Governance for a decarbonized future - the EU Strategic Energy Technology Plan

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This paper is part of a suggestion for a future book manuscript, introduction and the analytical framework to analyze the development and functioning of the EU Strategic Energy Technology Plan (SET-Plan). It reflects very much work in progress. We would appreciate comments on the structure, the research questions posed in the manuscript, and the analytical framework.

1. Introduction

This book investigates a pillar of EU's energy and climate policy that has received scant attention by political science scholars - the development of a low-carbon energy research and innovation policy, launched with the idea of a Strategic Energy Technology Plan (SET-Plan) in 2006. The SET-Plan was formally proposed in 2007 and adopted in 2008 in tandem with a larger package of EU energy and climate policies to deliver on the goals of fighting climate change, improving the security of energy supply and the competitiveness of the EU in the global economy. This policy package initiated a long-term low-carbon transition of the EU economy with the target set for reducing EU emissions of greenhouse gases (GHGs) by 80-95% by 2050. A series of interim targets and policies were adopted for 2020 that included reducing EU GHG emission by 20% compared to 1990, ensuring that 20% of total energy consumption would be generated by renewable energy and improving energy efficiency by 20%. The SET-Plan constituted the low-carbon technology push pillar of this package, complementing those parts adopted to create new demand for such technologies, including the Renewable Energy Directive and the revised EU Emissions Trading System (ETS).

The strategic aim of the SET-Plan has been accelerating the development and market uptake of low-carbon technologies to assist achievement of short- and long-term energy and climate goals. Its operational objectives are to spur more resources for low-carbon technology development in the EU, and re-organisation of research and innovation efforts so as to make better use of scarce resources. The plan envisions new comprehensive coordination of research and innovation efforts at the EU and member state levels, between
research institutions and industrial companies, to avoid fragmentation and duplication and to create the critical mass of resources needed for accelerating development, testing and commercialization of a selection of the most promising technologies.

The saliency of the SET-Plan in EU's energy and climate policy has been underscored by the Commission, stating that if technology development fails, so will achievement of the EU climate and energy targets and the transition of the energy system that will need new breakthrough technologies (Commission, 2006). Despite of this stated saliency, the politics of adopting and making the SET-plan function is still an unexplored terrain, in contrast to the many volumes and articles analyzing the politics of EU low-carbon technology demand-pulling policies (footnote with references). The few articles produced on the SET-Plan are mainly a-political in nature, aimed at describing the plan and assessing its achievements (references).

The aim of this book is taking stock of the SET-plan at its ten-year anniversary and filling a research gap on the politics of EU technology innovation policy by investigating and analyzing why and how the SET-Plan came into being and later developed. Has it developed as intended without problems and political conflict? An indication of the opposite might be major reforms of the SET-Plan initiated in 2013 and adopted in 2015. What was this reform about and why was it initiated? Has changes in contextual factors affected the SET-plan? It was adopted as part of a policy package to speed up in response to major international challenges facing the EU on mitigating climate change, tackling climate change to achieve energy and climate policy targets towards 2020. In 2014, the EU decided to increase the ambitiousness of its energy and climate policy towards 2030 by setting new stricter targets for reduction of GHGs (40% by 2030 compared to 1990) and energy system restructuring (27% share for renewables in EU energy consumption and 27% improvement in energy efficiency). These targets were in 2015 incorporated in the larger Energy Union policy strategy towards 2030 that set energy-technology policy development as one of its five pillars. Why was such a shift in general climate and energy policy ambitiousness decided and did it affect the SET-plan reform and functioning? What are the prospects of the SET-plan in light of the reforms?

These are main questions addressed in this book. The SET-Plan policy case and the questions posed will be analyzed from central political science perspectives. It can be viewed as a new field of European Integration where different integration theories would explain differently why the plan came into being, how it was designed, and later developed. On the other hand, it could be seen as a case of Europeanization where EU policies were aimed at creating adaptation pressure on member states and stakeholders to commit more resources to research and innovation (R&I) at the EU level and steer these resources towards specific prioritized technologies (convergence). Degree of EU adaptation pressure would here be a factor that could explain whether or not the plan has functioned as intended. Or, the policy case could be seen as a typical collective action dilemma (Axelrod, 1980) whereby the
rationalities of individual interdependent actors in implementation of the plan could lead to collectively irrational outcomes unless backed by proper governance. The functioning of the plan may thus be explained by characteristics of the adopted governance system. This focus on governance issues is timely with the current political and academic discussion in the EU on energy governance more generally, associated with the realization of the EU Energy Union.

The book will apply all these central political science approaches that are currently in use for the study of European policy – different approaches will be needed for analyzing politics of different aspects and phases of the emerging EU energy-technology R&I policy. Case study method will be applied for collecting and analyzing SET-Plan process data, making use of different analytical techniques to adopt causal explanations, including process tracing and pattern matching. Process data is collected by interviews (with European Commission staff, member state government members of the SET-Plan Steering Committee, national research councils, industry and university stakeholders involved in SET-plan development work); and document analyzing

The book might be informative for scholars beyond EU studies, however. The SET-Plan might be seen as a test case for more comprehensive internationalization of national innovation systems by its aim for institutionalization and coordination of research policies at the international level, a phenomenon scantly studied in this literature (Carlsson, 2006). The book is divided in five additional chapters. Chapter 2 presents the analytical framework with theoretical expectations for analyzing the most central questions Chapter 3 analyze why the SET-plan was established and given its initial structure (goals, prescribed actions and governance system), i.e. the baseline for analyzing its later development and functioning. We here present the background for the initiation of and the decision to set up the strategic plan. The decision is a puzzle since it signaled stronger integration at the EU level in a policy field where the member states had earlier been reluctant to loosen national control, energy policy (Birchfield and Duffield, 2011; Wettestad et al, 2012; Skjærseth et al., 2016). It is a puzzle also because it signaled closer co-ordination at the EU-level of two EU policy fields that had earlier evolved as largely uncoordinated at this level: energy and R&I policies. Chapter 4 analyzes how the SET plan developed and functioned based on its initial structure with revisions in 2009 until the broader changes in structure were initiated in 2013 and decided in 2015. This chapter thus looks into early implementation of the plan and the extent to which the plan delivered on what it was intended to accomplish and next, why the structure of the plan (prescribed actions and governance structure) was changed. The decision for change in structure of the plan is here discussed on the background of how the plan had functioned and alternative explanations. Chapter 5 next assesses functioning of the plan after its structural changes, whether this has improved accomplishment of what the plan was intended for. Chapter 6 sums up the analyses, main conclusions and prospects ahead for the reformed SET-Plan.
2. Analytical framework and methods

The main questions put up for analysis in this book are: Why and how did the SET-plan come into being, i.e. why was it established and why was it given its initial structure? 2) How did it function initially and what can explain the functioning? 3) Why was the SET-Plan structure changed? 4) How has the plan functioned after these changes in structure?, and finally, what are the prospects of the plan after the reform?

These questions concern aspects appearing at different stages of the SET-Plan timeline from initiation, decision, implementation, reform and new implementation. Important points on the SET-Plan timeline demarcating stages correspond with European Commission adoption of communications that first initiated the plan, next proposed the plan and finally proposed alterations to the design of the Plan. These communications were in turn discussed and decided by key decision-makers, the Council, European Council and the European Parliament, with input from stakeholders. We start by tracing the process that led to the 2006 Green paper on the Strategic Energy Review where the idea of a SET-Plan was launched (Commission 2006). The SET-Plan idea was elaborated in the January 2007 Communication ‘An Energy Policy for Europe’ that proposed a greater energy and climate policy package for the European Union with climate and energy targets for 2020 and beyond (Commission, 2007a). Following an impact assessment (Commission, 2007b), the SET-Plan was formally proposed with design features in the November 2007 Communication ‘A European Strategic Energy Technology Plan (SET-PLAN) Towards a low carbon future’ (Commission, 2007c). A major addendum to the SET-plan came in 2009 (Commission, 2009), with the proposal in the Communication ‘Investing in the Development of Low Carbon Technologies (SET-Plan), followed by new rounds of discussions in the Council and EP. Then in 2013, the Communication ‘Energy Technologies and Innovation’ set out a series of reform proposals for the SET-Plan (Commission, 2013), discussed by the Council and EP in 2014. Further elaboration of these changes came with the 2015 Communication ‘Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation’ (Commission, 2015).

Why was the SET-Plan established?

A first premise when analyzing this first basic question is that the establishment of the SET-Plan represented stronger EU-level integration in a policy field that had earlier been poorly integrated at this level: the EU member states decided to co-ordinate more extensively than before its energy technology R&I activities at the EU-level. This makes European Integration theory a relevant starting point for analyzing the question.

A second premise is the functional connection between integration in energy technology R&I activities and the wider simultaneous integration of also other climate and energy policies at the EU level in the form of the 2020 package aimed at restructuring energy systems towards renewable energy, promoting energy savings, and decarbonizing the EU economy (Skjærseth
et al. 2016). Hence, the decision to integrate in energy technology R&I policy could follow from the decision to pursue wider energy and climate policy integration.

Such functionalist explanations dominated early stages of European Integration theory development (Haas, 1958; Lindberg, 1963; Schmitter, 1970). Scholars postulated that EU integration in one field would spill over to integration in other related policy fields. Different spillover mechanisms would counteract the power of sceptic member-state governments to veto such integration. Societal actors benefiting from initial imperfect integration would demand extension of integration to realize higher gains (functional spillover), (Haas 1968). More international exchange between national actors (industries, interest groups, bureaucrats) because of initial integration would spur new transnational coalitions advocating extended problem-solving at the EU level (political spillover), (Haas 1968; Lindberg and Scheingold, 1970). Professionalization and leverage of EU institutions like the European Commission, due to initial integration would increase their leverage in extending the integration agenda (Haas, 1968; Schimmelfennig and Rittberger, 2006).

In reaction to these integration-optimistic scholars that viewed supranational institutions as capable of driving integration, the Intergovernmentalist position maintained that national governments would control the degree and speed of integration, rejecting the idea that states were overwhelmed by demands from interest groups. Integration would happen if this would preserve the national interest (Bache, George 2006: 13). The succeeding Liberal Intergovernmentalist position (LI)\(^1\), emphasized domestic rather than national interests. First, on the domestic level, various interest groups would compete in order to influence national preference formation in integration. Then, the outcomes of these struggles would go on to inform the positions taken by governments in interstate bargaining.

Today, the ‘supranationalist position’ is continued by the Multilevel Governance Approach, emphasizing that the is EU more than a tool for member-states (Marks and Hooghe, 1996). The sovereignty of European states will be limited by majority decision-making in the EU Council, by the growing competence of supranational institutions with interests of their own, and by states losing their grip on the mediation of domestic interest representation (Marks and Hooghe: 1996: 341; 2004:1). Domestic interests may by-pass national governments when seeking leverage and turn their allegiance directly to the EU-level, by lobbying EU institutions individually or collectively, through EU-wide transnational associations (Marks and Hooghe: 2004: 1). Supranational institutions would back EU integration to expand their own powers, including through strategic alliances with transnational stakeholder groups.\(^2\)

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\(^1\) This approach adapted Intergovernmentalism to the new European reality of extended integration in the 1990s.

\(^2\) The European Commission has as a mandate to promote integration, possesses administrative/knowledge resources and holds an exclusive right to propose legislation. Thus, it sets the framework for subsequent negotiations by drawing up policy-proposals, enabling it to influence policy output.
Based on the LI approach, we would expect the initiation of the SET-Plan to be rooted in the member states and that the policy idea was brought onto the EU level by national governments. The final establishment of the SET-Plan would reflect a political compromise in the Council of Ministers between constellations of member state governments with different interests tied to low-carbon technologies seeking to upload their policy preferences.

The MLG approach would open for an explanation where integration-eager European Commission held entrepreneurship over the idea of a SET-Plan, strategically seeking support from transnational stakeholders organized at the EU-level.

Process data patterns that would match the LI expectations is active involvement by national government in developing the idea of the SET-Plan and bring the idea onto the EU-level policy agenda, as well as active and strong support of the SET-Plan idea by a majority in the Council and European Council. Patterns that would match the MLG expectation are that the SET-Plan idea was developed within the Commission, with direct input from industrial networks, and national government taking a passive stance in the initiation stage.

Why was the SET-Plan given its initial structure?

Assessing the SET-plan structure

This question presupposes a first assessment of what was the SET-Plan structure. Glueck (1980:3) provides a general definition of strategic planning that may inform this assessment: ‘procedures formalized to determine in advance what actions and/or human and physical resources are required to reach goals set’. Accordingly, the structure of the SET-Plan would include what had been ‘determined in advance’ and formalized of: stated goals (what was the wanted end-point?), scope of actions (what should be done to reach the end-point?), procedures (who should do what at what time?) and identification of resource needs (how much would it cost of human and financial resources to reach the end-point?).

The SET-plan was proposed and established with a series of general and specific aims and objectives. As noted in the introduction, general aims for the SET-plan and the series of policies adopted in parallel were fighting climate change, improving the security of energy supply and the competitiveness of the EU in the global economy. The SET-plan, like these other policies, was further aimed for contributing to accomplish the target set for reducing EU emissions of greenhouse gases (GHGs) by 80-95% by 2050 and the interim energy and climate targets for 2020. An aim specific for the SET-Plan was ‘accelerating the development and market uptake of low-carbon technologies’ to assist achieving short- and long-term energy and climate targets. The main objectives adopted by the plan was to increase the level of funding for energy technology R&I and make better use of scarce human and

3The SET-Plan here formulated the objective to closing the gap between the sheer magnitude of the energy and climate change challenges and the current levels of research and innovation effort by encouraging
financial R&I resources through co-ordination that should lead to prioritizing development and commercialization of the most promising technologies (initially for a series of six pre-defined technology fields: wind power, electricity grids, CCS, solar power, biofuels, nuclear power and with one additional associated field organized differently before the SET-Plan, the Fuel Cells and Hydrogen Joint Undertaking).

Main actions (what should be done to reach the objectives) included setting up a collective and co-operative strategic planning system whereby the Member States, industry, and the research and financial communities would broadly commit to and participate in joint decision-making and implementation of the plan.4

An extensive list of procedures (who should do what at what time) were formulated to organize and spur collective decision-making among these actors that constituted what was termed the governance system of the SET-Plan.

To ensure commitment and engagement by the Member States, this governance system would include a Steering Group on Strategic Energy Technologies to convene regulatory, composed of high level government representatives from Member States and chaired by the Commission. The Steering Group would have the mandate to coordinate policies and programmes, make resources available, and monitor and review SET-Plan implementation progress. To support the Steering Group in building consensus around the SET-Plan programme priorities and monitor progress, a Commission-established information and knowledge management system (SETIS) was proposed developed by the Commission’s Joint Research Centre as part of the governance system.

To ensure effective implementation of technology development and market introduction efforts endorsed by the Steering Group, a series of governance mechanisms would spur commitment and engagement of R&I stakeholders in European industry and the research community. A first mechanism was called European Industrial Initiatives (EIIs) whereby European industrial actors would collectively develop technology roadmaps for the commercialization of selected technologies through setting-up large-scale demonstration projects within the timeframes defined by the plan in the technology areas given priority under the plan (initially six technology areas). A second mechanism was to create a European Energy Research Alliance (EERA) of national research institutes and universities with the mandate to move from project collaboration towards implementing joint coordination between different existing funding schemes and sources, and by mobilizing additional financial and human resources for research and related infrastructures, industrial-scale demonstration and market replication projects.

4 The SET-Plan communication also included spurring international cooperation on research and setting international standards as actions to stimulate the global development, commercialisation, deployment and access to low carbon technologies. Included here was cooperation on ‘public good’ and longer-term frontier research with other developed countries where competition is a key element, and building new market opportunities for EU industry in developing and emerging economies through helping these develop and grow in a more sustainable manner. .
programmes (JP) aligned with the SET-Plan priorities, and build durable partnerships also with industry.

**Explaining the initial structure of the SET-Plan**

Focus for explanation is actions and procedures included initially in the plan, specifically the initial selection of prioritized technology fields for development and the governance system set up to spur collective action in planning and implementation of R&I in these technology fields. A premise is here that the governance system prescribed comprehensive but only voluntary collective coordination as main procedure, with member state government opportunities for influencing the process to be ensured after intergovernmental deliberations in the Steering Committee.

European Integration theory would again be applicable as basis for explaining this initial structure of the SET-Plan, the LI and MLG approaches combined with a historical-institutionalist approach.

Starting with the initial selection of technology fields to be developed, the LI approach would expect this to reflect uploading of preferences by member state governments, deliberations in the Council and majority decision. Member state preferences for technologies would reflect aggregation of domestic interests. A premise is here that the member states would represent heterogenous domestic interests in energy technology, reflecting variation in incumbent technology solutions in the respective national energy systems (high-carbon vis low-carbon technologies), variation in strength and technology scope of energy technology manufacturing industries (that would benefit from national and EU technology support policies), and variation in climate policy ambitions, security of supply and international competitiveness concerns. The preferences for co-ordinating national energy technology R&I interests at the EU level could follow from member states having: proved positive to transfer competence to the EU level in climate and energy policy generally; high national ambitiousness in low-carbon energy transformation; strong national low-carbon innovation systems; and a strong role for the government in choosing technologies for further development.

The MLG approach would expect the selection of initial technology fields to reflect European Commission preferences, potentially shaped after direct input from national and EU-level networks of energy technology actors. The motives for such EU-level allegiance may differ. It may e.g reflect that industry saw opportunities for expanding total support of R&I to support their competitive conditions in the global market. On the other hand, active uploading of own technology preferences at the EU level may be a strategy to pre-empt uploading of competing technology preferences. A premise is that since EU-level energy and climate targets were adopted for 2020 as part of the SET-Plan, we could expect the European Commission preferences to be pushing selection of technology fields that were already at a sufficient level of maturity to assist achieving these short-term targets.
Process data patterns that would match the LI expectations are active involvement by national governments in uploading technology fields to the SET-Plan. We would expect the initial selection of technology fields to reflect preferences of the majority coalition in the Council and that the technology fields chosen did not necessarily belong to a cluster of substantially mature technologies. Patterns that would match the MLG expectation are that the SET-Plan idea was developed within the Commission, with member state governments being passive in their initial discussions on these matters in the Council. We would expect initial technology fields to belong to the cluster of most mature technologies.

Concerning the initial governance structure established for the SET-Plan, we could interpret the Steering Committee structure as reflecting Member State government preferences for control over the SET-Plan process. However, the European Commission has been secured many different roles in the governance structures, including leadership of the Steering Committee, participation in the EIIs, etc. that could be interpreted as strategic measures for influencing SET-Plan work. The LI perspective would expect member state governments and the Council to have had an active role in forming the SET-Plan governance structure. If this structure was drafted by the Commission without much debate in the Council, this would support an MLG explanation.

As a complementary explanation to the MLG approach, Pierson (1994) stresses the need to study European integration as a political process which unfolds over time. Such a perspective highlights the limits of member-state control over long-term institutional development, due to preoccupation with short term concerns, the ubiquity of unintended consequences, and processes that "lock in" past decisions and make reassertions of member-state control difficult. This historical institutionalist approach would explain the initial structures of the SET-Plan in light of past structures evolving at the EU level.

This might be a relevant perspective since energy R&D funding has been part of EU policy since the adoption of the Coal and Steel and Euratom Treaties in the 1950s. In the 1980s, broader EU energy research programmes also supported research in energy efficiency and renewable energy through the EU Framework Programmes FP1-FP6 (1984-2006). Institutionalisation of actors took place at the EU-level, including the establishment of the Joint Research Centre and various EU-level energy industry associations working to increase the support of their technology solutions. In the year 2000, the EU adopted the European Research Area (ERA) as part of the Lisbon Agenda that established European Technology Platforms - industry-led stakeholder fora to give advice on the priority of the R&I agenda. The governance structure of the SET-Plan could accordingly be interpreted based on the major governance reforms in the EU in the early 2000s where the new Open Method of Coordination was introduced.5

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5 The emergence of the OMC generally reflected member state concerns with EU institutions extending their competence and powers in areas where the subsidiarity principle was meant to apply (Armstrong et al., 2008; Commission, 2001). The OMC shifted the roles of member state governments and EU institutions in policy
How did the SET-Plan function initially and what can explain the functioning?

To answer these questions we must first develop a template for assessing SET-Plan functioning (what was intended to be accomplished), then assess SET-Plan accomplishments according to this template, and next explain degree of correspondence between intensions and accomplishments.

Assessing the functioning on the SET-Plan

The assessment must be based on the structure of the plan, what it formally ‘determined’ in advance on who should do what at what time to reach the end-point?

The classical ‘goal-attainment’ approach in the policy assessment literature combines some measurement of ‘goal achievement’ with an ‘impact assessment’ that deals with whether observed changes are in fact the result of the assessed policy (Vedung, 1999). Applying this model, however, presupposes that clear goals were formulated for the policy to be assessed and that it is possible to isolate impacts from the policy from that of other factors.

We here noted the SET-Plan overarching strategic goal of contributing to achieving quantitative energy and climate targets set for 2020 and beyond. Progress on such target achievement has regularly been assessed by the Commission. However, given the wide range of 2020-policies adopted in parallel at the EU and member state levels, any meaningful assessment of the specific impact from the SET-plan would be nearly impossible. Similarly, the parallel strategic goal of maintaining international competitiveness for European energy technologies could be measured by various indicators (patents, market shares, etc.) but again, isolating the effects of the SET-Plan is difficult. Likewise, the objective of the SET-Plan to contribute to ‘accelerating the development and market uptake of low-carbon technologies in Europe’ can be measured through indicators such as patents and market shares for low-carbon technologies, but isolating the SET-Plan as the main impacting cause for any accelerated development of low-carbon technologies would be methodologically difficult. Parallel to SET-Plan policies, the member states pursued their own energy R&I policies that collectively were far greater in scale and scope.
Hence, this book give primary attention to other structures in the SET-Plan as basis for assessing how it initially functioned, the series of actions prescribed.

- For one thing, the SET-Plan prescribed extensive collective action with participation (engagement and commitment) from the range of R&I agents in Europe: to co-decide on technologies for priority development because of their potential to deliver on the strategic targets, co-ordinate activities and executing the priorities by setting up and funding technology programmes and large-scale demonstration projects. This reflected a recognition that R&I resources, even with higher levels of funding, would still be scarce and should be amassed to avoid fragmentation and duplication and create the ‘critical mass’ necessary to ensure commercialization within the target dates.

- More specifically, the proposal first prescribed the Steering Group of member state government representatives to participate with high-level representatives that could commit national governments to finally decide on what technology trajectories to give priority for EU-level development, contribute funding to these and otherwise promote joint technology initiatives between groups of EU countries and the EU.

- Secondly, it prescribed the Joint Research Centre of the Commission to develop an effective information system to monitor technology development activities in the EU, member states and globally. Without effective information about energy technology R&I activities and capabilities in the member states, rational planning of how to create value added by EU action would be restricted. The SET-Plan here prescribed transparent and effective flow of information from the various R&I actors in Europe to the EU-level that would build up the Strategic Energy Technology Plan Information System (SETIS).

- Thirdly, the proposal prescribed European industries to take leadership in networks and participate in planning and implementation of so-called European Industrial Initiatives (EIIs) that should lead to the establishment of large-scale demonstration projects.

- Fourthly, it prescribed National Research Institutions to participate in networks to establish joint research programmes within the SET-Plan priorities and link up with industrial stakeholders to bring research into real innovation.

- Fifthly, the proposal prescribed member states and industries to increase levels of funding for low-carbon energy technology development in the European Union, both at the national and EU-levels.

- And finally, the proposal prescribed R&I actors to increase co-operation with and establish new international innovation networks outside the SET-Plan area to co-develop R&I capacities in other countries and create new market opportunities for European-developed technology.

This book will assess SET-Plan functioning based on whether the prescribed actions (broad participation in co-ordinated planning and funding of selected technology areas based on
well-functioning sharing and monitoring of information) is observed in the implementation period. To what extent have European industrial agents participated in joint planning and funding of large-scale demonstration projects? To what extent have national research institutions (research councils and universities) participated in co-ordinated planning and funding in joint energy technology programmes? To what extent have R&I agents contributed to transparency in information about own activities to build an effective SETIS? To what extent have member state governments in the Steering Group participated and taken leadership in realizing an EU energy technology policy?

Preliminary assessment of SET-Plan functioning (work in progress)

Patterns in observed outcome indicate progress in functioning but also initial problems:

- Total level of energy R&I funding in Europe increased but far from sufficient to accomplish the research tasks identified during the first period of detailed planning.
- The EIIs have produced comprehensive planning documents, detailing research needs, timelines and resource needs.
- The EIIs have failed to match their plans with funding, and the objective of establishing large-scale demonstration projects have largely failed. The SET-Plan (and what they produced of priorities) had limited influence over actual research programmes (like FP7) that continued to fund many small projects for a large range of technologies.
- There are major variation between the EIIs in results, i.e. how much funding have been matched with the priorities identified in the planning process.
- Many Joint Programmes were established under the EERA but many of these were initially virtual (sharing information) rather than REAL co-ordination of R&I activities based on co-funded programs.
- As to participation patterns in the collective planning process, there are indicators of unstable participation (shifts over time in who meet up), participation only by low level staff, but that more stable participation patterns may have evolved.

Explaining policy functioning (will be further developed)

Focus for explanation is observed functioning based on the assessment (that is not finalized). A major focus will be explanation of variation in functioning (deviation according to the plan) across technology fields.

Point of departure is that these problems can be explained by characteristics of the SET-Plan governance system that was established to spur voluntary collective action among actors at different levels and the extent to which this governance system was implemented and functioned differently to spur collective action across the technology fields.\(^6\) Contextual

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\(^6\) In its 2007 Impact Assessment (Commission, 2007) the Commission put up both positive (strengths) and negative expectations (weaknesses) of the chosen governance model. Important dimensions were whether the
factors may vary for the technology fields and thus affect the functioning of the governance system differently.

The explanatory framework will be based in collective action theory which identifies dilemmas where individual rationality of interdependent actors may lead to collectively irrational outcomes (Olson 1968; Chamberlin 1974; Axelrod 1980, Howard 1988). Typical is that actors may share the overarching goals for collective action but fail to cooperate because of pursuit of individual interests. Identified solutions to collective action problems are first, that there is a third party with power to change the sub-optimal outcome of the strategic constellation between actors. Second, that there is a social structure allowing for and stimulating repeated interactions between the same actors, thus stabilizing expectations about each other, and even developing social resources such as trustworthiness and credibility (Axelrod 1984, 1997). These social resources pertain to the reciprocity which was expected to be promoted in the EU as a stable institution organizing actors’ interactions.

Under the circumstances of reciprocity, conflict potential is likely to be reduced and the chances for cooperation increase. In this perspective, the EU is an example of a complex international organization which not only links different policy fields but may also generate social norms and knowledge, thus giving rise to a social order (Gehring 2002). Even though governance model would provide for leadership in energy technology development, implementation aspects and resource mobilization aspects.

On the positive side, the Commission predicted that as a first-of-a-kind initiative putting innovation on energy technologies at the heart of the European energy policy agenda, the Steering Group would follow up with coherent and stable leadership, thus increasing the ability to adopted critical programmes of prioritized technology development projects. On the negative side, the Commission predicted that compromises that had to be made could prevent agreement of areas of common interest and action and resources.

Concerning implementation, the Commission proposed the ‘sharing-in-doing’ implementation approach to create engagement and commitment of resources at the Action level, and allow for the quick adjustment of resources and priorities to the evolving needs without having to amend a budget allocation. On the negative side, the Commission pointed to the danger of possible discrepancies emerging between the overall strategy and the long term commitment of the stakeholders to carry out the action plan since funding is decided and committed at the action level. It also predicted that there might be difficulties to agree on the timely contribution of existing programmes to new joint Actions at the European level.

Finally, concerning resources, the Commission predicted that the governance system could facilitate additional private investment and industrial involvement across the overall portfolio of energy technologies and that broader allocation of resources would be expected from multiple sources –Community, National, Industrial etc. – because of a coherent European Framework and Action Plan. On the negative side, the Commission pointed to that the long term availability of funding needed to carry out a multi annual strategy was not guaranteed by the commitment of funding at the Action level. It also predicted that difficulties could emerge for the long term viability of individual actions since the contribution of the different supporting programmes would be on a volunteer basis, although the empowerment of the governance could reduce this risk. Also, a non-unified source of funding could result in conflict of interest between funding parties at the expense of a common EU dimension, and a possible lack of funding for actions with long lead times might come from the reluctance of industry to contribute. Summed up, the Commission expected that ‘variable geometry’ could emerge between technology fields at the Action level because of differences in conflict of interests, commitment and engagement within each technology coalition (Commission, 2007). Given the various groups of R&I agents entitled roles in SET-Plan implementation, such ‘variable geometry’ could reflect deliberations between member state governments and uploading of national vested interests (Liberal Intergovernmentalism), the influence of the European Commission in the process (Supranationalism) or the abilities of industrial stakeholders and research institutions to coordinate their efforts and strike compromises.
interests of the politics actors are still the major motivation for political action, they may become modulated by norms of appropriate behaviour. Both social norms and reciprocity can ‘thicken’ into collective identity, increasing the chances of cooperation even further. The socialization is expected to modify actors’ preference formation from idiosyncratic to more collective-orientated (Kaina, 2009).

This framework may explain functioning of the SET-plan. It predicts that cooperative solutions may be found if there is a strong third party, if there is stable recurrent interaction between participants and reciprocity. We investigate the role of the Commission as third party in the process and how patterns of interaction has proceeded within different parts of the SET-Plan governance system and how actors perceive reciprocity conditions.

**Why was the initial structure of the SET-Plan changed (to be developed)?**

Observations to be explained (to be further specified):

- Changes in 2009 concerning co-ordination of funding sources for SET-Plan development
- Changes in technology fields given priority for development under the SET-Plan: addition of a new technology field in 2011 (Smart Cities Initiative)
- New Restructuring of technology fields by the reform in 2013
- Changes in the governance system by the reform in 2013

Explanatory approaches

Past policy experience: Assess the changes in light of how the SET-Plan had functioned so far?

Add with information about who demanded changes and were generators of change (member state governments, EU institutions, R&I stakeholder networks) to interpret the changes from the LI and MLG perspectives.

**How has the SET-Plan functioned after the reform (to be developed)?**

Better linking of SET-Plan governance and funding?: Horizon 2020, NER300, EIB, European Fund for Strategic Investments

**Assessing prospects for the SET-Plan**

To be developed. SET-Plan now a pillar in the Energy Union Strategy towards 2030.
Methods and data (very preliminary)

A combined set of data will be applied for measuring behavioral changes. Data on whether various actors have contributed to higher levels of funding of SET-Plan priority technologies can here be found in R&I statistics collected by the IEA and the European Commission. The European Commission and the Joint Research Centre have on a regular basis published SET-Plan implementation progress reports that includes a series of indicators concerning EII and EERA functioning, like participation in networks, realisation of joint programmes, . A series of interviews conducted in 2016 with EU Commission and JRC staff, national contact points in the Steering Group, representatives from the EERA Secretariat and participants in various European Industrial Initiatives have provided additional information on the functioning of various parts of the SET-plan.

References (to be completed)


