

Steps Towards a 2000 Watt Society: Developing a White Paper on Research Development of Energy-Efficient Technologies

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- 8) **External researcher(s):** no entry

- 9) **Funding source(s):**
 - ETH internal grant

- 10) **Partner organizations:** no entry

- 11) **Short Summary:** This pre-study examines the question whether a reduction of the per capita

energy demand in Europe by two thirds seems to be technically feasible within 50 years despite of additional economic growth. Enormous efforts in R&D and a total turnover of the existing capital stock would be needed.

12) Keywords: Chemistry, Economics, Engineering Sciences, Materials Technology, Physics, Psychology

13) Project description:

In the coming decades, the likely stagnation of oil production between 2020 and 2030, the re-concentration of crude oil production in the Near East, and the threat and consequences of climate change, will compel industrialised nations to make much more efficient use of energy and of materials that are energy-intensive. Research and development within this decade that helps realise energy efficiency potentials is likely to be regarded as important in scientific, entrepreneurial, and political realms.

In 1998 the Board of the Swiss Federal Institutes of Technology promoted the vision of a "2000 Watt per capita society by the middle of the 21st century". A yearly 2000 Watt per capita energy demand corresponds to 65 GJ/capita per year, which is one third of today's per capita primary energy use in Europe. Assuming a growth of GDP (gross domestic production) per capita by 70 to 80 % within the next 50 years, the 2000 Watt society implies a factor 4 to 5 improvement in primary energy use, admitting some influence of structural change on less energy-intensive industries and consumption patterns.

Objectives

This vision poses a tremendous challenge for R&D to improve energy and material efficiency. It is obvious that completely new technologies and supporting organisational and entrepreneurial measures are needed to meet this goal. Hence, the vision has to enquire:

- û Are the necessary efficiency goals achievable in principle by 2050?
- û Which technologies and conditions are central to arrive at the 2000 Watt per capita vision in 2050?
- û When do they need to be available in order to unfold their desirable impact by 2050?
- û Which kind of R&D and other policies have to be installed today?

To approach these questions, the technological areas and necessary research have been screened in a first attempt. Valuable advice and suggestions given by expert colleagues in Switzerland and abroad, particularly by the participants in the international workshop on 9-10 September 2002, have been collected and summarised in the pre-study.

In view of the challenges facing humanity this century, the question of how to further research and policy in energy and materials efficiency, and how to convincingly promote and effectively

organise that, must be insistently re-addressed based on the experience of the pre-study carried out in 2002.

Methodology and results

The pre-study examined efficiency potentials in energy's transformation from primary energy to useful energy and, more importantly, from useful energy to energy services. It is easy to envisage technologies that would make a 2000 Watt society possible by the year 2050. However, without exploiting the opportunities re-investment cycles offer, a 2000 Watt society will not emerge and will not even be technologically feasible. The pre-study emphasised the enormous size of energy conservation potentials achievable not only by reducing energy losses but also by decreasing the specific demand for several different energy services through improved material efficiency and intensification of product use (Figure 1).

The pre-study reaches the following definitive conclusions:

- (1) Achieving 2000 Watt per capita by the middle of this century implies a complete re-investment of the capital stock in industrialised countries (and a complete re-furbishment of the building stock to be used in 2050).
- (2) In light of these requirements, energy research must be understood to encompass all technical systems that use energy during their operation and production phases, not solely energy conversion technologies.
- (3) Reducing current per capita energy demand by two-thirds within five decades requires not only research in natural and technical sciences but also behavioural research on decision making and day-to-day operation and innovation in industry, services, crafts, transportation, and private households.
- (4) Moreover, the transition to a 2000 Watt per capita society needs the support of a fundamental change in innovation system (e.g. research policy, education, standards, incentives, intermediates and entrepreneurial innovations). This system must be continuously extended, evaluated, and improved over the coming decades with the perspective being part of a Swiss policy on sustainable development.

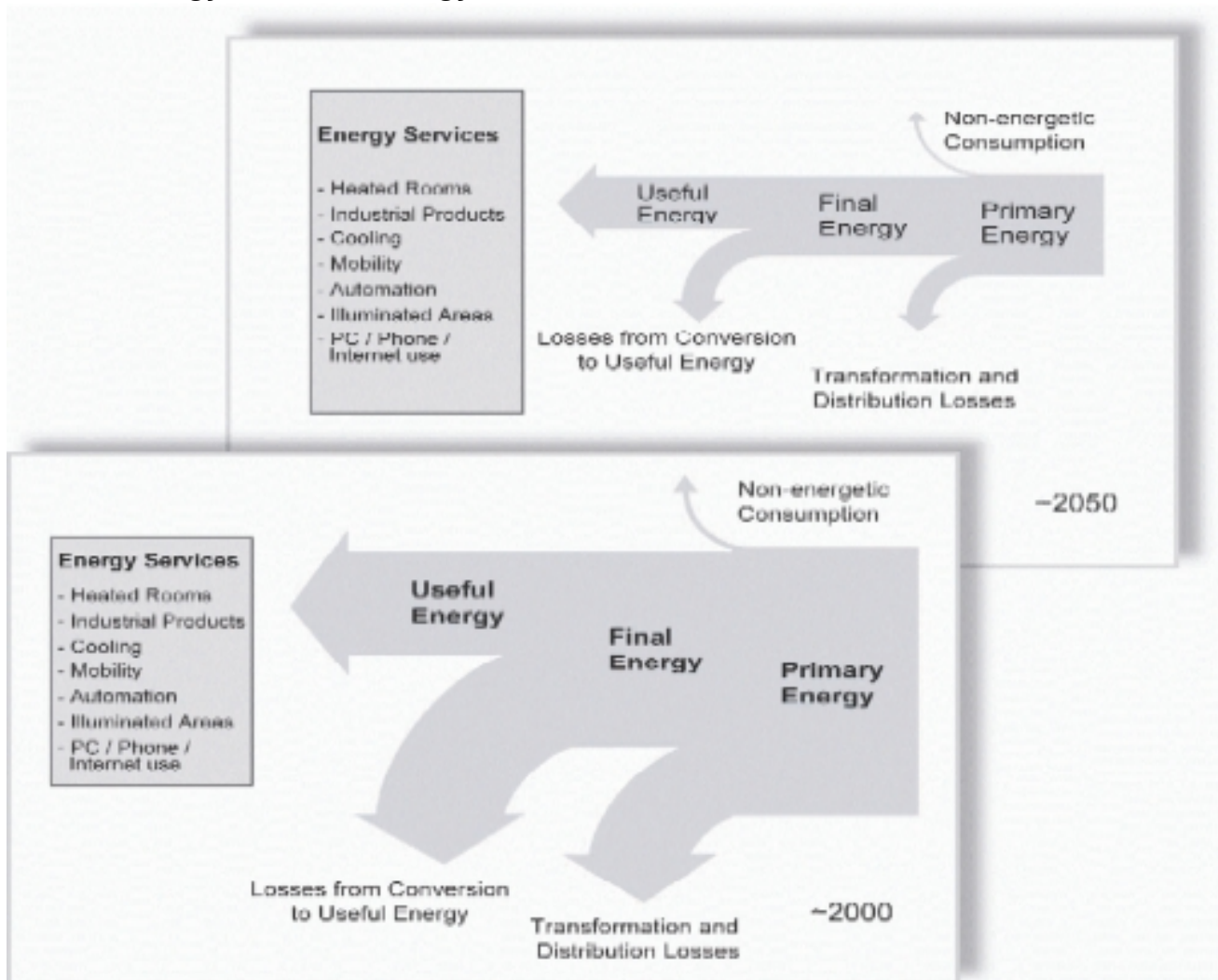
The authors of the pre-study strongly recommend the design of a research programme and process that could have a decisive impact and help Switzerland and European countries to become leaders in technologies for a 2000 Watt society.

The White Paper on Research & Development of Energy-Efficient Technologies was positively reviewed by the International Human Dimension Programme for endorsement by the members of the Industrial Transformation Scientific Steering Committee and the International Project Office (IPO) in summer 2003.

14) Popular description: no entry

15) Graphics:

Energy flows and energy services of Switzerland in 2000 and 2050



Centre for Energy Policy and Economics (CEPE)

16) Publications:

- Jochem, E., Favrat, D., Hungerbühler, K., Rudolph von Rohr, P., Spreng, D., Wokaun, A., Zimmermann, M., co-contributors: Semadeni, M., Goldblatt, D., Kemmler, A., Lienin, S., Janssen, A., Gutzwiller, L., Keller, P., Kölble, C., Primas, A., Weber-Marin A. S., Maréchal F., Richter K. 2003. Steps towards a 2000 Watt Society, Developing a White Paper on Research Development of Energy-Efficient Technologies. Centre for Energy Policy and Economics (CEPE), ETH Zurich and novatlantis, (Pre-study, Final Report), Zurich, 190.

- Jochem, Eberhard; Rudolf von Rohr, Philipp; et al. 2004-01-01. Steps towards a sustainable development, A white book for R&D of energy-efficient technologies. Novatlantis, Dübendorf.

17) Links to important web pages:

- <http://www.novatlantis.ch>