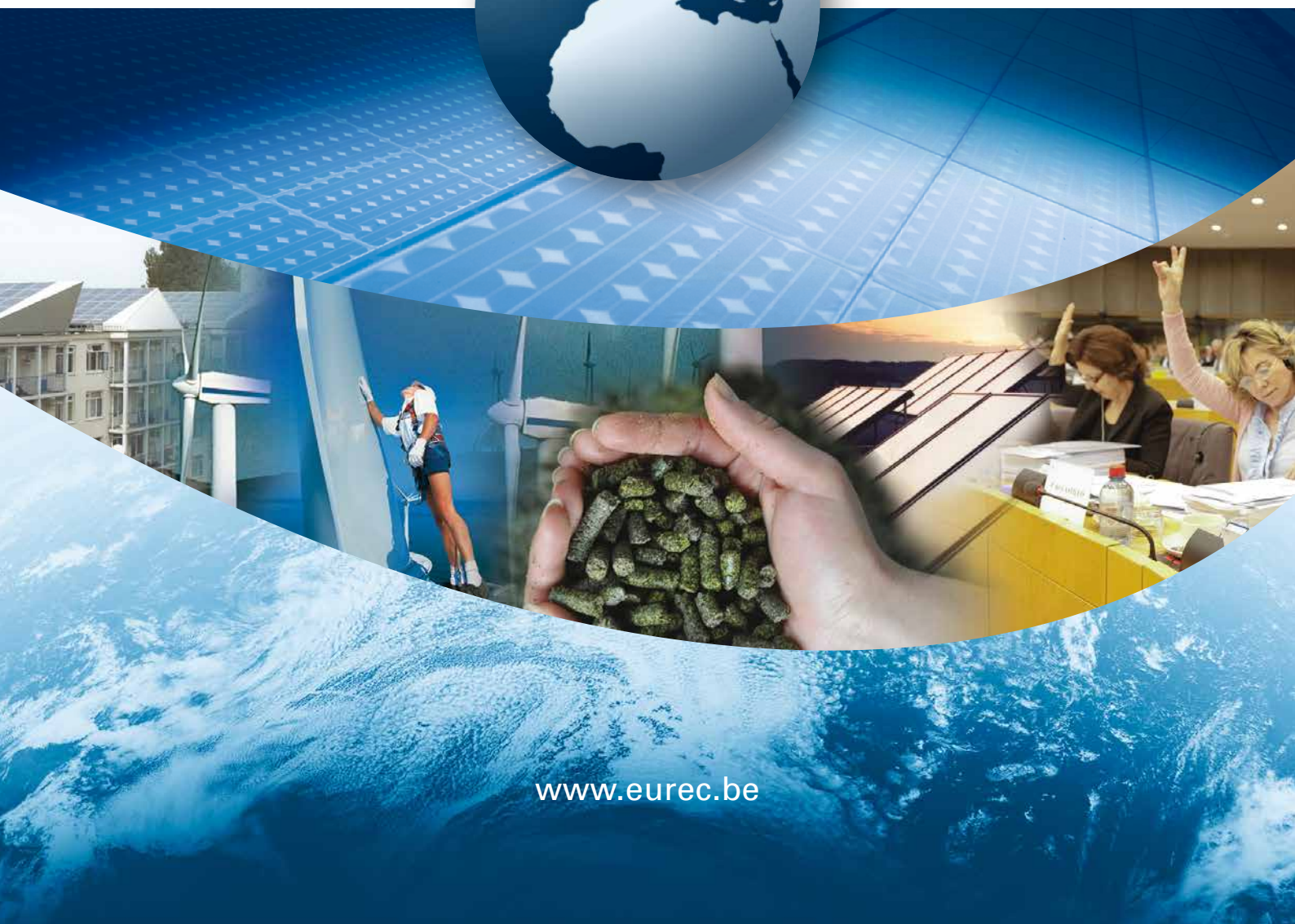




The Association of European
Renewable Energy Research Centres

THE FUTURE SHAPE OF EUROPEAN **RENEWABLE ENERGY** RESEARCH AND INNOVATION



www.eurec.be

ENERGY UNION'S R&I DIMENSION,
THE NEW SET PLAN AND
THE INTERIM EVALUATION OF
HORIZON 2020



FOREWORD

We're on an exciting journey to a destination whose precise features are not yet known, but whose contours are just becoming visible. The world's energy system is undergoing an unstoppable transformation. More and more countries are embracing renewable energy technologies as the cost-effective option for their energy needs. In so doing, they are helping to save the climate and to reduce their dependence on energy imports and the wealth transfer and geopolitical risk that that entails.

EUREC members have been crucial for this journey. We are 41 publicly-funded research organisations with strong links to Europe's renewable energy industry and universities. At least one of our members is represented in half of all energy-related projects in the Horizon 2020 programme of the European Commission. We have worked with companies to improve the performance of wind turbines, photovoltaic modules, solar collectors, gasifiers and many other technologies, looking at, for example, their conversion efficiencies, manufacturability, durability and recyclability. We also look upstream of the hardware itself, to the cultivation of biomass, for example, or energy systems modelling; and downstream, to tackle the integration of these technologies into the grid by fully exploiting their complementarities and the opportunities offered by ICT. In the coming years we will face the important task of ensuring that Europe remains the key hub for the market introduction and penetration of these technologies, to keep Europe and European companies at the forefront of this rapidly expanding field.

This document sets out our views on three interrelated areas, aspects of Energy Union, the SET Plan and the interim evaluation of Horizon 2020. It is to be read alongside position papers that we produced in 2015 and 2016 available on our website (<http://www.eurec.be/en/Policy-Publications/Policy-inputs/Overview/>), which contain further recommendations on these topics.

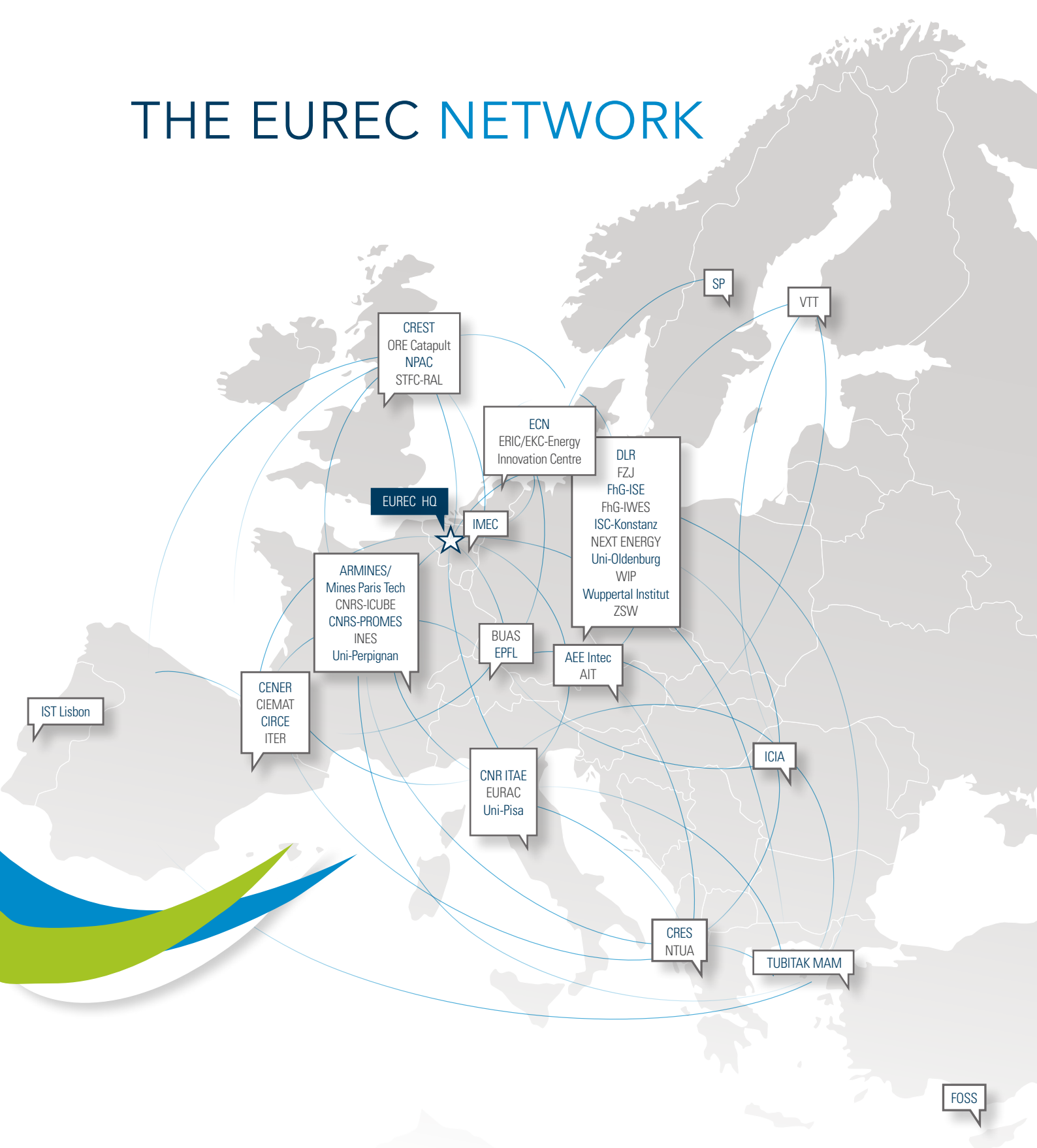
The exploitation of renewable energy sources to the fullest extent possible is the path to follow. We will light the way.

A handwritten signature in black ink, appearing to read 'E. Weber'.

Eicke Weber

President, EUREC

THE EUREC NETWORK



The Association of European
Renewable Energy Research Centres

INTRODUCTION

EUREC, as the Association of European Renewable Energy Research Centres, takes a keen interest in all European policy related to research and innovation in energy. Developments in energy policy shape Europe's energy system and the technological solutions needed to create that system. Likewise, improvements to technology open up new vistas for the energy system and make previously unconscionable energy policies realistic.

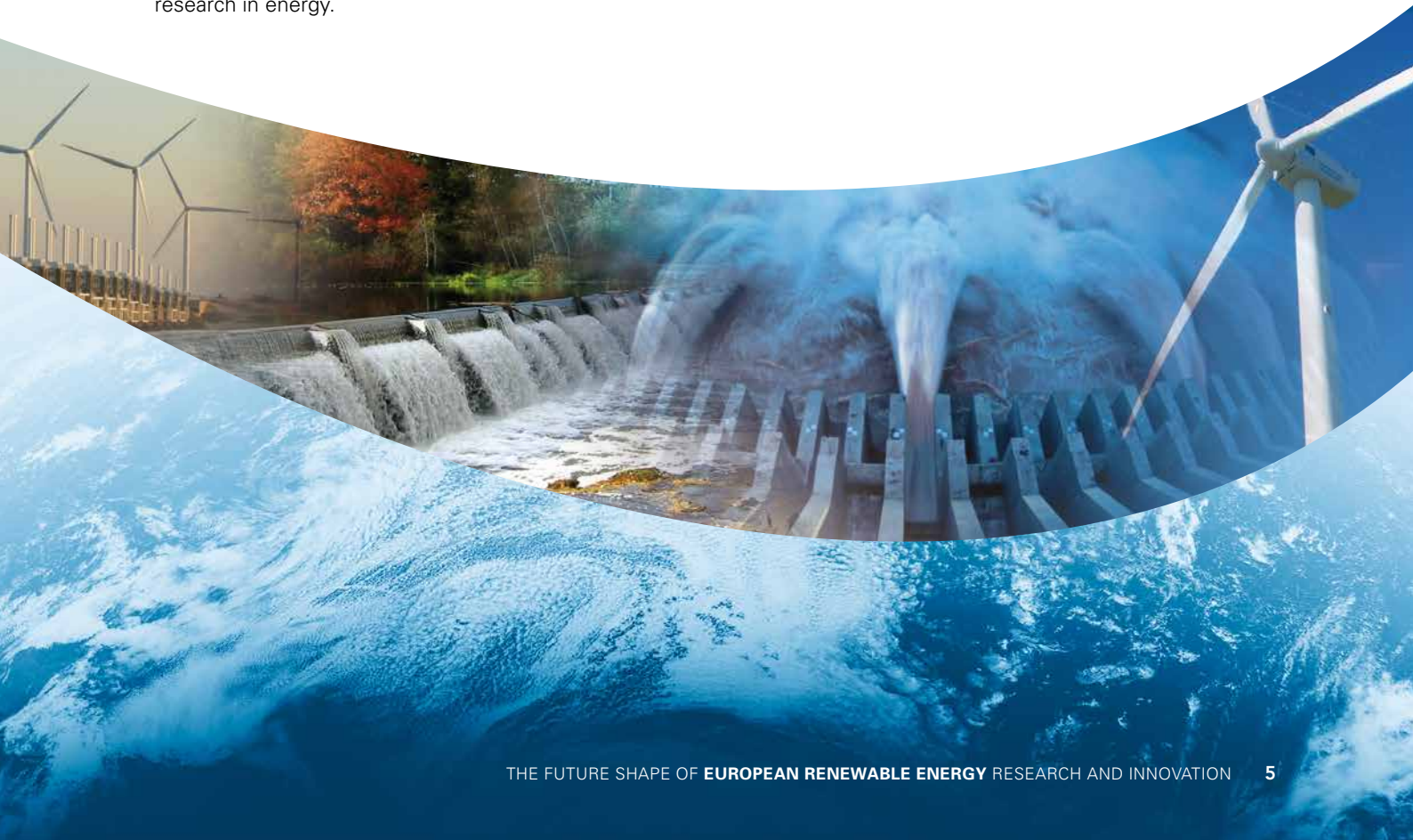
This document is a combined input to three related EU initiatives: Energy Union's R&I dimension, the SET Plan and Horizon 2020's interim evaluation. These are all affected by, and themselves affect, the framework for the exploitation of renewable energy in Europe, and at the time of publication of this document the European Commission will also be releasing key proposals in this regard. So we comment on this framework, too.

It starts with a look at the big picture. We set out our view on the path that the EU's energy system should follow. We also comment on reform of the electricity market – a hot topic, with legislative proposals expected from the Commission soon.

We offer our view on the meaning of some much-heard catchphrases, then we drill down into the nitty gritty of the SET Plan. The Commission's reforms of Q4 2015, introduced in the Communication *Towards an Integrated SET Plan* [C\(2015\) 6317](#) are incomplete. The interaction between stakeholder groups and the Commission and Member States needs to be rethought both when small groups are involved and when actors in energy come together in large gatherings. We look closely at ERA-NET-COFUND, a funding instrument that is at present the most common way for Member States to demonstrate their commitment to the SET Plan.

European Structural and Investment Funds could and should provide better support to demonstrations of innovative energy technology. We think we've identified an important obstacle to that happening.

Finally, the suggested European Innovation Council could be a new tool for stimulating applied research in energy.



SUMMARY

- ▶ Future energy markets will need to reward flexibility in generation and consumption better than they manage today. This will enable more variable renewable electricity to be integrated in the grid. Demand must be created for technology that is a source of flexibility. Where electricity and heating networks are linked e.g. through heat pumps, thermal networks will adapt to electricity networks, not vice versa because of the cheaper cost of storing heat compared to storing electricity.
- ▶ In the electricity retail market, the model for charging residential consumers for access to the grid may need to be changed in some countries. Alternatives to volume-related charges will be needed to reflect the fact that some consumers are now also producers of renewable electricity that they consume themselves.
- ▶ The 'SET Plan' should support the changing energy system by becoming the strategy for all energy research and innovation in Europe.
- ▶ The vehicle for determining the SET Plan's research priorities are the ETIPs (European Technology and Innovation Platforms), which should be open, transparent and representative advisory bodies populated with stakeholders in the energy field concerned.
- ▶ The Research and Innovation Framework Programme's features mean it has the greatest potential to be the ideal transnational funding programme for the European Research Area. The priority for the Commission must be on helping the Framework Programme to reach this potential, and not on setting up sub-European transnational programmes which, unavoidably, compete with it.
- ▶ New instruments like the European Innovation Council could provide additional support. Europe's regional funding programmes could also support demonstrations of innovative energy technology.



THE BIG PICTURE: A WORLD GETTING TO GRIPS WITH CLIMATE CHANGE AND RAPIDLY CHANGING ITS ENERGY SYSTEM

The agreement at the COP21 climate conference in December 2015 in Paris demonstrated a new willingness to fight global warming and put additional momentum behind a transformation that was already underway. Renewable energy technologies have fallen dramatically in cost, with further cost reduction a near certainty. A model for energy system development that a few years ago seemed immutable has been overturned and populations are turning to renewable energy technologies *en masse*. Global CO₂ emissions have been almost flat for three years despite economic growth.

The effects that clean, abundant energy could have on the world are far-reaching. For example, with the equipment to produce energy available at scales equivalent to the consumption of a person or small group of people, the balance of power might tilt away from energy companies (equivalent to the State in many countries) and towards the individuals who had hitherto relied on them for all their energy services. New uses for our time will be created as machines do more of our work.

Horizon 2020's attachment of the phrase "societal challenge" to the energy topic does not tell the whole story. Europe's enthusiasm for transforming the energy system has created economic opportunity. It has encouraged the development of energy-efficient products (popular around the world) and achieved leadership and exports in renewable energy technology and services.

Within renewable electricity technologies it is photovoltaics (PV) and wind that have achieved the greatest cost reduction, and major inroads into the energy mix. For most of this century, wind and PV will likely form the backbone of more and more energy systems around the world. But when the wind blows and when the sun shines cannot be controlled, so the rest of the energy system will need to fit around these technologies, whose marginal cost of production is near-zero.

The energy system of the future will prize flexibility. Plants that don't control their output can expect to compete in energy markets where prices are low. Large, always-on thermal plant will be in this position as much as generators dependent on the vagaries of the weather. While there will still be a "base load" (i.e. a demand for energy permanently greater than a certain level), being a supplier of "baseload power" will no longer be a boon but a handicap.

Markets are needed to remunerate suppliers and consumers of energy whose actions achieve system adequacy and maintain power quality. On the supply side, hydropower, biomass-fired generation and solar thermal electricity are likely participants. On the demand side, a great many new participants could come in. New tariffs based on real-time prices could be offered to small-scale consumers, even households. Growth in the use of heat-pump systems, which have some ability to store heat, creates the possibility to use electricity at times of abundance and to avoid its use when it is scarce. The increasing numbers of electric vehicles, if charged at the right time, can also buffer peaks in supply.

Where links are made between electricity grids and district heating networks, we expect to see the heating network adapt to the needs of the electricity grid rather than vice versa because it is (and will remain) much cheaper to store heat than to store electricity.

Electricity will only go some way in meeting demand for heating and cooling and in transport. The cost-effective, low-carbon option for these final uses could remain bioenergy, geothermal energy, directly captured solar heat or waste heat.



Work in progress at the new lab of Eurac Research for district heating and cooling systems (DHC) in the industrial zone of Bolzano, Italy. The lab (ready in spring 2017) will simulate a new generation of DHC networks that reduce energy transportation losses.

Flexynets Project
Coordinator: Eurac Research
www.flexynets.eu

EUREC'S UNDERSTANDING OF SOME MUCH-USED PHRASES IN EU ENERGY POLICY

The President of the Commission Jean-Claude Juncker made this statement when he was standing as candidate for this post:

"I therefore want Europe's Energy Union to become the world number one in renewable energies."

[POL 2014]

For EUREC, President Juncker's pronouncement refers to technology leadership. Europe should aim to be the place where discoveries that lead to better-performing and lower-cost technologies are made, and the place where these technologies are first manufactured or deployed.

Europe's innovation system must facilitate this. The region should exemplify best practice in smoothly bringing new technology to market. It should recognise the role of regulation – the interplay between 'technology push' and 'market pull' policies, and the need for both to act in synergy. For very new and little-known technologies, like ocean energy technologies or advanced biofuels, significant attractive returns may need to be offered for some time to create the market for the technology and provoke its wider uptake. That is entirely normal. As costs come down and investors perceive the technology to carry less risk and accept lower returns, so should public support be reined in.

To succeed in fighting climate change, the rate of deployment of renewable energy technologies will need to increase worldwide. The task is most urgent in the countries with the dirtiest energy mixes and highest per capita emissions, and where the cost of swapping polluting energy for non-GHG emitting technology is lowest (or, increasingly, most profitable).

"an energy system approach that goes beyond technology silos"

This phrase appears in the European Commission document "Integrated Strategic Energy Technology Plan (SET-Plan)" created by the SET Plan secretariat in October 2015. Here it is in context: "Until now the SET-Plan priorities were exclusively concentrated on individual technologies for energy supply. However, the need to provide a larger share of renewable energy, to further efficiency gains and to enable the active participation of consumers in the energy system requires an energy system approach that goes beyond technology silos." Similar language appears in the Communication *Towards an Integrated SET Plan* [C\(2015\) 6317](#) of one month earlier, and in 2013, Commissioner Geoghegan-Quinn, speaking of the recent adoption of the previous Energy Technology and Innovation Communication, had used the phrase "challenge-based approach" to mean the same thing, i.e. "addressing the whole system and forging interdisciplinary approaches across the different technologies, sectors or scientific disciplines."

This is an appeal for coordination, for different sectors to talk to each other about their research needs or deployment ambitions, and adjust their own plans accordingly. Additionally, they might seek out research projects that straddle their domains. It does not follow, however, that coordination is the only way to reach a cost-optimal energy system.

All technologies facing an 'integration challenge' interface with a grid (transmitting and/or distributing electricity or heating or cold water). So it may be sufficient to lay down rules for the way in which each may access the grid. With that done, each technology may derive the direction in which it must develop, and may safely retreat to its silo to work on delivering, optimally, the contribution determined for it. If, for example, post-2020, wind and solar installations continue to be supported with payments at a flat rate for every kWh that they produce, this would mean research in those technologies would focus on maximising output, while research on dispatchable forms of energy would focus on flexibility, fast-ramping, minimised losses in spinning reserve mode etc. If, on the other hand, wind and solar are exposed to

variable pricing, then this implies they, too, must deliver flexibility or grid services, if necessary at the expense of overall efficiency.

We disagree with the European Commission that “European research and innovation needs to bring together all relevant stakeholders and initiatives, including relevant Public Private Partnerships (PPPs) and Joint Technology Initiatives” (C(2015) 6317) if this means that all “relevant stakeholders and initiatives” must always be sitting together when research priorities are being defined. There will only be some occasions when they need to all sit together, as explained above.

“The consumer at the centre/heart of the energy system/market”

This phrase has appeared in *Towards an Integrated Roadmap* in 2014 (“Integrated Challenge 1: Active consumer at the centre of the energy system”) and in an *EC press release of July 2015* (“... households and business consumers at the heart of the European energy market...”).

In EUREC’s view, the phrase conveys the notion that consumers expect high quality energy services at a good price. Both research and innovation have a big role to play on both fronts. New wind turbines, PV systems, solar thermal collectors etc will provide energy at lower cost. The consumer, meanwhile, will have greater choice in their electricity tariffs. Time-of-use tariffs will be offered and some consumers will adopt them wholeheartedly.

The “consumer at the heart of the energy system” also speaks to a recognition of the shift in power from utilities to consumers. Consumers are becoming ‘prosumers’. In this role, through activity on the supply and on the demand side, they are shaking up the business models of utilities. They also shake up the way in which the costs of maintaining and expanding the grid are recovered, as the Commission noted in 2015 [COM 339]: “If consumers generate their own electricity from onsite renewable energy systems, they consume less electricity from the grid. This will affect how network tariffs are calculated. Network tariffs should be designed in a cost-reflective and fair manner while supporting energy efficiency and the renewable energy objectives and being simple and transparent for consumers.”



Work in progress at the new lab of Eurac Research for district heating and cooling systems (DHC) in the industrial zone of Bolzano, Italy. The lab (ready in spring 2017) will simulate a new generation of DHC networks that reduce energy transportation losses.

Flexynets Project
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Aside: Electricity market design

The vast majority of electricity prosumers, we are quite sure, will want a grid connection even as the cost of local micro-storage (batteries of single-figure kWh capacity) falls. They will want to know that even if their battery empties and sunlight fades they have access to as much electricity as they may need.

Somehow or other, this grid will be paid for. It is simply too useful to do without. Currently, in many European countries, small-scale electricity consumers such as single households pay for the maintenance and upgrade of the grid via a volume-dependent component on their electricity bill. This approach had the advantage of incentivising demand reduction and of not penalising poor people (be-

cause poor people consume less). But volume-dependent charging had the disadvantage that it disregarded the cost structure of transmission and distribution grids. They have high fixed costs and low volume-dependent costs. This means reductions in demand for grid-transported electricity (whether by the success of energy efficiency measures or own-produced renewable energy) will result in grid operators that use this charging model losing money in the long run if the demand reduction is big enough.

The operators could increase their volume-dependent charges, but doing so will only drive people to find ways to escape them. They could alternatively switch to a charging model that takes in at least the three components below:

COMPONENT	COMMENT
A fixed, volume-independent charge	<p>How to ensure the poor do not subsidise the rich in this scenario? The fixed fee could be related to the value of the property supplied with electricity, with more expensive properties paying more.</p> <p>At least some consumers will perceive this kind of business model as a way for reactionary incumbent electricity supplier-distributors to hold onto power and market share. The best way to convince prosumers this is not the case is to press for full unbundling of generation and transport activities, including at distribution network level.</p>
A charge related to (or restriction put on) the peak power that may be fed-in or taken from the grid	<p>Puts an upper limit on the amount of copper needed in the ground</p>
A time-of-use-dependent charge	<p>This will determine the equilibrium amount of local storage to be installed on the system. This component should be significant if it is cost-optimal (as determined by simulations, modelling etc) to have lots of storage at the site of the consumer and near-zero if it is cost-optimal for the grid operator or supplier to invest in storage or use another means to meet demand at any moment.</p>

Europe's interconnected grid is a huge, valuable asset representing enormous sunk costs that it makes sense to utilise to the full. Exposing end-consumers to fixed, volume-independent grid charges would be one way to do that. The charges could boost the attractiveness of 'embedded generation' projects (projects where renewable energy is produced and consumed on-site) leading to greater deployment of renewables: one investment group has said it considers it risky to invest in projects in countries that have not yet made the switch to fixed charges. It fears that in those countries, the grid tariff structure will change and that the profitability of projects there will be damaged when that happens (Box 1).

BOX 1

"Investors like ourselves will not invest, or will be very worried about investing in projects of embedded generation in those countries where the grid charges are linked to volume, because we see a risk of those charges rising in the future. Investment will flow in those projects where the charges are fixed."

Luis Quiroga, Hg Capital [HLG 2016]

SET PLAN 2.0

(STRATEGIC ENERGY TECHNOLOGY PLAN)

EUREC has tracked, inputted to, and commented on the SET Plan since the European Commission (EC) first precluded it in 2006. The SET Plan has the ambition to be the EU's overall strategy to advance energy technologies. It should set the course for the EU's R&D spending priorities, including those of the Member States.

Help ETIPs to feel they're making a difference

In the past year and a half two currents have run through the recommendations we've made on the SET Plan. One is that the stakeholders who put their time into feeding the EC with information (often for free) need to have the sense that they are making a difference and that their efforts are worthwhile. We would like one particular set of stakeholders, European Technology and Innovation Platforms, to be given more responsibility and greater visibility on EC platforms, e.g. the EC websites. These 'ETIPs' are advisory bodies recognised in the SET Plan and in Horizon 2020's official texts as bodies that deliver balanced, sensible advice by virtue of a representative composition. They are composed of experienced research managers from the public and private sector. Our guideline would be for equal proportions from both and our support for them is predicated on proportions close to 50/50 being achieved. They derive their legitimacy from this balance.

We would like ETIPs to be invited to provide detailed input to the Work Programmes that descend from the European Commission's Research and Innovation Framework Programmes, and for this input to be subjected to public scrutiny by being posted on a relevant EC webpage. This will bring greater transparency to the process of selecting Work Programme topics. It is in the common interest for these discussions to take place in a group that's open, free to join, independent, representative and takes itself seriously because of the importance of the task entrusted to it. There would be no obligation for the EC to reproduce the suggested ideas in its Work Programme, but they would serve as the starting point for a three-way discussion including the Member States and the countries associated to the Framework Programme (more details in Box 2). Like it

has done with the Issues Paper/Input Paper exercise [SET 2016], the EC would give its reaction to the ideas proposed. The ideal for coordinated research programming using a stakeholder group could be the process used in the aviation sector (Box 3).

BOX 2

The EC wants research managers in the public and private sector to use ETIPs as places where they can write down their ideal plans or formulate the recommendations they would ideally want to make – see quotes below. The EC is right to encourage this activity because it will show where public policy should aim. Compromises can be made later.

"It's totally fine for researchers, universities and industry to have a space to discuss apart from the others in the ETIP. [...] Our assumption is that if an ETIP presents a Strategic Research Agenda it does this on behalf of everybody except the public sector."

Paul Verhoef, former Head of Unit Renewable Energy Sources, DG Research, European Commission, 5 Oct 2015 [HOU 2015]

"The EC highlighted the importance of avoiding country representatives in ETIP's Governing Board (with the exception of the Smart Networks for Energy Transition and the Sustainable Nuclear Energy) since ETIP have to be run by stakeholders [...]."

Minutes of SET Plan Steering Group meeting 14 September 2016

BOX 3

Research programming in the aviation sector: pan-European consensus through dialogue between industry stakeholders and government

Two research programming documents in aviation, ACARE's Flightpath 2050 and its 2012 Strategic Research and Innovation Agenda (*Realising Europe's vision for aviation*) were prepared by the entire aviation stakeholder community including the European Commission, and were thus accepted Europe-wide. National Programmes like LuFO (Germany), CORAG (France) or TakeOff (Austria) refer to these documents, as officials from these countries they were directly involved in preparing them.

On an equal footing to the Advisory Group on Energy (AGE)

ETIPs' involvement in shaping the Work Programme could be like AGE's. Before the EC begins production of a Work Programme, AGE is invited to make its suggestions on the contents, for example in its *Strategic priorities for the Energy work programme 2018-2020*. Its finished documents are public.

Reform of the European Commission's horizontal rules for Expert Groups, including AGE, is underway. We welcome the fact that 'meaningful and complete' minutes of Expert Groups' meetings will be made public. In other respects, however, the reforms do not go far enough. People who participate as "Type B - Individual expert appointed as representative of a common interest" need give only the barest indication of who or what that common interest is: one of seven categories of stakeholder, plus 'Other' (see sample application form [EXG 2016]). Their "proven capacity to represent effectively the position shared by stakeholders" is a selection criterion, but the applicant is not asked to write a public statement detailing how they will continue this representation once in office or how they may be approached by people unknown to them. There remains a tension between the need to discharge this liaison function effectively and the need to respect the confidentiality of documents that may be shared with the Expert Group.

AGE, we think, should only contain people who speak in a personal capacity, so-called Type A. People who are "representative of a common interest" or who "represent organisations" (Type C) should still give input, but these people should be the members of ETIPs and the invitation to give input should be directed at the ETIP as a whole. The franchise should be extended to all ETIPs in energy. Switching to this *modus consultandi* would sidestep difficult questions about the nature of a "common interest",

a "stakeholder" and possible recriminations arising from choices to represent some "organisations" but not others. Thus the EC can seek input on its Work Programme from two well-delineated complementary perspectives.

If "representative of a common interest"- and "representative of an organisation"-seats must stay, the next best option is that ETIP Chairs are selected as Advisory Group members and given permission to share the material distributed to the Advisory Group with their ETIPs.

Not just about Work Programme advice

There are other ways that the work of ETIPs may be used. In an exercise that ran from end of 2015 till half-way through 2016, different ETIPs set themselves indicative performance targets for various aspects of the technology each was concerned with. They were discussed with the European Commission and Member States in the SET Plan Steering Group and written down in 'Declarations of Intent'. The highest-level target was often a cost target, to be achieved by 2020 or 2030 under certain assumptions, notably that considerable progress is made in the lab and that a certain level of deployment is met. The cost targets are substantially lower than those expected in 2020 and 2030 by the EC in its annex to State of the Energy Union 2015 [SOE 2015].

We need to see these targets taken up in the EC's wider energy policy proposals. Omitting a 'SET Plan scenario' from the Impact Assessment of the Renewable Energy Directive for the period 2021-2030 was a missed opportunity. This would have been a scenario that assumes great strides in the development of new technology, explicitly using the data of the Declarations of Intent as the parameters for it. The scenario would have woken people up to the potential tangible impact of R&D in energy policy, in euros spent, in MW installed, and in MWh produced, as well as raised the visibility of the SET Plan.

Aside

We agree with AGE's criticism of PRIMES, namely, "[...] AGE members pointed to the limitations of the PRIMES model, notably its limited capability to take time-scale of events sufficiently into account as well as shortcomings due to its top-down approach and lack of transparency regarding assumptions. Attention was drawn to alternative models that are capable of

accounting for additional dimensions and time scales, as well as integrate more complexity and thus arrive at different results and conclusions." – *Strategic priorities for the Energy work programme 2018-2020*, p14. AGE also advises setting up an EU modelling forum. EUREC suggests the initial four members of this forum could be the four winning projects of the **LCE-21-2015 topic**, "Modelling and analysing the energy system, its transformation and impacts".

Member States

The second of the two currents running through EU-REC's SET Plan engagement has been to consider Member State involvement in the SET Plan, specifically the approach of Member States to the creation of joint transnational funding programmes (see chapter on ERA-NET-COFUNDS, p17) and the relationship between ETIPs and Member States. The suggestion of the EC for the latter is to create a structure known as a 'Temporary Working Group' in which stakeholders (from ETIPs and elsewhere) and Member States will write an 'Implementation Plan'. The groups seem bafflingly similar to the EII Teams that it was the EC's intention, signalled in Communication [C\(2015\) 6317](#), to dismantle. It is time to try other ways of organising the interaction. Some suggestions are given in Box 4.

What might ETIPs want from contact to Member States?

- An opportunity to tell Member States about the research priorities for their sector that would be in Europe's overall interest
- The opportunity to suggest some specific measures to some specific countries, or to tell the assembled countries what they should do collectively
- An opportunity to get the Member States' reaction both on their research priorities and on the measures proposed
- Follow-up: statements from the Member States on how they have taken our recommendations into account, at least the ones that they agree with

Crucially, the information flow between ETIPs and national governments must be bidirectional, and Member States should allow themselves to be held to account for their decisions. This means that the ETIP needs to address both high-level administrators who have authority over funding decisions, and technical experts who can explain the nuances in a country's funding policy.

There is an example of an annual EU-Member States coordination cycle. It is called the 'European Semester' and applies to economic governance. In the first six months of the year, advice and guidance comes from the EU-level (signed off by the Member States as a collective in the Council of Ministers). In the second six months, Member States implement that advice. Something similar could be attempted for the SET Plan.

BOX 4

A combination of contact at these levels could be the right way to create a deeper relationship between ETIPs and Member States.

ETIPs present to relevant ministers at a Council of Ministers meeting As the SETIS website said of the Luxembourgish Presidency's SET Plan conference (<https://setis.ec.europa.eu/newsroom/news/set-plan-conference-2015>) (which happened in Sept 2015), "It will be held back-to-back with the informal council of the Energy Ministers in Luxembourg, thereby placing research and innovation in energy at the heart of Luxembourg's Council Presidency." We could ask for such councils to become the norm, and for ETIP chairs to have the chance to give short pitches at them. They could also be given a prominent place in the programme of SET Plan conferences.

ETIPs present to Member States' Directors General Periodically European Commission Directors General convene meetings in Brussels of their counterparts from Member State ministries. ETIP chairs could be invited to present or discuss their needs at suitable occasions when they are gathered. These meetings could alternate with the Council of Ministers meeting suggested above (e.g. May: Directors-General; November: Ministers).

A delegation of SET Plan Steering Group members who are particularly interested in the technology covered by a particular ETIP attends the General Assembly of that ETIP. These countries are the ones that follow the work of the ETIP by being incorporated into the ETIP's structure or by being in that ETIP's Temporary Working Group.

Representatives of the SET Plan Steering Group would maintain day-to-day contact with the ETIP. These people might be civil servant colleagues of the SET Plan Steering Group with deep technical knowledge of the ETIP's area and of their country's energy technology policy. They might be the same people who make up the 'Mirror Group' that some ETIPs maintain, or volunteers for the Temporary Working Groups.

We are grateful to the European Commission also for recognising that the calibre of the Member State representative matters. DG Research and Innovation former Head of Unit Paul Verhoeve said [[HOU 2015](#)], "It would be great if we can have those experts from the Member States involved who bring in this or that [competence], including people involved in financial issues, regulatory issues, skills and whatever else needs to be addressed so that we have people involved in these ETIPs who really can make a difference. This is at least what we would like to try and do." One crucial group to involve are those who control European regional funding in the



The RED-Heat-to-Power project adopts a game-changing approach that generates electricity from low grade heat in the temperature range of 40 to 100oC. This clean source of electricity is very flexible and can cover base load or peak load at a very competitive cost, having all the characteristics for contributing to the mix that will form the backbone of the future energy system.

RED-Heat-to-Power Project
Coordinator: WIP Renewable Energies
www.red-heat-to-power.eu

Member States. There is a link between the “Energy and Managing Authorities Network” (EMA) and the SET Plan Steering Group, but it is rather tenuous. The EMA needs to know more about the contribution that regional funding could make in funding innovation, and the SET Plan Steering Group needs to know more about the accessibility of European Structural and Investment Funds.

Mission Innovation

The European Union, represented by the European Commission, joined ‘Mission Innovation’ in June 2016. Launched at the COP21 climate talks in Paris, at the heart of Mission Innovation is a pact to “double its governmental and/or state-directed clean energy research and development investment over five years.” The five-year span is 2015-2020. Among other actions, the (today) 23 signatories of Mission Innovation commit to ‘Information sharing, innovation analysis’, ‘Roadmapping’ and ‘Business and investor engagement’ [MI 2016].

The EU does not need to make any adjustments to its overall Horizon 2020 budget plan in order to comply with the Mission Innovation entry condition, as spending on climate and energy topics was scheduled to ramp up during the period and reach a doubling, anyway. Somehow, though, one expects more of the European Commission than to rely on a budgeting fluke for the EU’s admission. It aspires to be a world leader on climate, led by a President who declared in his manifesto [POL 2014] that he wanted as the third of his ten priorities “A Resilient Energy Union with a Forward-Looking Climate Change Policy”. The EC should use the upcoming mid-term reviews of the Multiannual Financial Framework and Horizon 2020 to increase spending on clean energy technology, specifically renewable energy technologies and technologies for their integration in the grid, and energy efficiency beyond the current trajectory. Furthermore, the EC, via the SET Plan Steering Group or higher-level interactions with Member States should seek to persuade all Member States to join. There is momentum for this (Box 5). The time is right for Mission Innovation’s members to discuss the budgetary commitment they will make to low-carbon energy after 2020. This spending has most probably not yet been programmed, making it easier for a clear common baseline to be agreed, and common methodology for determining the budget increase.

BOX 5

“I was in San Francisco last week for the first ministerial meeting and I must say that the mood of the Mission Innovation meeting was electrifying. Everyone involved seemed eager to start [...]. Everyone was on board and there was a very positive atmosphere in the room.”

Lars Gulbrand, Senior Adviser, Swedish Ministry of Environment and Energy [HLG 2016]

Breakthrough Energy Coalition (BEC)

The Breakthrough Energy Coalition was set up at the same time as Mission Innovation. Its 28 members, all of them potential private investors in innovative energy projects, describe themselves as “a network of private capital committed to building a structure that will allow informed decisions to help accelerate the change to the advanced energy future our planet needs.”

We see a role for the European Commission in opening a channel to the BEC for European researcher-entrepreneurs in energy. One of the things the Commission could do is to create an opportunity for researcher-entrepreneurs with suitable projects to get in front of a panel of BEC investors. The Commission, having knowledge of the projects it has funded, would choose the best ones from its portfolio.

The SET Plan conference would be used as an occasion for BEC to talk about the projects they are backing that have European involvement. The conference could include a session where researcher-entrepreneurs pitch in public. The event would attract high media attention – far higher than SET Plan conferences currently manage. AGE is thinking along the same lines as us. Its *Strategic Priorities for the Energy work programme 2018-2020* suggest “Cultivating the concept of pitching to investors during (for example) start-up events - similar to in the US; enabling technology developers to bridge the gap from start-up to commercialisation by providing access and exposure to more funds.”

MONITORING PROGRESS IN THE EU’S RESEARCH AND INNOVATION POLICIES WITH WELL-CHOSEN INDICATORS

One of the most interesting features of the initiative ‘Energy Union’ is the annual ‘State of the Energy Union’ report that it mandates. The first was issued in November 2015 [SOE 2015]. It tracks a good mix of input- and output-related R&I indicators (the two kinds

must be compared), and lays down a frequency for reporting on each that finds the right balance between the cost of acquiring the data and its usefulness for policy-making (Table 2).

	EVERY YEAR	EVERY TWO YEARS
Input-related	<ul style="list-style-type: none"> Investment in research and innovation (both private and public sector) 	
Output-related	<ul style="list-style-type: none"> Trends in patents The number of researchers active in the energy sector 	<ul style="list-style-type: none"> Technology developments Cost reductions Systemic integration of new technologies.

Table 2 Indicators the EC committed to monitor, and the frequency of monitoring, Communication ‘Towards an Integrated Strategic Energy Technology (SET) Plan’ of 15 September 2015, C(2015) 6317. The Communication says, regarding the annually-monitored targets, “Further key indicators are being developed in parallel for the Energy Union governance and their consistency will be ensured.”

Reliable data on private sector spending on energy R&D and on researcher headcount, which are among the indicators surveyed in State of the Energy Union, are difficult to get hold of. The data is often considered commercially sensitive with companies choosing not to report it, or reporting aggregate figures only. The last time the EC (via SETIS) reported company spending was in the 2015 edition of the Capacities Map [CAP 2015], which used data from 2011. The fortunes of many energy technologies and the companies backing them have changed a lot since.

The EC could consider, as a condition for signing grant agreements, that companies provide this information in confidence. It will provide a rough estimate (possibly also a representative one) of the current situation, which more detailed studies can be checked against for consistency. Aggregated data from these surveys, or at least trends that they show, could be made public.

The advent of Mission Innovation makes it all the more important to track spending on public investment in research and innovation.

These indicators will paint a picture of the EU's performance overall in innovation in energy but they cannot describe progress on the European Commission's biggest organisational project in energy research policy of the last nine years, the Strategic Energy Technology (SET) Plan (Box 6).

BOX 6

"Measuring the impact of the SET-Plan on the energy policy objectives is absolutely necessary to justify its central role in transforming the European energy system and hence the need for developing and applying a practical and effective reporting system."

SETIS's review of EII and EERA 2010-2012 [EII 2012]

The EC says that since 2007, the SET Plan "has created a vibrant open innovation ecosystem which capitalises on the results of research. And it has contributed to open science by making many of its results accessible to all." Above all, however, it has been an attempt at joint programming. Discussions in its European Industrial Initiatives (groups containing industry and research stakeholders, the Commission and Member State officials) have centred on whether new transnational funding programmes parallel to the European Commission's funding programmes FP7 and Horizon 2020 may be set up. The EERA (European Energy Research Alliance), meanwhile, brought together research centres in order to give them the opportunity to coordinate their research with each other (a function, by the way, that makes EERA members valuable participants in ETIPs).

Energy Union therefore needs to monitor the following additional indicators, which go to the heart of the SET Plan's aims:

- ▶ The number of ongoing joint actions (ERA-NETs, ERA-NET-COFUNDS, Joint Programming Initiatives, Eurogiga2020 or other) by Member States with and without EC cofinancing
- ▶ The number of Member States participating in them
- ▶ The funding they committed to them
- ▶ The size of the EC's budget for research, as increases in this are also evidence of Member States attributing importance to transnational research.

Correlations should be understood: is there, for example, a causal link between public investment in energy R&I and greater interest in joint actions?

This information might become available. The indications are that Member States will need to report progress on "alignment of research programmes and common programmes" as part of their obligations under 'Energy Union governance'.

Concerning the EC's claim that the SET Plan has "contributed to open science by making many of its results accessible to all", EUREC thinks that it is an independent initiative that is driving accessibility to data, the 'Open Data' agenda. This requires Horizon 2020 grantees at a minimum to "take measures to ensure open access to the data underlying their scientific publications." We support the EC's expansion of the Open Research Data Pilot to all Horizon 2020 contracts from 2017.

ERA-NET-COFUNDS: USEFUL IN THE SHORT TERM, A POTENTIAL DANGER TO THE FRAMEWORK PROGRAMME IN THE LONG TERM

'ERA-NETs' have proven to be the most popular tool for furthering the SET Plan's aim of funding more transnational research outside of the Research and Innovation Framework Programmes. In the Horizon 2020 era, a new variant was created, 'ERA-NET-COFUND'. The instrument changed from one that funded groups of Member States to set up the processes to launch a joint call, to one that would additionally see the EC part-financing some of the projects selected from the call.

EUREC has in the past been worried that the European Commission contribution to ERA-NET-COFUNDS is made available to Member States in proportion to the volume of funding that each agrees to make available to its research centres in the joint call. This, it seemed to us, would tend to concentrate Framework Programme funds in the richest Member States. Without the ERA-NET-COFUND, on the other hand, the money would be available for all to bid for.

However, early evidence suggests that this is not what is happening, which makes us more enthusiastic for the instrument in principle. It seems that Member States in general are using 10-50% of the EC's contribution for 'gap-filling in the ranking list'. This means that if a

high-scored project needs money from a Member State that can't provide it because its budget for the call is already exhausted, the EC's budget can fund the project instead. This is a very welcome use of the EC's budget. It promotes solidarity over selfishness while ensuring that only the best projects are funded.

Recommendations

A comprehensive survey should be made of the use that is made of the EC's budget in ERA-NET-COFUND projects disaggregated under three main headings:

- i) the proportion going towards ranking-list gap-filling
- ii) the proportion covering the administrative overhead: publicity, evaluations, coordination meetings, database creation and maintenance, etc
- iii) the proportion going towards rewarding countries that commit the most national resources ("juste retour")

This information is hard to find, but it might be contained in the Expert Group's report due in November 2016. In future, we ask that all ERA-NET-COFUNDS should report it. Towards the end of Horizon 2020, or in FP9, the EC could make the proportion of the budget on gap-filling an explicit selection criterion for projects, with a minimum threshold, and with a real threat of the proposal not being funded if this share is too low.



The Competitive Solar Power Towers CAPTure project aims at increasing concentrated solar power (CSP) plant efficiencies and reduce levelised cost of electricity (LCOE) by developing all relevant components that allow implementing an innovative plant configuration.

CAPTure Project
Coordinators: CENER/IK4 Tekniker
www.capture-solar-energy.eu

The ERA-NET-COFUND overhead

Item (iii) on the above list relates to the administrative overhead. These costs are minimised if the same group of Member States begin a new ERA-NET-COFUND project as soon as the old one expires. If an interruption can be avoided, then the processes to set up joint calls do not need to be re-created or relearned. Also, there will be less need for a publicity drive to rekindle interest from stakeholders.

Even if minimised, however, the administrative overhead of ERA-NET-COFUND seems unlikely to be less per unit of funding disbursed than that of the Framework Programme. The Framework Programme was designed from the outset to be a transnational funding programme, and its processes and operation have been fine-tuned over decades. Most crucially, however, it is vastly larger than individual ERA-NET-COFUNDS, and is itself part of an even larger budget, the seven-year Multiannual Financial Framework. Its size means countries pay no attention to their return on individual projects of programmes, and are only barely interested in their return on the whole Framework Programme. They care about the aggregate redistributive effect of the MFF, which covers regional funding and funding for agriculture, too.

The absence of a big-picture view is a problem pinpointed in a report by ERA-LEARN [ERA 2015]. This report includes the responses to a questionnaire of 10 ERA-NET-COFUNDS, including at least one in energy, DEMOWIND. In each of them, the Member States contributing budget to the COFUND needed to devise their own deal on how to share the European Commission's contribution. They had to devise their own compromise between the three areas mentioned under i), ii) and iii) above. That finely balanced compromise must be re-found for every ERA-NET-COFUND contract to adjust for changes to the composition of the consortium from one contract to the next, or to the amount of money each member commits. Clauses are needed to manage unexpectedly many or few strong applications to the Cofund from particular countries. All these delay-inducing checks and balances are politically necessary because the ERA-NET-COFUND budgets do not look beyond their boundary to the budgets of other projects or whole programmes, meaning the solution must be found within each individually. This is desperately inefficient compared to the Framework Programme.

ERA-NET-COFUNDS may be seen as a workaround for the fact that it is difficult politically today for Member States to put more into the EU budget, but supporting them might, in the long term, undermine the Framework Programme. Member States and Associated Countries might argue that in contributing to transnational research via ERA-NET-COFUNDS they may reduce their commitment to the Framework Programme.

Side effects

The side-effects of ERA-NET-COFUNDS' compromise-constrained construction is felt by bidders. One is that Member States have different views on the kinds of project to fund, with some, according to our interviews "wanting PhDs" funded and others "products". This makes it hard to build a consistent project. Like EUREKA projects, the M-ERA-NET in materials suffers from the fact "that country of the partner you might want to have in the end might end up not having enough funding in the call. Then you have to use the partner whose country will fund him, not the best partner for the job," said an EMIRI contact¹, backed up a member of the Spanish administration responsible for ERA-NETs. "The rules and regulations are different. Some countries like the Netherlands and Denmark require you to submit a proposal to the national funding mechanism in parallel with the proposal to the ERA-NET-COFUND. You need eyes at the back of your head not to get caught out by the idiosyncrasies of the different rule-books. One day before the proposal deadline we discovered a particular form needed to be provided for the Netherlands." (DEMOWIND participant).

The end-users of some ERA-NET COFUND schemes do note some benefits, but many of them are accidental and do not derive from any intrinsic property of the instrument. The application forms may require less text and the calls may be more targeted than in the Energy Work Programme of Horizon 2020. Partners with projects that fit well to the call report a higher success rate. The application process is two-stage, with (like EUREKA projects) a pre-proposal and a full proposal if the pre-proposal is accepted. According to the information from the 10 ERA-NET-COFUNDS in the ERA-LEARN study, it runs slightly faster than a two-stage Horizon 2020 process, where the time-to-grant (from deadline for first-stage proposal to signed grant agreement) is around 13 months. Unlike in Horizon 2020, the bidders receive feedback on their pre-proposal, and it is relatively common to use the same evaluation team for the pre-proposal as for the full-proposal.

1- EUREC is an associate member of EMIRI, the Energy Materials Industrial Research Initiative



Our members propose improving ERA-NETs by making them more permanent, with a lifetime that doesn't end with the close of the EC contract. They would like to see countries accept the evaluations made by the ERA-NET-COFUND consortium without needing to perform their separate ones, and for common rules to be adopted by all countries. On this last point, the ERA-NET-COFUND instrument, EUREC notes, is a vehicle for driving the convergence of Member States' research funding processes from the bottom up. It creates a desire among stakeholders for the convergence.



Kick off of the H2020 Exceed Project at Eurac Research in Bolzano/Italy. The team will create an European energy efficient building & district database, allowing the analysis of energy performance and environmental quality at the level of single building/district, geo-cluster of buildings and European building stock.

Exceed Project
Coordinator: EURAC Research

ACCESSING EUROPEAN STRUCTURAL AND INVESTMENT FUNDS FOR INNOVATION (ESIF) IN RENEWABLE ENERGY

European Structural and Investment Funds are targeted at “individual firms/bodies within a particular place” and are “largely focused on improving the R&I capacities and R&I eco-systems” in that place [JRC 2014]. Research Framework Programme money, by contrast, is awarded through “competitive calls for proposals addressed to international groupings” with a “focus on individual R&I Projects”.

There will be some projects with ‘Framework Programme’ character that should, however, not be too hard to fit into a ESI Fund programme. These would be projects that are clearly anchored in one location, for example because they involve the construction of something (e.g. a wind farm that uses a new form of wind turbine). They would be projects that involve a rather small consortium, or at least one where a small number of partners shoulder a large share of the cost.

The JRC has noted [JRC 2013], “Some private investors and lenders lack the competence to evaluate the risk level of first-of-a-kind projects. If they are supported in their evaluation, it could make them more willing to invest/lend.” We think that ‘Managing Authorities’ (the public entities that distribute European Structural and Investment Funds) likewise need more help in evaluating projects that come before them and that carry a lot of technology risk. This could perhaps be achieved through an expansion of the scope and mission of the ELENA facility offered by the European Investment Bank. The scheme currently provides assistance for creating and presenting business cases for energy efficiency or renewables projects in built-up areas.

To help mount cross border projects, the Smart Specialisation Platform in Energy (S3P-E) is a promising initiative. The regions and countries that join the Platform are provided with a mechanism to exchange information on their respective programmes and strategies. The assumption of S3P-E is that if a joint strategy could be agreed at high level, then it will be easier for stakeholders in the regions concerned to create joint projects making parallel use of their region’s ESIF allocation. It will be a kind of regional funding answer to ERA-NET-COFUNDS.

Ultimately it might be possible for regional funding to dissolve that other distinction from Horizon 2020: selection on the basis of competition. Competition for funding is especially desirable when projects carry technology-risk because it ensures that even if the evaluator does not perfectly understand the risks in a proposal at least the threat of losing the competition incentivises the bidder to make the best offer (s)he can.

The JRC has recognised Sweden’s success in including an element of competition in its distribution of regional funding, as well as in introducing with other Nordic countries rules creating the flexibility to work cross-border [JRC 2014].



The CREATE concept is based on advanced compact thermal storage for existing dwellings using thermochemical storage materials. The heart of the system consists of a vessel that contains a salt that is hydrated and dehydrated, which generates an energy effect. In the time between de-hydration and hydration the energy is stored in the salt.

**CREATE Project
Coordinator: TNO
www.createproject.eu**

EIC - EUROPEAN INNOVATION COUNCIL

FP7 ushered in the start of the European Research Council. We hope that 'FP9' (i.e. the research programme that succeeds Horizon 2020) will include proposals for a European Innovation Council that take account of the following:

- ▶ The real valley of death for 'deep technologies', as opposed to software-based enterprises, is the funding needed to do the tedious job of scaling up, durability testing, optimisation of materials etc [DRD 2016].
- ▶ A bottom-up funding instrument should be created targeting this valley of death for deep technologies. That means the instrument must target applied research.
- ▶ The ERC is the right model for administering this instrument because it is run at arm's length to the European Commission, is well-resourced, and has built up a reputation such that it attracts really good proposals. An EIC modelled on the ERC should offer quick decisions on a proposal's fundability. In contrast to the ERC, however, excellence would not be the only criteria by which proposals are assessed. The commercial prospects of the technology should count in the evaluation, too.

- ▶ In the energy field, the Breakthrough Energy Coalition, could provide a substantial amount of venture capital, which may be used alongside the EIC's applied research grants. Channels for European researcher-entrepreneurs to access it should be created with the Commission's help.

If the EIC ultimately looks quite different from the ERC-inspired institution we describe, then as a minimum we say

- ▶ it should help technologies overcome the valley of death by providing funding for first-of-a-kind demonstration projects.
- ▶ It should complement existing instruments such as the ERC, standard collaborative Research and Innovation Action or Innovation Action contracts and Public-Private Partnerships.

The ground must be prepared for this EIC in the remaining years of Horizon 2020, with a pilot scheme of adequate scale fashioned out of existing instruments and budgets.



REFERENCES

CAP 2015	<i>Capacity Mapping: R&D investment in SET-Plan technologies.</i> This document used data from 2011. The three earlier Capacities Maps (2007, 2009, 2011) used data from two years prior to their year of publication.
COM 339	Communication from the Commission COM(2015) 339 , <i>Delivering a New Deal for Energy Consumers</i> – 15 Jul 2015
DRD 2016	The phrase ‘deep technologies’ comes from a presentation by the Druid Collective in to the 13 July 2016 European Innovation Council Call for Ideas Workshop . The group thinks Europe lacks a venture capital network to support them.
EII 2012	<i>Review of the SET- Plan Implementation Mechanisms for the period 2010-2012</i> – 3 Dec 2012
ERA 2015	<i>First experiences of ERA-NET Cofund Projects</i> – Dec 2015
EXG 2016	Annex II of C(2016) 3301 containing sample application form for expert group members, including on p19 the seven categories of interest the candidate member can choose to represent – 30 May 2016
HLG 2016	High Level Roundtable on Low-Carbon Innovation – 9 June 2016. Luis Quiroga made his statements at 13:55:45 in the recording
HOU 2015	Paul Verhoef’s statements at the <i>Meeting with the Chairs of ETIPs and EIs for the new SET Plan governance</i> – 5 Oct 2015
JRC 2013	<i>Report on Innovative Financial Instruments for the Implementation of the SET Plan, First-Of-A-Kind projects</i> – 2013
JRC 2014	<i>Developing Danube R&I Projects across Borders – How to Make the Joint Use of EU-Funds a Reality</i> – Sept 2014
MI 2016	<i>Enabling Framework for Mission Innovation</i> – 1 Jun 2016
POL 2014	<i>A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change – Political Guidelines for the next European Commission</i> – Jean-Claude Juncker – 15 Jul 2014
SET 2016	The Issues Paper/Input Paper exercise was a SET Plan exercise of 2016 that culminated (or will culminate) in the signing of ‘Declarations of Intent’ – see https://setis.ec.europa.eu/towards-an-integrated-SET-Plan
SOE 2015	Communication from the Commission State of the Energy Union 2015, COM(2015) 572 ; and its accompanying document, <i>Monitoring progress towards the Energy Union objectives – Concept and first analysis of key indicators</i> , esp. Figure 59, SWD(2015) 243 – 18 Nov 2015



FOR MORE INFORMATION

on EUREC's activities,
contact the EUREC secretariat:
info@eurec.be



www.eurec.be

