariffs have their pros and cons (see Klein *et al* 2010, Ragwitz *et al* 2007). Size limits have pros (encouraging small generators) and cons (lower economies of scale)
Location-specific support level	FIT level modulated according to the location of the plant (stepped FIT)	FIP level modulated according to the location of the plant.	Different number of TGC according to the location of the plant.	Pre-approval of sites. Location-specific support is the result of the bidding procedure.	Stepped tariffs have their pros and cons (see Klein *et al* 2010, Ragwitz *et al* 2007).

Source: Own elaboration based on BMU (2011), Ragwitz *et al* (2007), European Commission (2008), del Río (2008, 2010), Haas *et al* (2004), Mendonca and Jacobs (2009), Kaldellis (2011), Kiviluoma (2010), KEMA (2008), Beaudoin *et al* (2009), Couture *et al* (2010), Yatchew and Baziliauskas (2011), Rickerson *et al* (2007), Rickerson *et al* (2008), Deutsch Bank (2009), Haugwitz (2008), Pegels (2010), NERSA (2009) and Mitchell *et al* (2011).

Note: * Y = yes; N = no. ** Except hydro <10MW. Plant size usually determines support level.

4.2 The degree of harmonisation: trade-offs

This section discusses the implications of different degrees of harmonisation from the perspective of "both ends" (i.e. full harmonisation vs. minimum harmonisation), as analysed in WP 6.

Political and other stakeholders have put forward several interlinked arguments that support the harmonisation of support schemes and the extension of the internal market to RES-E. Among these of highlight are that the internal market and the objective of its extension is a fundamental part of the '*acquis communautaire*', and it is the EU's goal to work towards its completion. It is therefore a logical step forward to create an internal market for energy, including renewable energy. Deviations from this overarching goal could pose not only economic, but possibly also legal challenges.

The creation of the internal market generally facilitates cost savings in various ways, which to a large extent also holds true for renewable energy. The following arguments are often used:

- the internal market leads to an optimized allocation of resources: that is, electricity would be produced at the most optimal places with, e.g., highest solar irradiation or wind speeds. This in turn results in cost savings;
- an internal market leads to more competition and innovation;
- a larger market with converged regulations reduces transaction costs for investors in renewable energy and leads to economies of scale, triggering additional investments in renewable energy.
- harmonised European support schemes and/or targets are more effective and easier to enforce, at least compared to the national support schemes of countries lagging behind.

Others have either criticised these assumptions or they have pointed to challenges for and limits to realising an internal market for renewable energy:

- Uniform support payments across Europe could lead to higher rents for those producers which make use of least-cost technologies and sites. This could lead to a substantial increase in target-achievement-related costs for society (taxpayers or consumers).
- Each MS has different geographical, legal, political and market conditions in which renewable energy support schemes operate. These contextual conditions would either need to be harmonised (which is only possible to some extent, which is often rather limited or at least uncertain) or the remaining differences would need to be sufficiently reflected in a d support scheme. A lack of context-specificity could decrease the effectiveness and efficiency of support, which is the opposite of what is aimed for with the internal market.
- In order to obtain public acceptance in MSs for a support scheme, a politically accepted distribution of costs and benefits would have to be achieved, which is likely to pose a significant challenge, given the large number of MSs and their national preferences (and the constraints of Article 194 TFEU as the legal basis under which any such EU measure would need to be adopted). Neglecting domestic costs and benefits could lead to (local) opposition and loss of public acceptance.
- Domestic energy policy and different policy interests make harmonisation difficult to achieve. In line with the principle of subsidiarity, MSs have developed their own tailor-made energy policies, which include different goals and ambitions: that is, different preferences. At the moment, not all MSs share a comparable ambition towards renewable energy, and they are not willing to transfer the required competences to a European level: and, in Article 194 TFEU, they have some support in the Treaty for not doing so.

4.3 The choice and design of support instrument

This section discusses the implications of different designs of the support instrument as analysed in work package 4 of this project throughout a detailed model-based analysis. The final modelling outcomes have shown that several RES policy pathways show a similar performance with respect to support costs for the post-2020 period. These include feed in premia/tariffs and quotas with banding, as well as keeping strengthened national support but with intensified coordination/cooperation and with or without complementary harmonised tenders for large-scale RES, and refer both to cases of full and minimum/harmonisation. The outcomes have also shown that in the case of soft/minimum harmonisation the use of cooperation mechanisms is a necessary design criterion.

The reason for the similar performance can partly be seen in the convergence of general design criteria towards best practices. For instance, a quota with banding and the possibility for banking/borrowing "behaves" very similarly to a feed-in premium and incentivises a similar set of RES investments, as could also be observed from the modelling outcomes.

Thus, the single most important design criterion is the question of whether the support should be technology-neutral or technology-specific: this is possibly even more important than the choice of the support instrument itself.

Advocates of technology-neutral support often argue that technology-specific support avoids competition between renewable energy generation options. While this is certainly true, it is not clear whether this has eliminated any potential cost savings that otherwise would have been induced by competition. Past experience has rather shown that most of the learning has taken place outside the box of the energy market in the upstream segment of the energy supply chain. This is due to the fact that, in the case of renewable energies, capital costs constitute the major cost component and thus cost savings can best be achieved by improving manufacturing processes. On the other hand, the manufacturing industry requires a stable market demand to make the necessary upfront (learning) investments – this in turn is better provided by technology-specific support.

A second aspect of technology neutrality concerns efficiency. In theory, it is best left to the market and not to administration to pick the set (or 'mix') of renewable energy generation technologies that provides the highest social welfare in the long term. It is, however, questionable whether the market can deliver such outcomes in practice. With regard to short-term efficiency – that means an efficient dispatch -, the current market certainly is capable of providing the desired efficiency, but long-term price signals are currently missing and hardly foreseeable by investors and it is thus questionable whether the market can incentivize the set of renewable investments that is efficient in the long term (see also section on market-based premia in this respect). A second argument against relying solely upon the market to determine the mix of renewables is based on the occurrence of knowledge spillovers. As companies are not able completely to internalize their cost advantage gained through learning, this would in principle lead to an underinvestment in renewable technologies with high learning potential.

An argument related to efficiency concentrates upon the excess producer profits that may arise in case of technology-neutral support policies. It has also been confirmed by the modelling outcomes that support instruments with technology-neutral design generally perform more weakly with respect to support costs. However it has to be stated that technology-specific support is not an end in itself and care has to be taken with regard to the implementation of this design criterion: in particular is has to be checked whether technologies receiving specific support actually offer the required learning potential, and to which extent certain technologies are actually required in a "future energy system" in order to avoid inappropriately high-cost investments.

4.4 Conclusion: Seek the best of "both worlds"

As discussed above, there exist trade-offs with respect to the degree of harmonisation. With regard to support instruments, several instruments are capable of delivering the required investments, provided that certain design criteria are in place, and technology specific support is especially effective in this regard. If minimum/soft harmonisation is chosen, cooperation mechanisms are also a required design element – from experiences again with cooperation mechanisms thus far it is, however, questionable whether these will be able to implement the costs savings potential (both with respect to volume and the mix of generation) as suggested by the analysis in WP 4.

A robust conclusion therefore might be to seek the best of "both worlds", meaning to combine the advantageous design features that are naturally referred to in case of either minimum or full harmonisation. While harmonisation is commonly referred to tariff-setting at EU level, more finely-tailored approaches are most often discussed in the context of national support. However, neither of necessity implies the other. Therefore, a distinction must be drawn between harmonised tariff-setting and the administrative level of tariff-setting. It would be thinkable that tariff-setting would primarily take place at EU level (so that a high degree of coordination is achieved), but additional efforts in Member States would be allowed, reflecting differing values for certain technologies or differing priorities with respect to the speed of renewable energy expansion. Thus, tariffs could be adapted accordingly at EU level, and Member States would be allowed to have additional instruments in place. A deviation from the EU-wide cost minimal RES expansion could be reflected by a Member State's higher share in the cost allocation, reflecting its higher willingness to pay. This would allow for both a differentiated policy approach and at the same time exploit the gains from European cooperation that might be dismissed in a fragmented national policy world, due to the lack of cooperation between Member States.

5 References

Batlle, C., Banez-Chicharro, F., Fernandes, C., Frías, P., Linares P., Olmos, L., Rivier, M., Klobasa, M., Winkler, J., Ortner, A., Papaefthymiou, G. (2013). Derivation of prerequisites and trade-offs between electricity markets and RES policy framework. A report compiled within the project beyond2020 (work package 5), supported by the EACI of the European Commission within the "Intelligent Energy Europe" programme. Comillas, Madrid (Spain). Accessible at www.res-policy-beyond2020.eu.

Beaudoin, L., 2009. Renewable Energy Payments: A Policy Guide to Feed-in Tariffs in America. Columbia University, New York

Bergmann, B., Bitsch, C., Behlau, V., Jensen, S., Held, A., Pfluger, B. Ragwitz, M., Resch, G.. 2008. Harmonisation of support schemes. A European harmonised policy to promote RES-electricity – sharing costs & benefits. A report compiled within the European research project futures-e (Deriving a Future European Policy for Renewable Electricity), co-financed under the European Commission's "Intelligent Energy for Europe" Programme. Fraunhofer ISI, Karlsruhe (Germany). [Online]. Available at www.futures-e.org.

BMU (German Ministry for the Environment, Nature Conservation and Nuclear Safety) 2011. Legal sources on renewable energy. Available at http://www.res-legal.de/en/search-for-support-scheme.html. Accessed August 20, 2011.

Couture, T., Cory, K., Kreycik, C., Williams, E., 2010. A Policymaker's Guide to Feed- in Tariff Policy Design. Technical Report NREL/TP-6A2-44849. National Renewable Energy Laboratory.

del Rio, P., 2008. Ten years of renewable electricity policies in Spain: an analysis of successive feed-in tariff reforms. Energy Policy, 36(8), 2917–2929.

del Rio, P., 2010. Analysing the interactions between renewable energy promotion and energy efficiency support schemes: The impact of different instruments and design elements. Energy Policy, 38(9), 4978–4989.

del Río, P., Klessmann, C., Winkler, T. Gephart, M. (2013). Interactions between EU GHG and Renewable Energy Policies – how can they be coordinated?. A report compiled within the project beyond2020 (work package 7), supported by the EACI of the European Commission within the "Intelligent Energy Europe" programme. CSIC, Madrid (Spain). Accessible at www.res-policy-beyond2020.eu.

del Río, P., Ragwitz, M., Steinhilber, S., Resch, G., Busch, S., Klessmann, C., De Lovinfosse, I., Nysten, J. V., Fouquet, D., Johnston, A. (2012a). Key policy approaches for a harmonisation of RES(-E) support in Europe - Main options and design elements. A report compiled within the project beyond2020 (work package 2), supported by the EACI of the European Commission within the "Intelligent Energy Europe" programme. CSIC, Madrid (Spain). Accessible at www.res-policy-beyond2020.eu.

del Río, P., Ragwitz, M., Steinhilber, S., Resch, G., Busch, S., Klessmann, C., De Lovinfosse, I., Nysten, J. V., Fouquet, D., Johnston, A. (2012b). Assessment criteria for identifying the main alternatives - Advantages and drawbacks, synergies and conflicts. A report compiled within the project beyond2020 (work package 2), supported by the EACI of the European Commission within the "Intelligent Energy Europe" programme. CSIC, Madrid (Spain). Accessible at www.res-policy-beyond2020.eu.

del Río, P., Resch, G., Ortner, A., Busch, S., Liebmann, L., Ragwitz, M., Steinhilber, S., Klobasa, M., Winkler, J., Gephart, M., Klessmann, C., de Lovinfosse, I., Papaefthymiou, G., Nysten, J. V., Fouquet, D., Johnston, A., van der Marel, E., Bañez, F., Batlle, C., Fernandes, C., Frías, P., Linares P., Olmos, L., Rivier, M., Knapek, J., Kralik, T., Faber, T., Steinbaecker, S., Borasoy, B., Toro, F., Plascencia, L. (2014). Roadmaps for practical implementation of a harmonisation of RES(-E) support in Europe. A report compiled within the project beyond2020 (work package 7), supported by the EASME of the Euro-

pean Commission within the "Intelligent Energy Europe" programme. Fraunhofer ISI, Karlsruhe (Germany). Accessible at www.res-policy-beyond2020.eu.

Deutsche Bank, 2009. Global Energy Transfer Feed-in Tariffs for Developing Countries. DB Climate Change Advisers (DBCCA), Frankfurt, Germany.

European Commission, 2008. SEC(2008) 57 – Commission Staff Working Document - The support of electricity from renewable energy sources. [Online] Available at: http://ec.europa.eu/.

Fouquet, D., Nysten, J.V., Johnston, A. (2012). Potential areas of conflict of a harmonised RES support scheme with European Union Law. A report compiled within the project beyond2020 (work package 3), supported by the EACI of the European Commission within the "Intelligent Energy Europe" programme. Becker Büttner Held (BBH), Brussels (Belgium). Accessible at www.res-policy-beyond2020.eu.

Fouquet, D., Nysten, J.V., Johnston, A., van der Marel, E. (2014). Report on legal requirements and policy recommendations for the adoption and implementation of a potential harmonised RES support scheme. A report compiled within the project beyond2020 (work package 3), supported by the EASME of the European Commission within the "Intelligent Energy Europe" programme. Fraunhofer ISI, Karlsruhe (Germany). Accessible at www.res-policy-beyond2020.eu.

Frías, P., Linares P., Olmos, L., Rivier, M., Banez-Chicharro, F., Fernandes, C., Klobasa, M., Winkler, J., Ortner, A., Papaefthymiou, G. (2013). Assessment report on the impacts of RES policy design options on future electricity markets. A report compiled within the project beyond2020 (work package 5), supported by the EACI of the European Commission within the "Intelligent Energy Europe" programme. Comillas, Madrid (Spain). Accessible at www.res-policy-beyond2020.eu.

Gephart, M., Klessmann, C., Kimmel, M., Page, S., Winkel, T. (2012). Contextualising the debate on harmonising RES-E support in Europe - A brief pre-assessment of potential harmonisation pathways. A report compiled within the project beyond2020 (work package 6), supported by the EACI of the European Commission within the "Intelligent Energy Europe" programme. Ecofys, Berlin (Germany). Accessible at www.res-policy-beyond2020.eu.

Guillon, D., 2010. Assessing Design Options of a Harmonised Feed-in-Tariff Scheme for Europe. Karlsruher Institut für Technologie and Fraunhofer ISI. Karlsruhe (Germany).

Haas, R., *et al*., 2004. How to promote renewable energy systems successfully and effectively. Energy Policy, 32, 833–839.

Haugwitz, F., 2008. PV market and industry development in China, Taiwan, Sout Korea, Malaysia. PV industry Forum Munich, June 10–11th 2008.

Johnston, A., Fouquet, D., Nysten J.V. (2014). Legal drafting guidelines on two key policy pathways: minimum harmonisation and soft harmon-isation with feed-in premium. A report compiled within the project beyond2020 (work package 7), supported by the EACI of the European Commission within the "Intelligent Energy Europe" programme. Ecofys, Berlin (Germany). Accessible at www.res-policy-beyond2020.eu.

Kaldellis, J., 2011. Critical evaluation of financial supporting schemes for wind- based projects: case study Greece. Energy Policy, 39 (5), 2490–2500.

KEMA, 2008. A scoping-level study of the economics of wind-project repowering decisions in California. Prepared for California energy commission, August 2008, available at http://www.energy.ca.gov/2008publications/.

Kiviluoma, J., 2010. The feed-in tariff system for wind power and biogas in Finland. Conference Nordic Energy Post, 21.01.2010, Copenhagen.

Mendonca, M., Jacobs, D., 2009. Feed-in tariffs go global: policy in practice. Renewable Energy World, 12(4), 1–6.

Mitchell, C., J. L. Sawin, G. R. Pokharel, D. Kammen, Z. Wang, S. Fifita, M. Jaccard, O. Langniss, H. Lucas, A. Nadai, R. Trujillo Blanco, E. Usher, A. Verbruggen, R. Wustenhagen and K. Yamaguchi 2011. Policy, Financing and Implementation. In: IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlomer, C. von Stechow (eds)], Cambridge, Cambridge University Press, available at http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch11.pdf.

NERSA, 2009. Reasons for Decisions on Renewable Energy Feed-in Tariffs (REFITs) Phase II, 30 October 2009, available at http://www.nersa.org.za/S.

Pegels, A., 2010. Renewable energy in South Africa: potentials, barriers and options for support. Energy Policy, 38, 4945–4954.

Ragwitz, M., Held, A., Resch, G., Haas, R., Faber, T., Huber, C., Morthorst, P.E., Jensen, S., Coenraads, R., Voogt, M., Reece, G., Konstantinaviciute, I., Heyder, B., 2007. Assessment and Optimisation of Renewable Energy Support Schemes in the European Electricity Market. Final Report of the project OPTRES (Assessment and optimisation of renewable support schemes in the European electricity market), Contract no. EIE/04/073/S07.38567, co-financed under the European Commission's "Intelligent Energy for Europe" Programme. Fraunhofer ISI, Karlsruhe (Germany).

Resch, G., Liebmann, L., Ortner, A., Busch, S., Panzer, C., del Río, P., Ragwitz, M., Steinhilber, S., Faber, T. (2014a). Cost-benefit analysis of policy pathways for a harmonisation of RES(-E) support in Europe. A report compiled within the project beyond2020 (work package 4), supported by the EACI of the European Commission within the "Intelligent Energy Europe" programme. Energy Economics Group (EEG), Vienna University of Technology, Vienna (Austria). Accessible at www.res-policy-beyond2020.eu.

Resch, G., Liebmann, L., Ortner, A., Busch, S., Panzer, C., del Río, P., Ragwitz, M., Steinhilber, S., Klobasa, M., Winkler, J., Gephart, M., Klessmann, C., de Lovinfosse, I., Papaefthymiou, G., Nysten, J. V., Fouquet, D., Johnston, A., van der Marel, E., Bañez, F., Batlle, C., Fernandes, C., Frías, P., Linares P., Olmos, L., Rivier, M., Knapek, J., Kralik, T., Faber, T., Steinbaecker, S., Borasoy, B., Toro, F., Plascencia, L. (2014b). Final report of the beyond2020 project – approaches for a harmonisation of RES(-E) support in Europe. A report compiled within the project beyond2020 (work package 7), supported by the EASME of the European Commission within the "Intelligent Energy Europe" programme. Fraunhofer ISI, Karlsruhe (Germany). Accessible at www.res-policy-beyond2020.eu.

Resch, G., Liebmann, L., Ortner, A., Busch, S., Panzer, C., del Río, P., Ragwitz, M., Steinhilber, S., Klobasa, M., Winkler, J., Gephart, M., Klessmann, C., de Lovinfosse, I., Papaefthymiou, G., Nysten, J. V., Fouquet, D., Johnston, A., van der Marel, E., Bañez, F., Batlle, C., Fernandes, C., Frías, P., Linares P., Olmos, L., Rivier, M., Knapek, J., Kralik, T., Faber, T., Steinbaecker, S., Borasoy, B., Toro, F., Plascencia, L. (2014c). Summary report of the beyond2020 project – approaches for a harmonisation of RES(-E) support in Europe. A report compiled within the project beyond2020 (work package 7), supported by the EASME of the European Commission within the "Intelligent Energy Europe" programme. Fraunhofer ISI, Karlsruhe (Germany). Accessible at www.res-policy-beyond2020.eu.

Resch, G., Panzer, C., Ortner, A., Busch, S., del Río, P., Ragwitz, M., Steinhilber, S., Klobasa, M., Winkler, J., Gephart, M., Klessmann, C., de Lovinfosse, I., Nysten, J. V., Fouquet, D., Johnston, A., Batlle, C., Linares P., Knapek, J., Kralik, T., Faber, T., Borasoy, B., Toro, F. (2012). Inception report beyond2020 – approaches for a harmonisation of RES(-E) support in Europe. A report compiled within the project beyond2020 (work package 7), supported by the EASME of the European Commission within the "Intelligent Energy Europe" programme. Fraunhofer ISI, Karlsruhe (Germany). Accessible at www.res-policy-beyond2020.eu.

Rickerson, W., Bennhold, F., Bradbury, J., 2008. Feed-in Tariffs and Renewable Energy in the USA: A Policy Update. Heinrich Boll Foundation, Washington DC.

Rickerson, W., Sawin, J., Grace, R. C., 2007. If the shoe FiTs: using feed- in tariffs to meet US renewable electricity targets. The Electricity Journal, 20 (4), 73–86.

Steinhilber, S., del, Río, P., Toro, F., Ragwitz, M., Boie, I. (2014). Multi-criteria Decision Analysis - Assessing policy pathways for renewables support in the EU after 2020. A report compiled within the project beyond2020 (work package 6), supported by the EASME of the European Commission within the "Intelligent Energy Europe" programme. Fraunhofer ISI, Karlsruhe (Germany). Accessible at www.res-policy-beyond2020.eu.

Yatchew, A., Baziliauskas, A., 2011. Ontario feed-in-tariff programs. Energy Policy, 39 (7), 3885–3893.

Project web: www.res-policy-beyond2020.eu

For further information on the topics addressed within this report we refer to the following beyond*2020 publications:*

Addressed Topic	*Corresponding* beyond*2020 publication*
RES policy pathways beyond 2020: elaboration of feasible pathways for a possible harmonisation of RES(-E) support in Europe beyond 2020	del Rio *et al* (2012a): "Key policy approaches for a harmonisation of RES(-E) support in Europe - Main options and design elements"
Policy evaluation criteria: identification and definition of evaluation criteria for the subsequent impact assessment of feasible policy approaches for a harmonisation of RES(-E) support in Europe from a theoretical viewpoint.	del Rio *et al* (2012b): "Assessment criteria for identifying the main alternatives - Advantages and drawbacks, synergies and conflicts"
Legal aspects: a general overview of all the Articles and provision in EU primary and secondary law which may have an impact upon the EU's legislative competence in the field of RES support.	Fouquet *et al* (2012): "Potential areas of conflict of a harmonised RES support scheme with European Union Law"
Assessment of legal requirements and policy recommendations for the adoption and implementation of a potential harmonised RES support scheme	Fouquet *et al* (2014): "Report on legal requirements and policy recommendations for the adoption and implementation of a potential harmonised RES support scheme"
Cost- benefit assessment: final results of the quantitative model-based analysis of future RES policies beyond 2020	Resch *et al* (2014b): "Cost-benefit analysis of policy pathways for a harmonisation of RES(-E) support beyond 2020"
Trade-offs with electricity markets: a literature review about the interactions between RES-E support instruments and electricity markets	Batlle *et al* (2012): "Review report on interactions between RES-E support instruments and electricity markets"
Quantitative assessment of the major interactions between RES-E support instruments and electricity markets and networks.	Linares *et al* (2013a): "Assessment report on the impacts of RES policy design options on future electricity markets"
Identification of key design elements for electricity markets and grid regulation that minimize non-desired impacts of RES policies and that remove barriers for the integration of large RES-E shares	Linares *et al* (2013a): "Derivation of prerequisites and trade-offs between electricity markets and RES policy framework"
Strategic aspects of RES policy support: a brief pre-assessment of potential harmonisation pathways for RES-E support schemes by contextualising this debate in the wider process and debate.	Gephart *et al* (2012): "Contextualising the debate on harmonising RES-E support in Europe - A brief pre-assessment of potential harmonisation pathways"
Assessment of interaction between climate and RES policies and recommendations on the way forward towards an enhanced coordination	del Rio *et al* (2013): "Interactions between EU GHG and Renewable Energy Policies – how can they be coordinated?"
Integrative assessment of policy pathways, focussing on a multi-criteria decision analysis, but including qualitative analysis on overarching issues as well.	Steinhilber *et al* (2014): "Multi-criteria Decision Analysis - Assessing policy pathways for renewables support in the EU after 2020"
A Legal Draft on two key policy pathways: minimum harmonisation and soft harmonisation with feed-in premium	Johnston *et al* (2014): "Legal drafting guidelines on two key policy pathways"
Guidelines for the detailed design suitable for practical policy implementation of assessed policy pathways as well as recommendations on the steps to be taken in the transition phase	del Rio *et al* (2014): "Roadmaps for practical implementation of a harmonisation of RES(-E) support in Europe"
Discussion of approach taken and of key results, findings and conclusions obtained within the beyond*2020* project	Resch *et al* (2014a): "Final report beyond*2020*"
Summary of key results, findings and conclusions obtained within the beyond*2020* project	Resch *et al* (2014c): "Summary report beyond*2020*"

This report

provides roadmaps for assessed policy pathways of harmonisation of RES(-E) support across Europe, including guidelines for the detailed design suitable for practical policy implementation as well as recommendations on the steps to be taken in the transition phase.