

# Preface

When in 2015 we resolved to organize the experts' round-table discussions that led us to decide to write this book,<sup>1</sup> we were aware of two central problems affecting current mainstream policy and research activities for a sustainable energy transition.

The first problem relates to a very controversial dichotomous approach still mostly adopted by scientists and policy makers when carrying out these activities. On the one hand, they indeed still mostly aim at identifying and implementing solutions that may increase the sustainability of human activities by fostering the substitution of *single* technologies with assumed equivalent models functioning with less energy inputs and causing less harmful emissions in the atmosphere. On the other hand, they aim at finding and stimulating the adoption of policy approaches that can change the behaviour of technologies end-users. In doing so, they assume that end-users can somehow be individually persuaded to buy these alternative models or be induced to modify their conduct when employing single energy consuming technologies and do not take into account systemic factors may impede achieving expected policy impacts.

This dichotomous approach can certainly contribute to improve the energy efficiency of single technical applications in important ways, this result representing a very relevant result. When assessed against the possibility that it can lead to an overall reduction in the consumption of natural resources caused by human activities, it results nevertheless highly problematic in so far as it misses to take into account how individuals and technologies are nowadays interlinked within complex systems which evolve according to logics that it cannot capture. Indeed agency (i.e. the power to generate change) has to be considered nowadays as distributed over large series of human and non-human actors,<sup>2</sup> including a variety of technological products, institutional settings, rules and habits that co-determine people behaviours and all together induce a trend of energy consumption growth which neither

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<sup>1</sup>See <http://iet.jrc.ec.europa.eu/energyefficiency/round-table/experts-round-table-practice-theory-and-complex-adaptive-systems-theory> for further information on this round-table.

<sup>2</sup>On this point see, for example, Latour (2005).

individuals, nor more energy-efficient technologies can reverse. Individuals taken alone cannot for example change the social constraints obliging them to commute every day or to buy houses where it is impossible to live without air conditioners. Moreover, the dynamics of growth triggered by the above-mentioned complex systems make often practically inevitable that the energy saved by one technology is then used as input for another technology in order to sustain this growth. In addition, the high level of power output that people composing societies can presently generate through these complex systems could be hardly achieved when renewable energy sources substitute on a large-scale non-renewable energy sources.

Although capable of determining relevant reductions in the consumption of energy inputs and in the production of greenhouse gas emissions that can be associated with the employment of single technical applications, the above-described dichotomous approach is hence affected by important limitations, which have to be ultimately considered as a consequence of two facts: it cannot significantly alter the overall energy consumption dynamics developing within current complex socio-technical systems, and it does not consider that a radical transition to renewables entails a radical reorganization of societies.

These are the main considerations that convinced us about the absolute relevance of alternative research and policy approaches that can take these complex dynamics into account.

At the same time, however, we were also aware of a major reflexivity problem affecting policy and research approaches informed by complexity. This problem relates to how social aggregates are mostly erroneously identified with kind of motors and information processors simultaneously maximizing their power output and energy efficiency while consuming abstract units of energy, time, information, money, etc. that are taken as actual ontological entities. Researchers and main stakeholders involved in the design and implementation of policies for energy sustainability tend indeed to identify socio-technical systems with input-output systems, while often forgetting that behind the abstract flows of resource units that they take as real entities and try to change there are very concrete and specific social habits, and there are people made of flesh who can, on the one hand, potentially actively contribute to face contemporary sustainability challenges and, on the other hand, may not react as expected to implemented policies.

This problem, however, does not only affect policy approaches and solutions developed by specialists and experts. It actually concerns societies at large and the way in which people currently imagine the world around them. We think that this problem is the result of a large-scale social construction that has led motors and computers to become central metaphors whereby the functioning of societies and human beings is explained and being reorganized. The complex systems resulting from this social construction can generate enormous material benefits but are also responsible for an increased dependence on the technological supply and efficient utilization of given homogenized and standardized resource units while causing the disappearing of a variety of alternative practices established by people to provide for their necessities.

The dynamics of growth that can be triggered by these complex systems certainly contribute to increase material well-being in important ways. Moreover, the complexification of energy systems that might accompany the ongoing massive transition to renewable energy sources can generate huge environmental benefits. It is for example the possibility of generating an organized complexity that makes possible to conceive that highly distributed renewable energy sources can substitute non-renewable sources and be used to supply the energy needed by present large social aggregates. At the same time, however, the dynamics of these complex systems seem to obey abstract logics escaping any form of social control, whilst an increased complexification of existing energy systems can determine more frequent cases of crash and disengagement from rules and principles established by societies to regulate themselves due, among others, to an associated increased dependency on energy flows that can change unpredictably.

It becomes hence extremely relevant to understand how these dynamics are generated by existing social practices and how the development of new practices can possibly allow accomplishing the above-mentioned transitions in a more sustainable way while allowing preventing unwanted systems crashes or coping with these generally very unpleasant situations whenever they may occur.

These are the considerations that led us to conclude that the sustainability challenges posed by complex systems have to be necessarily also addressed by trying to take existing social practices and related theories as main research and policy target.

The policy approaches that can be designed and implemented in this way are generally radically different from approaches informed by complex systems theories. Whilst policy and governance strategies informed by these latter theories are inevitably based on considerations concerning existing and future energy, material and monetary flows, strategies informed by theories of social practices are supposed to take existing possibilities to reorganize the outputs of concrete actions undertaken by people as main starting point. Whilst the former strategies are informed by abstract considerations concerning inputs needed and outputs produced, the latter strategies can be designed based on considerations concerning what people say and do and how they organize and can concretely change own habits in a given context. Finally, whilst the former strategies are mostly based on technical considerations and do generally foresee a very limited active involvement of people in their design, the latter strategies are more genuinely political in so far as they relate to aspects that people can actively contribute to modify. In the case of future large-scale transitions to hypothetical renewable energy distribution networks, the former strategies are, for example, often focused on technical and economic interventions allowing an automated and mutual adaptation between energy demand and supply, whilst the latter strategies target people practices in their entirety and can be focused on whether and how these practices can be actually changed or reorganized by people in order to make them compatible with the increasingly intermittent energy availability that might be expected from these networks.

We are convinced that the different characteristics of these two strategies reflect a fundamental and unescapable complementarity that can be identified in the approaches that can be followed when developing or employing rules, material

artefacts, institutional settings and know-how whereby societies are organized. On the one hand, these societies can develop or rely on general and abstract rules and principles that can be blindly applied to all of its members who are in this way mostly identified with kinds of passive users (this might happen for example in case of rules and technical solutions that can be implemented to allow that aggregated electricity demand and supply can be balanced in future smart grids). On the other hand, they must cultivate a particular practical sensibility allowing that these general rules and principles can be adapted and subordinated to the initiatives undertaken by individuals and to their specific conditions (in the previous example of the smart grids this might for example entail a subordination of these rules and principles to practices developed by people who could in this way be made collectively responsible for the management of the energy resources, the technical apparatus and the institutional settings whereby these grids can be administered). We think that the insights provided by social practices theorists can help policy makers and researchers to cultivate this particular sensibility, given the fact that a suitable way to combine the two above-mentioned approaches has always to be found and the fact that the prevailing of one out of the two approaches within policy making is generally destined to cause disasters of various nature.

Based on the above considerations, we decided to gather around a table a series of acknowledged scientists working on complex systems and social practices. Given the interdisciplinary character of the questions we wanted to address, very different competences were represented. The invited scientists are indeed acknowledged sociologists, physicists, engineers, economists, anthropologists, biologists, ecologists and policy analysts. During the two-day event we organized we managed to discuss some of the above questions with them, whilst other experts that could not be with us were sent the proceedings of our meeting and were involved in the e-mail discussions that took place during the following weeks. Altogether we then decided to produce a publication that could hopefully serve to make the scientific community and policy makers more aware of the relevance of the analysis approaches discussed and of the insights that can be gained through their application.

The present book is the result of this interdisciplinary effort.

Nicola Labanca

Paolo Bertoldi

Isabella Maschio

Daniele Paci

European Commission, Directorate-General Joint Research Centre

Unit C.02 Energy Efficiency and Renewables

Ispra,

Italy

## **Reference**

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