MILESECURE-2050

Multidimensional Impact of the Low-carbon European Strategy on Energy Security, and Socio-Economic Dimension up to 2050 Perspective

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4.1 Final publishable summary report

This section must be of suitable quality to enable direct publication by the Commission and should preferably not exceed 40 pages. This report should address a wide audience, including the general public.

SECTION 1: An executive summary (not exceeding 1 page).

The EU FP7 MILESECURE-2050 – *Multidimensional Impact of the Low-carbon European Strategy on Energy Security, and socio-economic dimension up to 2050 perspective* – is a 3 years collaborative and multi-disciplinary project seeking to identify the modes through which energy security is defined at the European, national and local scales, focusing on energy transition towards a low carbon society. It aims to provide new scientific knowledge on the general objective of regional, territorial, and social cohesion by developing new European models, which support and enable energy security at the European, national, and local scales. More specifically, the project aims to understand and overcome the political, economic, and behavioral traits and trends that led Europe to its difficulties in reducing fossil fuel consumption, and in diversifying its energy balance at rates which guarantee European energy security at the horizon 2050, reduce the threat of climate change, and diminish the risk of an energy gap in the coming decades. The 2050 timeframe is used to assess the legitimacy and efficacy of policies in terms of capacity for societies to transition to energy security, and to consider the long-term, socio-economic impact of such options. The project has been devised in order to produce broad reaching and long lasting impacts in line with the objectives of the European Commission, namely: i) advance the knowledge base that underpins the formulation and implementation of relevant policies supporting inclusive and sustainable growth and societies in Europe or, whenever relevant, outside Europe; ii) achieve a critical mass of resources and involve relevant communities, stakeholders, and practitioners in the research with a view to assessing the potential for sustainable practices, values, policies and behaviours in Europe; and contributing to the development of the intellectual foundations of new European social models that encourage the combination of economic, social and environmental objectives under the Europe Energy Strategy.

In order to produce the above impacts, the MILESECURE-2050 approach has conducted the following activities (WP): 1. analysis of trends, policies and existing scenarios from national to worldwide levels on energy security and energy transition; 2. evaluation of concrete anticipatory experiences of energy transition at the local level; 3. identification of both the options and factors influencing energy transition processes, including its societal dimension; 4. development and testing of multidimensional models of interrelations between energy transition and social/individual behaviours; 5. elaboration of a consistent framework for improving the governance of energy transition processes. Finally, a relevant role was placed to dissemination activities and awareness raising among policy makers and other stakeholders about processes of Post-Carbon transition, their potential and problems, especially for what concerns Energy Security. This is part of the activities produced in the WP 6 with the aim to ensure effective communication and dissemination of the results being obtained through the project.

The MILESECURE-2050 Consortium is formed by 4 High Education Institutes, 4 Research centers and 3 SMEs, combining the following strengths: 1. Excellent technological competence in the socio-economical issues and energy sectors, geo-political science. 2. Deep knowledge of the current research on SD and policy trends in Europe and internationally. 3. Strong links with the institutional, scientific and business communities in Europe and developing countries.

SECTION 2: A summary description of project context and objectives (not exceeding 4 pages)

Energy issues have been at the heart of the European agenda since its inception, and the progressive consolidation of sustainability and security of supply as the main complementary pillars of the EU energy strategy have allowed for Europe's energy system to become incrementally lower-carbon, more competitive, and more secure. However, while the EU has been successful in institutionalising a climate policy, the formulation of a fully effective energy security policy remains a more complex issue. This is mostly due to the differences that characterize the various national agendas. Whereas there is a clear, urgent need to agree upon shared objectives at the EU level, as well as to persuade the EU Member States to 'speak with one voice', this need is not always translated into practical results and current European energy policy continues to be strongly influenced by the heterogeneity of national approaches, portraying it as one of the least successful areas of integration, despite its importance for the everyday life of EU population and in moving towards a shared sustainable future. Moreover, the potential synergies and trade-offs between climate change and energy security are scarcely addressed in academic literature and when they are considered, it is more of a direct consequence of the agenda of international negotiations over the last fifteen years on climate emission reduction targets than of the result of initiatives promoted by the EU. The situation is acknowledged by the European Commission through the recent EU Green Paper on a 2030 framework for EU climate change and energy policies, which states that "the 2030 framework must identify how best to maximise synergies and deal with trade-offs between the objectives of competitiveness, security of energy supply and sustainability" (COM(2013) 169). In this light, European policy-makers are constantly challenged with the need to achieve energy security while promoting a transition that radically decarbonises energy use without undermining the well-being of its citizens. However, this complex goal requires taking a considerable number of factors into account, covering almost the entire range of human experiences, from political practices to the most intimate aspects of the lives of communities and individuals.

The MILESECURE-2050 research project was built on the above issues to generate new scientific knowledge that can lead towards a low-carbon and secure EU energy system. In particular, the main objectives of the project were:

The MILESECURE-2050 project pursued the following objectives:

1. Analysis of policies, trends and existing scenarios from the national to the worldwide level upon energy security and energy transition;
2. Evaluation of concrete anticipatory experiences on energy transition at the local level;
3. Identification of both the options and factors influencing the energy transition processes and its societal effects;
4. Development and testing of multidimensional models of interrelations between energy transition processes factors and social/individual consumers behaviours;
5. Elaboration of a scheme for improving the governance of energy transition processes;
6. Development of a European policy guidelines and recommendations;
7. Raising awareness, promotion and dissemination of results and findings.

The MILESECURE-2050 purpose was to understand and overcome the political, economic and behavioural traits and trends that led Europe to its difficulties in reducing fossil fuel consumption, and in diversifying its energy balance at a rate which would guarantee energy security, reduce the threat of climate change, and diminish the risk of an energy gap in the coming decades. This purpose was pursued through a thorough exploration of the different dimensions of energy transition and energy security, and of how the latter are defined and may be addressed at different scales, from the global to the regional and local ones. To do so, the project reviewed and combined different understandings of energy security to produce quantitative and qualitative results that address geopolitical tensions, economic factors, social cohesion, technological options and environmental issues.

In the rationale of the project, energy security was seen as a final output of the energy transition towards a low-carbon society. This transition has been considered as a process that is influenced by the interaction of multiple intended and unintended elements. This is partly attributable to individual attitude, in particular by the complex range of factors that influence the ways consumers operate in the current market. On the one hand, individuals are influenced by emotions, habits, the behaviour of those around them, as well as by structural factors such as transport infrastructure. Societies, on the other hand, are

influenced by technological, political, economic, environmental, lifestyle, and cultural factors as well as the interrelation between them and the sum of individuals that compose them. To disentangle this complexity, the research integrated different perspectives in approaching societal energy transitions:

- A technological perspective which characterizes energy transition as a process of technology development, innovation and transfer, centred on the enhancement of sustainable energy technologies within a particular national or local context;
- A political perspective focused on the political processes involved in energy transition, including dynamics such as decision-making, adoption of political standards, fund raising and management, power relations between political and administrative levels;
- A geopolitical perspective which took into account the relationships between the EU and other world macro-regions, exploring existing and emerging spatial and scalar alliances and dependencies;
- A economic perspective which allowed the study of the economic factors which influence societal transition, such as optimal level of prices, taxes, subsidies, resources availability and efficiency, external costs and market stability, but also the level of life satisfaction and of European citizens wellbeing;
- A environmental perspective put forward the environmental factors that influence energy transitions, including how a society perceives the environmental impacts of energy use and a low-carbon strategy;
- A lifestyle and cultural perspective focused on lifestyle and culture influences on energy transitions (e.g. social norms, societal priorities, customs, cultural needs, etc.).

Overall, the project applied behavioural and social sciences to investigate the challenges that may prevent societies from achieving an energy secure, low-carbon transition, and to suggest how future policies can be adjusted or fine-tuned to effectively tackle these challenges. The adopted approach aimed at explaining the underlying context of how attitudes, practices and behaviours have developed, and how shifts to alternative scenarios might permit the fundamental shifts in future attitudes, practices and behaviours necessary to achieve energy security and low-carbon societies. Complementarily, MILESECURE-2050 adopted a more holistic approach to societal change that covers the interactions and synergies occurring between these societal processes. The project explored the potentials and barriers for a more sustainable and secure consumer behaviour towards energy consumption using the comprehensive approach and the analytical steps described above. In turn, this produced relevant evidence on which to build a preliminary set of suggestions and recommendations for the formulation of new policies.

The factors influencing societal energy transition have been used to further develop existing models, SMET and IMACLIM-R, which were utilized to perform numerical experiments based on a set of alternative scenarios. Three alternative scenarios have been considered: a reference scenario (NER), a Centralized energy transition (CENT) and a Social Energy Transition (SET) scenario. These scenarios explored potential approaches to future energy transition to provide a better understanding of their implications for energy security aspects as well as of their costs.

Different modes of governance were analysed in relation to their potential to promote energy transitions. In particular, the research underlines the ways in which human beings can generate and mobilize energy, many of which are not included in technological and economic discourses. There is a need to further broaden the scope of the human factor within social and political perspectives, to consider broader issues of legitimacy and acceptance of policy that may release or constrain the potential of human energy.

Although at a European level, it has generally been recognized that citizens, communities and societal organizations are to be mobilized towards behavioural change, collected evidences showed that the ways in which such change of behaviour is to take place remains a largely disputed issue. The research showed that behaviour can only be changed if the larger context of the behaviour is understood and addressed. This requires people's empowerment through knowledge, their stimulation to recognize problems as their own, all this within institutional contexts ready to welcome local initiative. To do so, the array of knowledge to be mobilized should be much broader than at present, to match the high complexity and heterogeneity of energy transition. First, the array needs to incorporate the knowledge of citizens, which is highly complementary to formalized knowledge currently available in institutions. This knowledge is indispensable if part of the change is to take place in the households, local organizations and communities in which those citizens live. At the same time, formalized knowledge should be used not only to inform

policy-making but, most importantly, as thought-provoking material upon which debate can be conducted, behaviours shaped and human potentials activated. The more that perspectives upon a problem are mobilized, the larger the creative pool from which solutions can be tapped.

The main findings of the MILESECURE-2050 research regarding governance issues constituted the foundations of the "Secure and low-carbon energy is citizens' energy", a manifesto for human-based governance of secure and low-carbon energy transitions. This manifesto targets a broad range of actors, offering guidance towards a more thorough inclusion of people as citizens into the processes of governance of energy transitions and calling for actions that serve low-carbon and secure energy development through top-down and bottom-up approaches, and through visionary grand narratives as well as local initiatives. The 10 Diagnoses and respective Remedies introduced by the manifesto argue that, whether at the local or at central government level, people should be cherished for their knowledge and creativity, and recognized as the reason why energy transitions matter in the first place. In other words, they show how governance strategies should be aimed at keeping both political debate and policy making receptive to the broadest possible range of perspectives.

By arguing this, the project also recognized that the role of citizens and communities have been inadequately understood, especially by policy-makers. People have been insufficiently enrolled, engaged and mobilized as a resource for innovation and change in low-carbon and secure energy transition. In civil society, governance strategies should be aimed at acquiring insight in how citizens, communities and societal groups define the problems and challenges of energy transitions. At the same time, top-down approaches need to continue to play a crucial role, by building social and technical infrastructures in such a way that small-scale experiments with alternative configurations for low-carbon and secure energy are enabled rather than closed off.

Both top-down and bottom-up strategies should be considered complementary to each other. Top-down interventions must be geared towards enabling local initiatives and towards empowering communities, and bottom-up initiatives might appeal to central governments so as to improve central regulations.

Building on the above issues, a preliminary set of guidelines and recommendations has been identified. These aim at triggering the potentials of the human factor towards the enforcement of a societal transition as derived from the SET scenario, which demonstrates that mobilizing human factors into innovative local initiatives and changes in lifestyles are necessary to achieve a low carbon transition.

The MILESECURE-2050 guidelines and recommendations have been classified as: extra-European, intra-European and local, considering that different territorial level of policy and regulations implies different approaches. The first level addresses EU decision and policy-makers actions within the broader world context. The second one aims at inspiring policymakers when they deal with EU internal energy issues as a supra-national organization composed of 28 Member States. The third one focuses on the local dimension, inspiring effective EU policies to maximise and activate the human factor. Finally, the MILESECURE-2050 recommendations support the capacity building section included in the recent UN-COP21 agreement, that invites the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement at its first session to explore ways of enhancing the implementation of training, public awareness, public participation and public access to information so as to enhance actions under the Agreement (CP.21 – 12 December 2015, adoption 84).

SECTION 3: A description of the main S&T results/foregrounds (not exceeding 25 pages), -

WP1 - Analysis of energy security policies, trends, and existing scenarios from the national to global level

Researchers identified a theoretical framework designed to study the different societal dimensions characterizing energy transition towards a post-carbon society and energy security. The objectives of the WP1 were, in fact, to:

- Provide a key-grid of policies, trends and scenarios concerning energy security and low carbon transition that Europe is experiencing and is likely to experience;
- Assess the geographical differentiation among member states in pursuing European policies and objectives towards a low carbon society;
- Explore different geopolitical scenarios and spatial tensions originated by the investments in new technologies, infrastructures and politico-economic alliances.

In light of objectives and framework, the historical evolution of energy policies at the global and EU scales as well as the international debates concerning energy security was explored. The current situation of EU energy security and low carbon transition strategies can be summarized by: *dependency, consumption, integration.* EU is *depending* from imports for the vast majority of its energy needs but it seems to be moving away from fossil fuels. *Consumption* seems to exacerbate the dependency of the EU and it calls for a closer look at lifestyles, societal organization in the energy field, different patterns according to local environmental and cultural conditions. *Integration* is required in order to harmonize policies at different levels, from the local to the EU and beyond. Finally, the macro-regional energy scenarios were reviewed on the basis of the expertise in modeling exercise. Different geopolitical scenarios and macro-regional conflicts were assessed in relation with energy costs and supply.

In specific, in Task 1.1 “Definition of the methodological approaches in multidimensional analysis of energy policies and scenarios” (M1-M6), Deliverable 1.1 “Report on key methodological approaches in multidimensional analysis” provided a comprehensive conceptual review of the various related concepts safety, security, resilience, risk, vulnerability and a solid common grounding in terms of methodology and conceptual framework that was implemented in the MILESECURE-2050 project. It provides a link between energy savings and energy security while, at the same time, providing a conceptual and analytical separation between economic and behavioral aspects of the energy analysis. The last part of the report provide a description on the evolution of policies since the origins of the European Union and a related review of the on-going international debate, thus linking the systemic perspective on energy security to the different phases of policy-making and scientific debate.

In Task 1.2 “Exploration of macro-regional future energy scenarios for different world macro-regions” (M5-M9), Deliverable 1.2 “Report on global and macro regional key trends and scenarios” presented a critical review of prominent long term modeling exercises using integrated modeling assessment conducted since the fourth IPCC Assessment Reports published in 2007. It showed that the complexity of social dynamics and transition patterns towards a low carbon society were not fully addressed by Integrated Assessment models. The Report provided also new perspectives to assess the interdependencies between climate policies, the complexity of transition patterns and energy security issues, thanks to an innovative modeling framework, which has been developed in WP4.

Task 1.3 “Analysis of main trends in European energy policy and of European geographies of energy security, technology and economics” (M5-M12), focused on Deliverable 1.3 “Report on main trends in European energy policies”. Main trends in European energy policies, European uneven geographies of energy security and energy economics were at the center of attention, with a review of European policies and strategies for a low carbon society and their implications on environmental and energy policies, and on national and continental performances. It also included a geographical analysis of current energy situations and trends at the EU level and then with specific focus on three national case studies (Germany, Italy, Poland). The definition of a EU framework of energy strategies and policies, furthermore, has

served as a basis for Deliverable 1.4 on macro-regional geopolitics of energy security, taking into account potential tensions that involve Europe in the global scenario.

Task 1.4 "Definition of macro-regional scenarios of energy security" (M11-M16), finally, has produced the Deliverable 1.4 "Report on the macro-regional geopolitics of energy security", that has focused on the macro-regional geopolitics of energy security and on the largest mega-projects in the renewable energy field. It encompassed potential geopolitical tensions concerning energy in a global scenario, with particular attention to relevant topics, such as the availability of stable and sustainable energy sources, the global competition for energy sources, the main trends towards the exhaustion of fossil fuels. All these elements are today crucial in global geopolitics, and many scholars have suggested that we are entering in a 'new' energy world order, in which a county's energy surplus (or deficit) strongly contributes to determine national position in the global world-system.
In conclusion, the main results of WP1 are listed below:

- It provided a comprehensive conceptual review of various energy security approaches and methodologies for the analysis of energy systems (Deliverable 1.1). This has been done by a) summarizing the international debate about energy security and energy transition, in order to reach a general definition of energy security; b) presenting a focus about the historical evolution of energy policies at the European level;
- It provided a critical assessment of long term macro-regional scenarios, particularly by focusing on the synergies and trade-offs between environmental, economic and social issues involved in phenomena related to climate change and energy security (Deliverable 1.2);
- It provided an analysis of the implications and consequences of the potential transformations of energy systems in the framework of the energy security question. The analysis also underlined some methodological perspectives and requirements for modelling at a global and regional level the synergies and trade-offs between climate policies and energy security issues (D 1.2);
- It provided a comparison of data, interpretations and comments presented by various international organizations (such as Intergovernmental Panel on Climate Change IPCC, United Nations, Eurostat, International Energy Agency IEA, Energy Information Administration EIA, etc.) in order to identify the position of the European Union in relation to the energy question and to global change (Deliverable 1.3);
- It developed a survey of the more significant strategies and policies for the environment and for energy security at the European level (Deliverable 1.3);
- It provided an analytic framework for comparing national case studies, particularly by mobilising energy and climate indicators and strategies proposed in Europe 2020 and EU SDS (Sustainable Development Strategy). The analytic framework has been implemented for the analysis of the case studies of Germany, Poland and Italy, focusing on CO2 emission targets, renewable energy targets and energy efficiency targets (Deliverable 1.3);
- It provided qualitative maps and synthetic geographical representations of key phenomena involved in EU energy security. The maps highlights strategic development zones, key corridors and functional-energetic macro-regions from the perspective of the EU energy security (Deliverable 1.4);
- It proposed an evaluation of two mega-projects: Desertech and North Sea Offshore Grid. The analysis of the two mega-projects allowed the development of some general considerations about the alternative and complex ways in which systems may be optimised, for example in terms of local supply, resilient mix, lowest-cost option, or environmental concerns (Deliverable 1.4);
- It developed a detailed statistical analysis (years 2005-2012) of the emissions of greenhouse gasses in Europe at the national level, distinguishing between direct emissions from the burning of fossil fuels plus industrial production within the boundaries of each country (territorial-based production emissions) and the emissions associated with the consumption of goods and services (consumption-based emissions) (Deliverable 1.4);
- It provided a systemic approach to the analysis of energy security and climate change policies, in order to develop an effective methodology for assessing trade-offs and synergies while accounting for the multiple technologies, processes, fuels, policies and actors that make up the global energy system (Deliverable 1.4).

The research managed to integrate the contributions coming from the different expertise composing the Consortium, taking under the same umbrella geographic and geopolitical approaches (POLITO), technical knowledge (ECOLOGIC, ENEA, EnergSys, IEn), modelling analysis (SMASH), sociological approaches (LSC), web data analysis (PLUS).

WP2 - Analysis of concrete anticipatory experiences with energy transition at the local level

The main results of WP2 are listed below.

i) **The study of anticipatory experiences of the low-carbon society**

For the first time a large set composed of 90 anticipatory experiences of energy transition from 19 European countries were singled out and studied during the research. The 90 anticipatory experiences have been assessed according to a set of criteria such as type of actions, anticipatory awareness, visibility, types of energy involved, sources of funding, and replicability. It has also sought to identify the determinants of success of such anticipatory experiences, in terms of both effectiveness and impact.

This large number of anticipatory experience gave us the possibility of study energy transition on the basis of empirical data and not on mere hypothesis. In this context results of the WP2 may be very useful in the next phases of the project, especially in the scenario building exercise, and in the policy guideline drafting.

ii) A portrait of energy transition process

A portrait of energy transition process was drafted. The main findings are, on one hand, (a) the change of energy systems is inevitably accompanied, and at the same time is made possible only, by a deep social change; (b) this deep social change is linked to the emergence of new risks and threats to energy security.

(a) The depth of change and the discontinuity in the management of energy systems, as observed in the anticipatory experiences, are characterized by the following traits.

- Anticipatory awareness. Rather than attempting to follow only ethical or moral imperatives, AEs' promoters are compelled by an awareness that dangers of different types at local or global levels can represent future setbacks for their communities.

- Critical attitudes to contemporary society. AEs are characterized by their critique of both the way contemporary society is managed and organized, and the management of traditional energy systems within it. They tend to express a general criticism of the way power is exercised as top-down in character and reserved for the privileged few. They see authority as being oriented toward high resource consumption, against nature, and failing those who are community oriented.

- Adoption of innovative approaches. AEs are and see themselves as highly innovative experiences which break with the past, developing the capacity to bring together professional backgrounds of different types; a strong tendency to adopt a holistic approach that enables them to act on a wide range of aspects of social, economic, technological and cultural life.

- The construction of new social configurations. Perhaps because of its innovative character, energy transition seeks to reconfigure social space and to develop shared meanings for the different communities involved. With the emergence of new leaders, the activation of symbols and myths related to energy transition, and a passionate participation of citizens in the process of change are pushing for a general synchronization of all actors toward the objectives of the energy transition.

(b) The pressure of deep changes, the transition to a low carbon society and the effort required to adapt to

new ways of living generated instances of **socio-cultural stress** which represent new risks and threats to the energy transition. Some of these stresses included:

- Social conflicts. The different actors involved in AEs tend to defend their own interests, acquired positions, professional routines and their own spaces from the changes that occur in the transition process. There is evidence of conflict between the promoters of AEs and, for example, constructors, professionals and technical staff of the municipalities, public administrations, commercial enterprises and even environmental groups.

- Dissonance with the surrounding reality. Bias or skepticism towards energy transition can create hostility within communities towards stereotypes (sometimes considered radicals or hippies) and against some of the technologies used (such as the aesthetic impact of wind turbines). Dissonance is also expressed in the inadequacy of regulatory frameworks for advanced technologies and the risk of experimenting with new solutions at the local level.

- Tensions due to personal resistance to change. This can arise from people's reluctance to adapt to new solutions offered by AEs. Not all citizens are inclined to adopt more sustainable lifestyles, to invest their savings (or even to apply for funding) or to take up the measures for energy efficiency. This can occur because of a fear of new technological solutions, or a worry that they will provide lower levels of comfort.

- Conflicts within the promoter group. Those promoting innovative projects and profound change, such as those introduced by AEs, are themselves subject to significant forms of stress. Conflicts arise from factors such as the acquisition, use and maintenance over time of financial resources; the management of relationships (including intergenerational relationships) and the acquisition of decision-making powers or governance status.

iii) The development of Human Energy Approach

- A new holistic and comprehensive conception of energy system in transition was delivered. Human Energy approach provided an effective framework for studying human factor in energy transition overcoming the dichotomy between technological and human aspects.

- One of the most important results of this research is making explicit and visible the latent role that the human factor exerts in energy systems in transition. Studying the AEs is clear that, for the analysis of energy systems in transition, it is crucial to adopt a broader concept that does not just include technological aspects but also social and personal dynamics. Human Energy is a holistic and all inclusive understanding, articulated in three dimensions that show different ways in which the human factor lies behind the energy system:

a) Social energy is the human capacity to bring together different forms of social activism that coordinate, and orient different social actors toward common goals and to overcome conflicts and oppositions that may represent a waste of energy;

b) Endosomatic energy represents the human capacity of effecting profound changes at the personal level in one’s daily actions and convictions, in view of using the body in synergy with the energy system as a whole.

c) Extrasomatic energy is the human capacity to activate and use the natural resources through the adoption of all kinds of equipment, technology or machinery (using all energy sources, whether carbon or low carbon);

iv) Singling out three social function conductive to the success of energy transition

The research on AEs sheds a light on how human factor may be able to make energy transition work. The research identified three social functions (corresponding to the three dimensions of human energy) conductive to the success of the transition. Those functions are listed below.

- Cybernetic Function: The social dimension of human energy can be interpreted as an adjustment of human and social relations that emerge in the context of the energy transition as a tendency of self-regulation. Such an adjustment – fulfilling what was called the cybernetic function – allows the governance of the energy transition. Tensions and conflicts that arise in the energy systems in transition are managed through a series of continuous, coordinated and simultaneous actions, like:

- the active participation of citizens in decision making;
- the widespread practice of negotiation for the resolution of conflicts and disputes between different social actors in the area;
- the ability to maintain a continuous and multilateral communication on multiple levels (from informal to institutional communication).

- Repositioning Function: For centuries the dominant trend has been to minimize the physical effort through the use of machines. It seems that in the context of the energy transition we witness an albeit partial reverse of this trend. In fact, in the energy transition individuals must reposition themselves into a new energy (and social) system in which the relationship between the human body and the surrounding social reality changes deeply. The endosomatic (or personal) energy is activated in energy transition to face the challenges associated with the increased use of the body in the daily lives. This action – fulfilling what was called "the repositioning function" – is to be considered as a continuous work of psycho-physical adaptation. Repositioning function refers to phenomena such as:

- increased resort to muscular strength and the use of the body, not only in the field of mobility (walking or cycling), but also in other fields (such as an increased use of body warmth to face the low temperatures heating system)
- new attention toward practical issues of everyday life, such as food, health and physical well-being, waste management, etc.;
- spreading of energy literacy among citizens

- Localization Function: The localization function regards the way in which the change from carbon energy sources to low carbon and efficient technologies takes place. In the energy systems in transition, the technologies and the services for the production, transport and consumption of energy, become more accessible and visible to the people who are led to develop a direct control of energy systems, both at the personal level, and at the collective level. Localisation function refers to phenomena such as:

- a localized production of energy;
- the presence of technical skills also spread among the citizens;
- the shared ownership of the means of production and self-production of energy.

Results that informed other WPs

A set of 33 factors of social nature were identified as barriers in the transition to a low carbon society during the empirical research. The set of 33 obstacles identified during the research was divided into vulnerability and insecurity factors, taking into consideration the theoretical framework developed under WP1. The set of 33 obstacles (as also the theoretical framework of the research) was used to fuel the work WP3, with special reference to Focus Groups and expert interviews.

WP2 informs about different social functions that may characterize the transition toward a low carbon

society (see above). These functions were the base on which the SET – Social Energy Transition Scenario was developed, and furthermore the IMACLIM-R Model was modified (i.e. with the "repositioning function" Non-motorized transport was added to the model)

The analysis conducted in WP2 became pivotal in the policy recommendations and in the manifesto drafted during the project. The Human Energy approach shed a light on how human factor lies behind the energy systems in transition; this was strongly reflected in the manifesto "A manifesto for human-based governance of secure and low-carbon energy transitions".

Other results

The research managed to integrate the contribution coming from the different expertise present in the consortium, taking under the same umbrella sociological knowledge (LSC, MUST), psychosocial and behavioral approach (USAL), economy (ECOLOGIC), urban geography (POLITO) and web data analysis (PLUS)
A large group of local actors involved in energy transition projects were identified, added to the MILESECURE-2050 database, and sensitized to the themes of MILESECURE-2050 project.
During the 7th Conference of the European Strategic Energy Technology Plan (SET Plan), held on 10-11 December in Rome, the MILESECURE-2050 POSTER was awarded "SET Plan Conference 2014 – Participants selected poster". The poster was dedicated to show mainly the WP2 results.

WP3 - Societal processes for energy transition

The findings from D3.1 led to a number of conclusions, both regarding methodology for identifying Factors and the relevance of Factors for the low-carbon energy transition.

Overview of key insights from qualitative and quantitative research on energy transition

- The *"Social, Political Movement and Grassroots Factors"* dimension (Citizens' orientation to change, engagement in movements and projects at the local level, willingness to pay in part for initiatives) is a foundation for smooth energy transition.
- External governance and financial instruments help bottom-up initiatives scale to a regional or national level.
- Behaviour change and transformation in the personal dimension are key to measurable success of transition.

Revised Framework

While a number of findings can hardly be generalised due to the low number of data points in the analysis, some very crucial lessons can be taken from the research:
- revision of the Factor naming and descriptions (clear language)
- revision of the perspectives (going from static to a dynamic concept)
- considering Factors in connection, not individually

Based on the findings above, it became apparent that the Preliminary Framework needed to be adapted. Factors were recombined, added, deleted and grouped differently. The revision as presented here is still not final as more research will be necessary in order to substantiate the findings further and reduce the risk of bias as much as possible[1]. The new framework keeps the three domains *E - Market, External and Governance Factors, S - Social, Political Movement and Grassroots Factors and P - Personal, Cultural*

[1] Additional feedback in the form of focus groups or expert interviews to verify the accuracy of this Final Framework was out of the scope of the project due to budgetary limitations.

and Site-specific Factors but the domains do not order the framework any longer. The revised key ingredients in energy transition are illustrated in Table 1, as follows:

Table -1 Revised Key Factors in energy transition (and domain).

Pre-conditions (leverage points in the system)	**Triggers** (change of flows in system)	**Impact** (behaviour or systemic change)
Openness of individuals to social change and change processes (S)	Engagement of individuals in local projects, existence of change agents (S)	New socio-cultural power structures; change in participatory processes (S)
Political leadership (covering various levels of governance) (S)	Legal framework, incentives, regulation (E)	New political power structures (S)
Human capital (E)	Effective implementation (project management, technical training, information) (P)	New interaction of individuals with technology, society and environment (P)
Positive economic impact of the project / measure (P)	Funding models (S)	Evolution of new business models (S)
Market signals (E)	Massive shocks, external disruptions to system (E)	New financial and economic power structures (S)

The revised Framework shows considerably fewer Factors in the P domain compared to the initial Preliminary Framework. It remains open at this point whether this is related to original description of P-factors or the fact that the "impact" Factors (the factors that happen in time after implementation/"triggers") seem less relevant in the overall picture.

On the other hand, there is no reason why all domains – i.e. *Market, External, and Governance Factors* (E), *Social, Political Movement, and Grassroots Factors* (S) and *Personal, Cultural, and Site-specific Factors* (P) should have equal relevance in the drivers and barriers of the energy transition. In fact, it was one of the aims of the present research to examine which Factors are most relevant – without any *a priori* judgment on the equal presence of domains.

A more complete Final Framework has been developed further with labelling, new descriptions and ties to the Preliminary Framework. This Final Framework will be used in subsequent MILESECURE work, specifically the SMET model. The Final Framework represents the culmination of standalone research and the synthesis of previous work in the MILESECURE project. The research conducted has married macro-perspectives on economics, infrastructure and the energy system with anthropological, sociological and behavioural understandings of energy transition into a common language and terminology as well as prepared this knowledge for novel, new modelling exercises.
This revised Framework can be found in **Table 2.**

Table -2. Final Framework of Key Factors in Energy Transition, based on analysis and qualitative expert opinion

Area	Factor Title	Link to Factors of Preliminary Framework	Factor Role	Factor Description
Participatory decision making	Openness of individuals to social change and change processes (S)	S3, P5, P3	**Pre-conditions** (leverage points in the system)	Orientation to grassroots activities, broad (non-narrow) worldview, and interest in eco-initiatives with expected or demonstrated environmental and social benefits.
	Engagement of individuals in local projects, existence of change agents (S)	S2	**Triggers** (change of flows in system)	The role of citizens in designing, spearheading, and implementing eco-initiatives.
	New socio-cultural power structures; change in participatory processes (S)	E2, S4	**Impact** (behaviour or systemic change)	A democratisation of decisions in society and the public engaged in driving eco-initiatives through learning and dissemination beyond the region.
Policy context	Political leadership (covering various levels of governance) (S)	S4	**Pre-conditions** (leverage points in the system)	Political legacy and priority of tackling complex energy challenges.
	Legal framework, incentives, regulation (E)	E3	**Triggers** (change of flows in system)	Mechanisms, incentives, and instruments put in place by governments to scale eco-initiatives.
	New political power structures (S)	S4	**Impact** (behaviour or systemic change)	An agile, efficient, and dynamic participatory governance system.
Adoption, implementation and uptake of **innovative solutions**	Professionals with education and capacity to support societal transition (S)	E1	**Pre-conditions** (leverage points in the system)	Versatile, intelligent group of people ready to change industry, take on new challenges, and execute or implement required steps in energy transition.
	Effective implementation (project management, technical training, information) (P)	P2, P1	**Triggers** (change of flows in system)	Operations, evaluation, and monitoring effectively deployed and suitably adapted in local context (sociocultural comfort, considerations, or lifestyles).
	New interaction of individuals with technology, society and environment (P)	P1, P2, S5	**Impact** (behaviour or systemic change)	Initiative outcomes change the human habits, the relationship between technology and individuals, their view on the environment, and their contributions in society.
Financial and entrepreneurial	Positive economic impact of demonstration projects / measure	P4	**Pre-conditions** (leverage points in	Potential profitability of the project and potential effects on local employment and value added.

Area	**Factor Title**	**Link to Factors of Preliminary Framework**	**Factor Role**	**Factor Description**
aspects	(P)		the system)	
	Relevant project funding models (S)	S1	**Triggers** (change of flows in system)	How diverse funding sources and fundraising methods, including local ownership models, are.
	Evolution of new business models (S)	S1	**Impact** (behaviour or systemic change)	Potential for entrepreneurial innovations to encourage new intiatives.
Macro (economic, political, geopolitical) factors	Market signals (E)	E4	**Pre-conditions** (leverage points in the system)	Cost trends and macroeconomic factors influence CapEx flows and project development structures.
	Massive shocks, external disruptions to system (E)	E5	**Triggers** (change of flows in system)	Dramatic events create political, geopolitical and societal moment for response.
	New financial and economic paradigm (S)	No link with preliminary framework	**Impact** (behaviour or systemic change)	Revamping of how environment and eco-initiatives are valued (in the context of resources and capital).

Areas of further research

The current research activity led to a number of further research questions which cannot be answered within this report but should be addressed in subsequent work.

As a very first step, the revised Framework ought to be examined through a similar process of using the Assessment Matrix, focus groups and expert interviews to validate the revised Factors.

Subsequently, the sample sizes both for the number of Anticipatory Experiences as well as the number of experts involved should be increased considerably, thus allowing the statistical analysis to be made on better grounds.

If necessary, a further refinement of the Framework will be required.

Independently of these suggested further research steps, the results of the present examination will be the basis for developing parameters and variables in low-carbon energy scenarios which will be modelled within MILESECURE2050 using the SMET model to supply findings to the CGE-FEU[2] and IMACLIM-R models.

D3.2 began by developing indicators for each of the factors, i.e. drivers and barriers of the energy transition determined from D3.1. In addition to these factors, three new factors, namely attention toward practical issues of everyday life, increased resort to muscular strength allow energy saving and spreading of energy literacy and of energy citizenship were developed. Selected indicators for each factor were used to develop factor assessments for 2012 for Germany, Poland, Italy and the EU based on quantitative and qualitative evaluations. Narratives were written for each of these countries and the EU based on the 2012 factor assessments and factor foresights developed for 2020, 2030 and 2050. The narratives forecast how the 18 factors will evolve from 2012 to 2020, 2030 and 2050 in both centralised and decentralised scenarios. These foresights will provide the needed inputs for WP4 modelling tasks.

This is the first time non-technical aspects of the energy transition are quantified in a harmonised approach and then integrated in modelling processes.

Several insights were gathered through the development of the methodology of this deliverable:

Once indicators describing each factor were compiled, it became apparent that the methodology to assess these indicators needed to be diversified to account for the different types of indicators. This resulted in the creation of three assessment approaches.

- The first evaluates indicators on a scale ranging from 0% to 100% where 0% corresponds to a value of -2 [absolute barrier] and 100% to a value of +2 [absolute driver] to energy transition.
- The second uses 0 as the minimum (-2) and the highest EU-28 value as the maximum (+2).
- The third uses the lowest EU-28 value for a given indicator as a minimum (-2) and the highest EU-28 value as a maximum (+2). These varying assessments were necessary to properly assess indicators and use them to assess 2012 factor assessments.

An average was taken of all indicator assessment values for each factor to determine the 2012 factor assessments. It is recognized that taking the average is not the only approach, though it was the one used in this case. Consultation with national experts was then used to adjust 2012 factor assessments to determine the 2012 Overall factor assessments. To calculate the Overall factor assessment values for the EU, a separate formula was used. This was decided upon as a way to account for other factors such as variations in population across the EU to provide for a more accurate 2012 Overall assessment for the EU.

Foresight values for each factor were determined by referencing 2012 Overall factor assessments, expert judgement and energy strategy and scenario documents on the national and EU level. Foresight values were evaluated on a scale from -2 to +2 using increments of 0.5. There are other approaches that could have been taken which may have been more precise but this method was chosen in an effort to account for the uncertainty of future changes and to simplify the model input for future analysis. Foresight values for 2020, 2030 and 2050 were determined by national experts using 2012 Overall factor assessments as a

[2] Computable General Equilibrium – Final Energy Use

baseline. It was decided that this would be the most effective way to make projections for these years for both the SET and CENT scenarios. To stay consistent, the formula used to calculate the 2012 EU Overall factor assessment values was used to calculate foresight values for 2020, 2030 and 2050. Instead of using national 2012 Overall factor assessment values, however, national foresight values for each year were used to determine EU foresight values for these years.

Factor assessment values for 2012, 2020, 2030 and 2050 for each country and the EU informed narratives depicted possible developments in both SET and CENT scenarios. Variations in the narratives exist among the countries which reflect different energy security mixes within the EU. Though alternative approaches could have been taken throughout this task, methodological decisions were made in an attempt to yield the most relevant results to feed into WP4 modelling tasks.

Above all, the primary output of the research is the development of a novel methodology for merging qualitative and quantitative information and for comparing energy transition progress across different countries and over time without focusing on the technical energy system, but instead on the human energy or polito-social system.

As a potential next step, the methodology can be further refined by applying it to more countries and validating it with stakeholders.

WP4 - Modelling approach, analyses, verification and validation

WP4 aimed at integrating the qualitative inputs from WP1, WP2 and WP3, in particular those related to the empirical analysis of societal processes into a modeling framework and then assessed the macro-economic impacts and the energy security implications of future energy and low carbon scenarios for EU and key Members States by 2030 and 2050.

Methodology: To that end, a modeling architecture based on the dialogue between different types of models (SMET, IMACLIM-R and CGE-FEU) was elaborated.
IEN and EnergSys elaborated the SMET (Socio-metric Energy Transition) model with the aim to translate qualitative information from the previous WPs into technological boundaries and a clustering methodology among EU countries. The methodology of the SMET model consists in building a set of indicators which translate main social, technological and political factors of societal energy transition processes. The SMET model uses Excel and can simulate technologies scenarios deployment by playing on logistic function curve parameters. IMACLIM-R model (EU28 level) and CGE-FEU (national level) models also included the technical boundaries from the SMET model. Both IMACLIM-R and CGE-FEU are hybrid models based on an explicit description of the economy both in money metric values, and in physical quantities, linked by a price vector.
The two hybrid macro-models (IMACLIM-R and CGE-FEU) were used to assess three scenarios:
• No emission regulation (NER) – being a reference level for research results of two significantly different options (scenarios) of low-carbon energy transition - in a 2030 and 2050 perspective.
• Centrally driven ENergy Transition (CENT) – with continuation of centralised EU policy – acheiving emission reduction targets included the EU Roadmap2050 and in the FRAME2030 document ("A policy framework for climate and energy in the period from 2020 up to 2030", (EU Council 24th October).
• Societal Energy Transition (SET) - aimed at a democratization of energy governance, building on the knowledge of local authorities and communities and providing them with more responsibilities reality and taking into consideration good practices of local AE's projects. The scenario assumes a significant increase in public awareness and acceptance, which by definition should lead to changes in consumption patterns and changes in individual and social preferences - not only at the local level.
These scenarios explored various governance regimes and policy mixes of energy transition towards a low-carbon economy in view to provide a better understanding of energy security issues.
In parallel, substantial methodological improvement were made within existing models. At the EU28 level, IMACLIM-R proposed a framework that helps disentangling the role of transport in long-term socio-economic trajectories and the potentials offered by specific measures on these sectors to face fossil

fuel depletion issues as well as emissions mitigation costs. Contrary to most E3 models that are used for energy security issues and for carbon mitigation assessments, IMACLIM-R includes a stylized representation of 'behavioral' determinants to explicitly represent the interplay between transportation, energy and growth patterns. This was a real added value for the project, since most modelling tools are mainly based upon sectoral approaches that have either a 'technology-based' or a 'behavioral-based' nature. Additional benefit of IMACLIM-R is that it joins both dimensions with a macro-economic closure, thus ensuring a robust assessment of the challenges posed to the economy by energy security and climate change issues.
IMACLIM-R also provided evolution of key macro-economic parameters to the CGE-FEU (national level) in order to guarantee a relative consistency between respective scenarios.
At the national level, the two Meso-impact modules (IEN/Energsys) aimed at assessing the impact assessment of energy transition policies on industrial and households sectors were adapted and updated. This involved a significant work of data collection and verification for the three countries considered (Italy, Germany, Poland). They are relatively consistent with assumptions and key data inputs that stem from different EU, OECD and national sources, including experts' assessment.

Findings: The main findings from the scenarios' analysis concerns two aspects: the transition to a low-carbon energy system and its impacts on European economy in the context of the global economy; and the transition and its impact on selected Member States (Germany, Italy and Poland).
Results from the IMACLIM-R model at the EU28 level show that the combination of a carbon tax with specific recycling options and investments into green infrastructures policies that include human factors in the SET scenario accelerates the decarbonization of the economy and limits the efforts required after 2030 for Europe to comply with its climate objectives. This result demonstrates that mobilizing human factors into innovative local initiatives and changes in lifestyles are necessary to achieve a low carbon transition with no social costs in a world where Europe acts almost unilaterally. Results at the national level stemming from the CGE-FEU models point out that not considering societal processes within climate policies increases the vulnerabilities of lower and middle income EU Member States by 2030 like Poland and Italy as regards to their specificities in terms of energy mix, substitutions capacities to fossil fuel energies, economic structures and availability of capital to invest into LCE. These outcomes argue for the necessity to better integrate societal processes for enhancing the low energy and carbon transition in Europe.

WP5 - Towards governance of the energy transition processes

Aims. WP 5 has engaged with the deep relationship between energy transition and the governance of contemporary societies. Using results from earlier work packages, it was articulated how energy transition reaches deep into the political dynamics that characterise a given social context (whether it be transnational, national or local). From different disciplines, it was articulated in which different ways energy represents a concern of primary political importance, which has strong impacts on the forms and configurations of power. Anticipations from WP2, in particular, showed how many political mechanisms are normally started by initiatives (even small scale ones) aimed at eco-sustainable energy, such as those concerning consensus building, decision making, public communication of political motivations and objectives pursued, local and national legislative production, political leadership training and rotation, the many forms of people's participation in decisions, not to mention the questions regarding funds. With work from the other work packages, these observations were further operationalized. It follows that Energy transition itself has a broad effect on political dynamics. In fact, it affects almost all public policy areas, starting, of course, with energy and environment, and then economic development policies, agricultural, planning, transport, science and technology, and health policies. This means that, energy transitions require complex coordination among the many actors involved in governance. It must mobilise a wide range of interests that are likely to produce conflicts, tension, controversy and resistance.
From this, some theoretical abstractions of regimes were devised. Regimes are defined as relatively stable social forms, oriented towards turning potential "dangers" (i.e. threats partially or totally out of control, both cognitively and operationally) into "risks" (that is threats that can be managed and placed under control), by anticipating and reacting to them. Some regimes seemed better at including and mobilizing

local initiatives than others. In particular, those that engage more intensively with citizens, are more successful.

Approach. The work package consisted of two main parts, each addressing one of the respective audiences. In task 5.1, a manifesto was produced that presented a diagnosis of current potentials and deficiencies in democratic governance, as well as tentative solutions to these problems. In order to secure coherence and consistency with outcomes from previous work packages, intensive bilateral and multilateral cooperative activities were established between partners. In task 5.2, policy recommendations were devised in a more direct and comprehensive way. This means that the full range of empirical and modelling outcomes could be mobilized.
This work package had no empirical method of its own, but took the outputs of the other workpackages as its input. This required sophisticated multidisciplinary and transdisciplinary operation, translation and alignment.

Findings. The most significant outcome produced by WP5 has been the articulation of what is generally referred to as the 'human factor'. It turns out that many different notions of this human factor are in fact competing below the surface, while at first sight the usage seems unambiguous and unproblematic. If governance processes of energy transitions are to be made democratic, they must before anything else be more explicit, more articulate, and more inclusive in their thinking about the human factor – up to the point of actually dropping the notion of human factor, and substituting it with 'citizen', 'consumer', 'activist', 'voter', 'tax-payer', etc., so as to give depth to what is hitherto left implicit.
The 10 Diagnoses and respective Remedies introduced in D.5.1 argue that, whether at the local or at central government level, people should be cherished for their knowledge and creativity, and recognized as the reason why energy transitions matter in the first place. In other words, they show how governance strategies should be aimed at keeping both political debate and policy making receptive to the broadest possible range of perspectives.
By arguing this, the project also claims that the role of citizens and communities has so far been inadequately understood, especially by policy-makers. Consequently, people have been insufficiently enrolled, engaged and mobilized as a resource for innovation and change in low-carbon and secure energy transition. In civil society, governance strategies should be aimed at acquiring insight in how citizens, communities and societal groups define the problems and challenges of energy transitions. At the same time, top-down approaches need to continue to play a crucial role, by building social and technical infrastructures in such a way that small-scale experiments with alternative configurations for low-carbon and secure energy are enabled rather
than closed off. Both top-down and bottom-up strategies should be explicitly rendered complementarily. Top-down interventions must be geared towards enabling local initiatives and towards empowering communities, and bottom-up initiatives might appeal to central governments so as to improve central regulations.

Outcomes. In terms of the processes underlying the two tasks, both tasks were completed successfully. It is felt that both deliverables are the work of the entire consortium, and the bilateral and multilateral activities have most certainly contributed to this. In terms of the deliverables, the two tasks were successful as well. The deliverables were delivered with only marginal delay, and well in time for them to be presented at the final event. A "manifesto", titled "Secure and low-carbon energy is citizens' energy", was developed to target a broad range of actors, offering guidance towards a better inclusion of citizens, and calling for actions that serve low-carbon and secure energy development through top-down and bottom-up approaches, and through visionary grand narratives as well as local initiatives.
In terms of the external success, it is hard to say at this point what impact can be claimed. However, the responses at the final event offer good hope that the message was relevant, innovative and convincing.

SECTION 4 - The potential impact (including the socio-economic impact and the wider societal implications of the project so far) - and the main dissemination activities and exploitation of results (not exceeding 10 pages).

Potential Impact

The MILESECURE-2050 project has been devised in order to produce the impact required by the Commission as indicated in the call, namely:

- advance the knowledge base that underpins the formulation and implementation of relevant policies supporting inclusive and sustainable growth and societies in Europe or, whenever relevant, outside Europe
- achieve a critical mass of resources and involve relevant communities, stakeholders, and practitioners in the research with a view to assessing the potential for sustainable practices, values, policies and behaviors in Europe and
- contributing to the development of the intellectual foundations of new European social models that encourage the combination of economic, social and environmental objectives under the Europe 2020 Strategy.

In a broad general sense, the project represents a contribution to the common objective of the Area 8.2.2. Regional, territorial and social cohesion of providing new knowledge on the processes (including social innovation) and policies which underpin regional, territorial and social cohesion, in line with the Europe 2020 Strategy and other relevant policies. An overall picture of the ways in which the project contributed to the specific impacts mentioned in the call is the following:

- The project focused on energy transition as societal process and produced new knowledge on energy security and regimes of governance, relevant for the formulation of appropriate policies and the promotion of inclusive growth.
- The project research methodology implied the involvement of “communities, stakeholders, and practitioners”. In WP2, WP3 and WP5 this involvement was pivotal for the implementation of activities.
- This “participatory” methodology facilitated the identification and assessment of different practices, value, policies and behaviors in Europe.
- The project contributed to the development of “the intellectual foundations of new European social models that encourage the combination of economic, social and environmental objectives under the Europe 2020 Strategy” thanks to the dissemination and scientific communication activities foreseen. In addition, by analyzing anticipatory experiences in the field of low energy and carbon transition and insist on their key role in the energy transition, the project has provided material for future networks of anticipatory experiences at the EU level that could be included in the "agenda for solutions" within climate negotiations.

A more analytical description of the ways in which project activities did contribute to the requested impacts - and the project deliverables relevant for the production of these impacts - is provided in the table below.

Expected impact	Project activities	Project deliverables
Project will advance the knowledge base that underpins the formulation and implementation of relevant policies supporting inclusive and sustainable growth and societies in Europe or, (…)	All the research (WP1-5) activities are aimed at increasing the knowledge base that is relevant for European Energy policies. More in particular: WP1 has produced this impact by focusing on existing knowledge concerning Energy security policies and by providing a scenario analysis and trends; trends will include also implications of energy transition for growth; WP2 consisted in an empirical study of anticipatory experiences of transition. This was a pre-condition for a deeper understanding of facilitating and hindering factors of post-carbon transition and the related possible implications for growth WP3 activities did consist in processing the data collected during WP2 and in providing an overall picture of options and factors influencing the energy transition processes. It resulted in an enlarged knowledge basis of carbon transition processes and energy security. WP4 activities focused on a modelling exercise related to transition processes, considering the governance dimension within the model. WP5 activities produced a new vision of the future on the basis of the activities carried out in previous WPs	The following deliverables of WP1 are relevant to this impact: D1.2 – Report on global and macroregional key trends and scenarios (M9) D1.3 – Report on main trends in European energy policies (M13) D1.4 – Report on the macroregional geopolitics of energy security (M17) Both deliverables of WP2 are relevant for the production of this impact D2.1 – Report on integrated analysis of local anticipatory experiences in energy transition in Europe (M13) D2.2 – Report on comparative analysis (M18) The deliverable foreseen in WP3 was important in giving account of the results of in depth studies of anticipatory experiences: D3.1 – Report on drives of societal processes of energy transition (M23) All the deliverables of WP5 are relevant for this impact D5.1 – Manifesto for a governance of energy transition (M36) D5.2 – Guidelines and recommendations for EU policies (M36)

(…) or, whenever relevant, outside Europe	WP1 trends that were taken into account will consider also implications of European level policies and their geopolitical implications WP3 drew conclusions also considering relevant experiences and data from outside Europe WP4 elaborated a modeling architecture based on the dialogue between different types of models (SMET, IMACLIM-R and CGE-FEU), allowing to consider phenomena and data concerning non-European countries. WP5 used data referred to trends concerning also non European countries. The study of governance issues and recommendations related to post carbon transition and energy security considering also non-European countries.	In the following deliverables, new knowledge about of post-carbon transition and of Energy security will be produced by taking into account non-European countries D1.4 – Report on the macroregional geopolitics of energy security (M17) D3.1 – Report on drives of societal processes of energy transition (M23) D4.1 – Report on IMACLIM-R model experiments and analysis (M29) D5.1 – Manifesto for a governance of energy transition (M36) D5.2 – Guidelines and recommendations for European policies (M36)
(…) They will achieve a critical mass of resources and involve relevant communities, stakeholders, and practitioners in the research, (…)	Research activities included also the consultation of members of scientific communities and of stakeholders. This happened in both WP2 (task 2.1) for the selection of best practices, and in WP3, for the selection of experts, in order to obtain results through a discussion with stakeholders WP5 also included stakeholders involvements when a manifesto and policy guidelines have been delivered and discussed (through WP6: international conferences)	Research activities carried out in WP2 and WP3, all including a wide consultation of stakeholders and experts will be summarized in the following deliverable D2.2 – Report on comparative analysis (M18) D3.1 – Report on drives of societal processes of energy transition (M23) D5.1 – Manifesto for a governance of energy transition (M36) D5.2 – Guidelines and recommendations for European policies (M36)

with a view to assessing the potential for sustainable practices, values, policies and behaviours in Europe	WP 4 was devoted to integrate the qualitative inputs from WP1, WP2 and WP3, in particular those related to the empirical analysis of societal processes into a modeling framework and then to assess the macro-economic impacts and the energy security implications of future energy and low carbon scenarios for EU and key Members States by 2030 and 2050.	The following deliverables did produce the selected impact: D4.1 – Report on IMACLIM-R model experiments and analysis(M29) D4.2 – Report on Socio Metric Energy Transition (SMET) Model of energy transition scenarios (M31) D4.3 – Report on policy implications of the integrated analysis and on the numerical information (M35)
and contributing to the development of the intellectual foundations of new European social models that encourage the combination of economic, social and environmental objectives under the Europe 2020 Strategy	WP6 – The activities carried out made it possible to contribute to awareness raising among policy makers and other stakeholders about processes of Post-Carbon transition, their potential and problems, especially for what concerns Energy Security. New intellectual foundation did consist in a view of energy transition wider than those currently shared. It was wider because it was based on an interdisciplinary research and on consultation processes involving different actors. It also highlighted the societal nature of the process, and the role that human factor play in this transition. The above achievements have been possible also thanks to the four Regional Workshops developed in WP6.	D5.1 – Manifesto for a governance of energy transition (M36) D5.2 – Guidelines and recommendations for European policies (M36) D6.1 – Construction of an informative web-site (M 4) D6.2 - Electronic newsletter issues (M 6, 13, 22, 26, 34, January 2016) Policy Briefs n.1 (M21) & n.2 (M26) "providing portraits of energy transition (results from WP1 and WP2)" D 6.3 – "Policy Brief on societal processes on energy transition" (M27) D. 6.4 – "Policy Brief on governance of energy transition processes" (M36) D.6.5 – Report on dissemination activities (M36). This includes illustration of the four Regional Workshops: BERLIN - Central Europe, 17 September 2014 (M21); ROME - Southern Europe (in coordination with the International Conference + EAB Meeting and PMC Meeting),18 February 2015. (M25); WARSAW - Eastern Europe, 26 June 2015 (M29); SALFORD, Northern and Western Europe (UK), 15 September 2015 (M33).

The project activities described above did bring about the listed impacts thanks to the fact they have been carried out on the basis of a sound strategy, consistent with the resources available. **Such a strategy was based on the following assumptions.**

- The **project has to produce new knowledge that is relevant for European Policies in the energy sector** on a number of issues such as maintaining European citizens well-being, impacts of social behaviours on some economic sectors and so on. Such a new knowledge should be able to lead strategies and policies to reach the EU objectives in the energy sectors.

- The new knowledge has to be **shared among very different audiences** and this objective, for being attained, has been actively promoted with specific activities. Also sharing and disseminating this new knowledge has required a **brokerage exercise** among those actors that can use it effectively.

Relational aspects have been of pivotal importance both in the **production and in the dissemination of knowledge**. It is to be considered that project outputs and results did not consist in patent, or software to be sold, rather in new insights about Energy security and its main social and economic aspects, especially those implied by the transition to a post-carbon society. The ways in which such outputs and results have been used and adopted by the various stakeholders, therefore, were the **production of consensus** about them and their potential benefits.

On the basis of these assumptions and considerations, the strategy for the production of impacts was based on **two types of communication activities**:

- **dissemination-oriented**, aimed at providing information to a wide variety of people potentially interested in the project about its achievements, progress and produces;
- **interaction-oriented**, aimed at creating exchanges with the actors interested to the projects issues and that wants to know more and/or could provide relevant inputs for projects activities.

Dissemination oriented activities have carried out with the objective of singling out people interested to receive and read materials published on the project web-site. This objective has been reached through **active e-mailing activities** aimed at defining a mailing list stratified according to a typology of entries that are relevant to the project and that will be updated during the entire project life. The people in the mailing list has been informed of the news through periodical mailing (the newsletter and other objects). Dissemination activities have been addressed in particular to the following audiences: Energy information and advice agencies; Energy services companies (ESCo); Utilties; Transport companies; Professional consulting companies; Other companies; Industry associations; Banks or other financial organizations; Mass media or information service agencies; NGOs – Consumers; NGOs – Environmentalists; NGOs – Other; Trade union organizations; Political parties; RTD Institutions; Educational institutions or associations; National governments; Regional or provincial governments; Local governments; Other public bodies; European Parliament; European Commission; European Economic and Social Committee; International organizations/financial institutions.

Interaction oriented activities have been aimed at creating a mutual exchange between various audiences (scientific communities, stakeholders, etc.) and the project. The objective was not providing information about the project, but using the connection for obtaining inputs relevant for the implementation of project's activities. Such inputs were of different types: Collecting comments about project outputs; Suggestions concerning research materials (e.g. the "anticipatory experiences", the governance modes, etc.); Collection of comments from experts for the validation of the projects results (see WP3 and WP5); Identification of people to interview or involve as key persons (see WP2, WP3).

Attention has been paid to single out networks that are relevant for the project, though "Social Network" and other more "conventional" networks (association of different kind, blogs and newsletters, etc.). Milesecure-2050 was actively promoted through the **social media channels** with two dedicated accounts: on Twitter (https://twitter.com/MILESECURE2050, and Facebook (https://www.facebook.com/Milesecure2050/). Disseminated content concerned general goals and nature of the project, achieved results, ongoing research activities, as well as promotion of the organized events (conferences, workshops etc.). Additional posts included information on project-external conferences within the topics of energy security and transition, as well as relevant news and activities. Both profiles were targeted at the stakeholders at large and the broader public. The project through the use of social networks (tweeters) contributed to bring closer science to citizens and increase awareness on the topics of the project (energy security, climate policies, societal processes) and support the role of public participation in the low carbon transition (cfr. **article 84 of the Paris Agreement**).

The management of the knowledge produced through the research activities has been carried out mainly through the use of the project website, the newsletters and the various communication activities between the project partners. Finally, all activities been realized according to the dissemination plan presented in D.6.1, which contains, among others, the description of the dissemination strategy, prepared on the basis of a survey among the advisory board members and other key contacts.

Main Dissemination Activities and Exploitation of Results

The section below includes a description of main dissemination activities and exploitation of results:

Dissemination Plan

As Task 6.1 leaders, IEn and LSC were responsible for the preparation of the Dissemination plan. Feedback and comments from ECOLOGIC, USAL, POLITO and Pierre Laconte (EAB) were collected.

Brochure

In May 2013, POLITO edited a first draft of the brochure (template, content, graphic), which was shared with IEn, LSC, ECOLOGIC and USAL for feedback and editing. Following the suggestions of POLITO, the brochure format was chosen to be a half fold brochure (4 page) paper folded in a half. The brochure was deemed to be distributed at seminars, workshops, meetings, conferences.

Project Roll-Up

POLITO edited first draft of the poster. The final version was edited by all WPs leaders, who were asked to deliver the sentences for the headlines expressing main results produced within the course of the project.

Website (Task 6.2)

Activities have been implemented according to the schedule reported. No delay at the end. **The project's website** was developed and is online at http://www.milesecure2050.eu
Public deliverables are available at: http://www.milesecure2050.eu/en/public-deliverables

Logo: POLITO designed and selected a MILESECURE-2050 logo. The Project logo has been used in all the dissemination material and deliverables.

Task 6.3: e-Newsletters and Policy Briefs

E-Newsletters

In accordance with the Dissemination Plan the first issue (1) of the e-Newsletter was about "project presentation (kick off meeting, partners, general characteristics of the project, ongoing WPs and next steps, Advisory Board)". The **second issue** (2) was about the "ongoing activities WP1 (trends, policy and scenario analysis) and WP2 (anticipatory experiences analysis)". The **third issue** (3) of e-Newsletter was about the "First regional workshop and WP3 ongoing activities (societal processes of transition), final products of WP1 and WP2". The **fourth issue** (4) of e-Newsletter was about model development (WP4) and final products of WP3, mainly with SMASH, ECOLOGIC, IEn and ENERGSYS contribution. The **fifth issue** (5) **(**focused on final outputs of WP4, manifesto publication in WP5 as well as WP6 Events: First International Seminar in Rome, Regional Workshop in Warsaw, Regional Workshop in Salford. The constant section has been updated with: Upcoming Events, Project planned events, Energy related events. The **sixth issue** (6) presented the list of final events and publications from the last 3 months of the project: policy brief, manifesto, and international seminar in Brussels. It promoted some Energy related events, e.g. the conference "Toward Post-Carbon Cities" - Sustainable Built Environment 2016 (SBE 2016 TORINO).

Policy Briefs

Policy Brief (1) providing portraits of energy transition (results from WP1 and WP2) was divided in two separate issues. **Issue n.1** - devoted to **WP1**, prepared by POLITO and reviewed by USAL, was issued in **September 2014** and distributed on the occasion of the Regional Workshop in Berlin. **Issue n.2** - devoted to **WP2** interim findings and related policy implications of the MlLESECURE-2050 project from the analysis of local "anticipatory experiences" of energy transition in Europe, using the holistic approach of human energy was prepared by LSC and reviewed by USAL. It was published in **February 2015** and ready to be distributed a the Regional Workshop in Rome (Feb, 2015). **Issue no. 3 (Deliverable 6.3)** on societal process of energy transition– devoted to **WP3** - entitled "A policy brief on the societal drivers and barriers of low carbon energy transition" was prepared by ECOLOGIC, reviewed by USAL and published in **March 2015**. **Issue no. 4 (Deliverable 6.4)** on governance of energy transition– devoted to WP5 – was prepared by MUSTS and reviewed by USAL. It consolidated earlier MlLESECURE-2050 insights into recommendations about the governance of secure and low-carbon energy transition. Particularly, it provided further depth to the notion of the 'human factor' that has so far been underdeveloped. It was issued in **December 2015.**

Task 6.4: Presence in media, networking and mailing list

In essence, the project aimed at maximizing impacts by involving strong actors clearly committed to the project themes and who, amongst other things, also have the capacity to influence other actors present in Europe. These actors included the representatives of the many networks active in the research fields dealing with energy security and post-carbon transition.

Task 6.5: Scientific papers and international conferences' papers

MILESECURE-2050 project results have been presented through the following **Conference Papers** and **articles**

- "*Toward a low carbon and energy secure society. Where is the EU going*?", paper presented on the WP1 results by G. Cotella, S. Crivello and P. Lombardi in AESOP Congress 2014, Utrecht, 9-12 July 2014, in the framework of Track nr.9 - "Energy, Food and Urban Metabolism"
- "*Geopolitics and energy security: strategies and policies in the European Union*" by G. Cotella, S. Crivello, P. Lombardi, F. Borio presented at the XXXV Conferenza scientifica annuale AISRE Uscire dalla crisi. Citta, comunita e specializzazione intelligenti, Padova, 11-13 September 2014
- "*Local experiences in energy transition*," by Patrizia Lombardi, in EAI journal, Special, Transition and global challenges towards low carbon societies Jun 16, 2015, Available here. . This paper was presented at the LCS- RNet 2014 Annual Meeting held in Rome, Italy, on 1-2 October 2014
- "*Assessing the role of societal factors for a low-carbon energy transition: reconciling the local with the national level - a case study for Italy*". Authors: Amerighi O., Baldissara B. & Felici B. (ENEA), Caiati G., Quinti G. (LSC), and Toniolo J. (POLITO), abstract presented at (ECM3) – 3rd International Symposium on Energy Challenges and Mechanics - towards a big picture, Aberdeen, 7-8 July 2015
- "*An analysis and evaluation of the EU states development coherence - some social and economic aspects*". Authors: Parczewski Z., & Labinowicz K. (IEn), Umer A. (EnergSys), abstract presented at (ECM3) – 3rd International Symposium on Energy Challenges and Mechanics - towards a big picture, Aberdeen, 7-8 July 2015
- "*Societal drivers and barriers of energy transition*" Authors: Prahl A., Grunig M. (ECOLOGIC), Sitko I. (PLUS), abstract presented at (ECM3) - 3rd International Symposium on Energy Challenges and Mechanics - towards a big picture, Aberdeen, 7-8 July 201
- "*Energy Security Scenarios of Future Europe*". Authors: Cassen C. Hourcade Jc. (SMASH), Cotella G., Lombardi P. (POLITO), abstract presented at (ECM3) - 3rd International Symposium on Energy Challenges and Mechanics - towards a big picture, Aberdeen, 7-8 July 2015
- "*Approaching a secure and low-carbon energy system as an unstructured problem*". Authors: Valkenburg G. (MUSTS) & Gracceva F. (ENEA). Abstract presented at (ECM3) – 3rd International Symposium on Energy Challenges and Mechanics - towards a big picture, Aberdeen, 7-8 July 2015
- "*Unpacking The Governance Of Energy Transition. A Conceptual Framework*" - paper presented by Valkenburg (MUSTS) & Cotella (POLITO), @ the AESOP Congress, Prague, 13-16 July 2015
- "*Energy Security Scenarios of Future Europe. Assessing the impacts of societal processes*", paper presented by Christophe Cassen, Meriem Hamdi-Cherif, Giancarlo Cotella, Jacopo Toniolo, Patrizia Lombardi, Jean-Charles Hourcade, during AESOP Congress, Prague, 13-16 July 2015
- "*Does resilient matter in energy transition*?", paper presented by P.Lombardi (POLITO), in the International seminar on Future Challenge in Sustainable urban development, Chelsea, 17-18 August, 2015. To be published by Wiley in the book co-edited by P.Brandon, Shen G. and Lombardi P., titled "Future challenge in Sustainable urban development", in 2016.
- "*Evaluating EU decarbonisation pathways to 2030 with an improved version of GTAP-E Dynamic Model*" by Tommasino (ENEA), Antimiani and Martini (INEA) presented at the 10th SDEWES Conference, 27 September – 02 October 2015, Dubrovnik (Croazia)
- "*Modes of Governance: a systematic Approach to Governance of Energy Transitions*", Govert Valkenburg (MUSTS) at the 2015 Annual Meeting of the Society for the Social Studies of Science (4S), Denver, Colorado, 11-14 November 2015

- "*A review of current energy systems and green energy potential in Kazakhstan*," Marat Karatayev, (POLITO). Peer reviewed article published in the Elsevier journal "Renewable and Sustainable Energy Reviews" Dec 11, 2015

The **list of publications is available at: http://www.milesecure2050.eu/en/publications**
Additional publications are:

- "*Guest Blog: European strategies for low carbon energy security*". Article written by prof Lombardi for the UK Energy Research Centre (UKERC) - a guest blog for official newsletter. Published @ http://www.ukerc.ac.uk/search-results.html?q=MILESECURE.
- "*Smart City as a Mobile Technology: Critical Perspectives on Urban Development Policies*", Lombardi, Vanolo (POLITO). Chapter published by Springer in the book titled "Transforming City Governments for Successful Smart Cities", 2015
- "*New spatial decision support systems for sustainable urban and regional development*", Lombardi, Ferretti (POLITO). Article published by Emerald Insight in the Journal: *Smart and Sustainable Built Environment (*Emerald Insight). 05 January 2015
- "*The rise of Human Factor in the Change of Energy Systems: the case of 20 Sustainable Districts in Europe"*, Caiati and Quinti (LSC). Paper selected for the SBE16 Conference (18-19 February 2016). Parallel Session: Sustainable Districts: case studies
- "*Energy Security Scenarios of Future Europe. Assessing The Impacts of Societal Processes*", by Hamdi-Cherif Meriem, Christophe Cassen (SMASH). Paper presented at the SBE 16 Conference. Parallel Session: Policies & Regulations for a Sustainable Built Environment. (18-19 February 2016).
- "*The Transportation Sector as a Lever of Reducing Long-Term Chinese Mitigation Costs"* Authors: Hamdi-Cherif Meriem, Christophe Cassen (SMASH). Paper presented at the SBE 16 Conference Parallel Session: Urban Infrastructure for Post-Carbon Cities). (18-19 February 2016).

Finally, MILESECURE-2050 results are going to be published in a **book** edited by Max Grunig (ECOLOGIC) and Patrizia Lombardi (POLITO) published by ELSEVIER in the year 2016, entitled: "Low-carbon Energy Security from a European Perspective".

Additional **open access publication are in progress**.

- "*Governance of sustainable transitions: a tentative framework*" by POLITO + MUSTS. Journal name: "Energy, Sustainability and Society": http://www.energsustainsoc.com/ Submission date: spring 2016.
- "*Towards low-carbon society: Local experiments seen through the lens of Twitter*", Author: Izabela Sitko (PLUS), submitted for the ELSEVIER Journal "Environmental Innovation and Societal Transition" (to be published in 2016)
- "W*ould climate policy improve the European energy security?*" (Guivarch C., Monjon, S., Vogt-Schilb, A), (SMASH) under revision

MILESECURE-2050 project results were also presented through **Conference Posters** within the following International Conferences:

- WCERE - 28 June - 2 July 2014. Poster by: Guivarch C., Monjon, S., Vogt-Schilb, A (SMASH)., titled "*Would climate policy improve the European energy security?*",
- GI_Forum 2014, Salzburg, July 1-4, 2014. Poster "*Towards low-carbon society: Local experiments seen through the lens of Twitter (based on WP2 results)*". Authors: Sitko I., Kazakopoulos P. (PLUS)
- Let's Conference - 30 September 2014, Bologna (POLITO). The poster illustrates a number of current EU projects including MlLESECURE-2050
- BEHAVE - Energy Efficiency and Behaviour Conference, 3-4 September 2014 in Oxford (UK). "*The role of behaviours in Energy Transition: The holistic approach of Human Energy*" (Caiati G, Quinti G, Pearson A.) (LSC and ECOLOGIC)
- 7th SET Plan Conference, Rome 10-11 December 2014. During the conference the Audience Award was won by the poster produced and prepared by LSC.

MILESECURE-2050 Special Sessions

Below the list of the **MILESECURE-2050 Special Sessions** organized by project partners within the following International Conferences:

» SB40 - UNFCCC - United Nations Framework Convention on Climate Change, Bonn, Germany, 14 June 2014, organized by ECOLOGIC
» Energy Week in Brussels, MILESECURE-2050 Energy Day, 25 June 2014, organized by POLITO
» LCS-R net - Low Carbon Society Research Network - Annual meeting, Rome, 1-2 October 2014, organized by ENEA
» ECM3 Conference – 3rd International Symposium on Energy Challenges and Mechanics - towards a big picture, Aberdeen, 7-8 July 2015, organized by POLITO
» SBE16 "Towards Post Carbon Cities" Turin, 18-19 February 2016, organized by POLITO

Task 6.6: Regional Workshops

Below there is the list of **4 Regional Workshops:**

» BERLIN – 1st Regional Workshop: Central Europe. 17 September 2014. Organized by ECOLOGIC
» ROME – 2nd Regional Workshop: Southern Europe (in coordination with the International Conference + EAB Meeting and PMC Meeting). 18 February 2015. (M25) LSC and ENEA as coordinators
» WARSAW – 3rd Regional Workshop: Eastern Europe. IEn as coordinator. 26 June 2015 (M29)
» SALFORD – 4th Regional Workshop: Northern and Western Europe. USAL as coordinator. 15 September 2015 (M33).

Task 6.7: International seminars

17 February 2014: International Seminar in Rome

INTERNATIONAL SEMINAR AND REGIONAL WORKSHOP: "EUROPEAN SOCIETIES FACING ENERGY TRANSITION. The challenge of the human factor and energy security, up to 2050".

The seminar focused on two key issues of MILESECURE-2050: understanding the role of the human factor in the process of energy transition, and studying the relationship between transition and energy security. 20 experts from different European countries attended the seminar, which was of great interest to the scientific community, energy field experts, policy makers and representatives from civil society. The seminar was composed by a Opening Session followed by two separate thematic sessions. The First Session was devoted to the role of the human factor in the energy transition, presenting the results from the first part of the project. These results are based on a broad set of research actions, such as the study of the main trends and policies related to the international and European context; the analysis of more than 90 local anticipatory experiences of low carbon society; and the realization of expert interviews and focus groups. One of the results of the research was to illuminate a rise of the human factor that, in the transition context, tends to assume a leading role in changing energy systems. The Second Session was devoted to the discussion of energy models and scenarios to 2050 that the project is developing and which will be completed at the end of 2015.

15 December 2015, International Seminar in Brussels

MILESECURE-2050 INTERNATIONAL SEMINAR "THE HUMAN FACTOR IN ENERGY TRANSITION & SECURITY TOWARDS 2050". Multidimensional Knowledge, Innovative Models, Effective Policies.

Reduced emissions, increased use of renewable energy and energy saving are the key environmental objectives that Europe has embedded in its strategy for 2020 and beyond to face the challenges of climate change and energy security. But changing energy systems has social, cultural, economic, political, geopolitical, and lifestyle implications that risk to be underestimated by traditional and strictly disciplinary studies. This is the background to the Final International seminar. The seminar was devoted to discuss the final results of the MILESECURE-2050 project and focused on the three key issues: Multidimensional Knowledge; Innovative Models; Effective Policies. For each one of these themes a paper highlighting the results of the project was presented and a dedicated working session was organised to discuss the results. After the working session a Round table discussed the results of the project with European experts and policy makers.

SECTION 5: The address of the project public website, if applicable as well as relevant contact details.

The project's website was developed and is online at http://www.milesecure2050.eu