Introduction to Panel 9 Products, appliances, ICT

Panel leader: **Eva Geilinger**
Swiss Federal Office of Energy
Switzerland
eva.geilinger@bfe.admin.ch

Panel leader: **Thomas Götz**
Wuppertal Institut
Germany
thomas.goetz@wupperinst.org

The energy efficiency of products, appliances, as well as information and communication technologies (ICT) has improved considerably over the last couple of decades. Product policy was a main driver for this progress. Minimum energy performance standards (MEPS) and energy labelling (together abbreviated as S&L) are widely implemented around the world, on mandatory or voluntary basis. They are at the heart of this panel. Research on energy consumption and saving potentials, sustainable procurement initiatives and subsidy programmes typically precede and complement S&L product regulation. Nevertheless, efficiency potentials are still far from being fully utilised, and challenges remain for market actors and policy makers as traditional markets and technologies are in a process of rapid transition. That said, energy efficiency policies for products are well established, and at present, efforts to cover wider environmental aspects such as resource efficiency and hazardous waste reduction are tangibly gaining momentum. As digitalisation continues, it is opening up opportunities for new efficiency gains and more far reaching product information requirements. Researchers are also rightly keeping an eye on the growing energy demand for data centres and ICT infrastructure. Global economic development and unfortunately climate change are further heightening the need to find sustainable solutions in particular, but not only, for heating and cooling equipment.

Heating & cooling: solutions that should be the new normal?

Efficient heating, cooling and ventilation equipment is essential for achieving climate protection targets. In this context, Roscetti et al. (extended abstract 9-003-21) tackle the question if heating with air conditioners could be an approach for a fast and affordable transition towards carbon neutrality. The paper presents results on the quality of appliances installed, their consumption levels, installation features and their costs for selected case studies with air-to-air heat pumps in new and refurbished buildings located in Switzerland in the alpine or pre-alpine areas.

Attali et al. (peer-reviewed paper 9-216-21) address the topic of heating and cooling equipment from the sufficiency perspective in terms of fixing problems in buildings as well as from the efficiency perspective by investing in new equipment. The H2020 project "HACKS – Heating and Cooling Knowhow and Solutions" works on both these axes. The authors present best practice examples as well as the tools developed by the HACKS project.

With focus on Standards and Labelling (S&L) for evaporative air coolers (EACs), Sharma et al. (peer-reviewed paper 9-087-21) analyse a roadmap to affordable and sustainable space cooling solutions in India. EACs can provide thermal comfort by evaporation of water to cool and humidify the supply air in residential and commercial settings under India's hot-dry and composite climatic zones. The aim of the authors' work is to bridge the information gap on standards nationally and internationally to support the development of S&L for efficient EACs in India.

Considering comfort fans as an affordable alternative to air conditioners, Rochat (peer-reviewed paper 9-024-21) compares product-specific energy efficiency requirements in Europe and in Asia. Due to a lack of minimum energy performance standards (MEPS) for fans in the EU, environmental dumping is taking place in Europe. Products that are being imported often

have a lower energy efficiency performance than required by the domestic MEPS implemented in the countries of product origin (e.g. China). Based on the gained results, the paper presents recommendations to improve EU policies.

Product regulation: market surveillance and monitoring

As important part of energy efficiency policies, market surveillance and monitoring is essential to ensure compliance with existing regulations and to gain data for new or revised polices. In this context Papazoglou (extended abstract 9-189-21) tackles the question why and how quantification of energy and non-energy impacts can influence consumer behaviour to support energy policy innovations in the EU. Based on the EEPLIANT 2 and 3 joint actions, the author discusses key results and aspects of the modelling of product noncompliance.

The general topic of circumvention and suspected manipulation of test results came into focus after scandals of manufactures trying intentionally to bypass regulations and test approaches. Graulich et al. (peer-reviewed paper 9-001-21) present results of the Horizon 2020 project "ANTICSS – Anti-Circumvention of Standards for better market Surveillance". Their paper presents definitions and examples of circumvention, including impacts, mitigation measures and recommendations for policy and standardisation.

Kreitz et al. (extended abstract 9-224-21) present results on the usefulness of sales data from systematic market monitoring for better understanding energy efficiency development of appliances. In a report published in 2021, comprehensive sales data from GfK for refrigerators, washing machines and tumble driers were analysed for the French, German, Italian and EU markets 2004 to 2019. For the three given product groups key observations as well as respective policy recommendations are presented.

With regard to the market in India, Kumar et al. (peer-reviewed paper 9-030-21) discuss impacts of the country's mandatory MEPS and labelling programme for refrigerators. In contrast to other world regions (including the EU), manufacturers, importers and traders on the Indian market are also required to register production data for appliances. Based on this national database for registered labelled appliances, the trends of technology evolution and market transformation as result of domestic efficiency policies are analysed and potentials for revisions are discussed.

Product regulation: evaluating effects

For the design and revision of energy efficiency policies, evaluating expected or achieved effects of different policy options is essential. With focus on the Nordic countries in Europe, Mogensen et al. (extended abstract 9-046-21) present an effect calculation module from the NORDCRAWL project. The paper illustrates the impacts of EU Ecodesign and energy labelling regulations, as well as estimated effects of complementary policies at a national level, including trends in market development and the need of market surveillance measures. Furthermore, potential future applications of effect modelling in the context of a circular economy are discussed.

Brocklehurst (peer-reviewed paper 9-031-21) asks if necessity has been the mother of invention. The question if S&L policies have driven manufacturers to innovate and to increase their competitiveness is analysed by a review of existing literature concerning assessments on the innovative effect of S&L. The paper presents the summarised results from the performed literature review.

With focus on four Latin American markets (Argentina, Brazil, Chile and Peru), Alatrista Corrales et al. (peer-reviewed paper 9-026-21) present insights from the international Topten initative. The four countries have different political and socio-economic conditions for the implementation of energy efficiency initiatives. Impacts of Topten in these countries are discussed for five main drivers of impact: (a) level of development of the national Topten website, (b) impact on the development of policy instruments, (c) involvement with retailers and manufacturers, (d) involvement with policy makers and (e) involvement of buyers.

Malinowski et al. (peer-reviewed paper 9-210-21) present the Mepsy Tool for analysing climate impacts and accelerating policies, launched by CLASP in 2020. This new, free modelling system currently provides appliance efficiency estimates for six high-energy using products (space heating equipment, air conditioners, refrigerators, motors, fans, and televisions) across 162 countries through a Web interface. This system for global and national analysis is based on the latest authoritative data available, and is intended to support the adoption of more comprehensive appliance policies.

Products, technologies and policy implications

With an extensive online survey of Swiss data centres, Müller et al. (peer-reviewed paper 9-162-21) investigate the most important parameters for estimating power consumption (installed capacity, power usage effectiveness, utilization) and energy efficiency measures (such as to increase the system temperature, adopting free cooling, using efficient storage and back-up systems). They find that while some efficiency potential has been tapped, partly because of promotion programs, there are still significant saving potentials of around 46 % of the total power consumption to be harnessed.

Kachhawa et al. (peer-reviewed paper 9-083-21) show the far-reaching multiple benefits of modernizing existing traditional cold storage facilities in West Bengal, India, into multipurpose cold storages. Detailed energy audits of three facilities and an assessment of energy efficiency measures (EEMs) demonstrate significant potential for improvement. The energy savings coupled with the monetary benefits of avoided food losses present a payback period of just 1.6 years. By better maintaining quality, stretching the product's marketable time and servicing a more diversified farmer's crop production, the investment also permits farmers to realize greater economic values and boost their income.

The rapid improvement in the efficacy of LED products requires an extrapolation (i.e. trend prediction) in order to determine suitable levels for performance requirements in new or revised policies. Isoardi & Coyne (extended abstract 9-160-21) present a method on how to do this based on historical performance data. The availability of suitable data and the criteria for its inclusion in the analysis and development of trend projections is discussed.

As the new EU product database EPREL is not yet accessible for statistical analysis, Schischke et al. (peer-reviewed paper

9-056-21) derived recent market data on energy efficiency class distributions (after the rescaling of the EU label) by an analysis of a price comparison website covering the market in Germany. The results show a quite different picture for different product groups. While some (like dishwashers) make good use of the new scale and still leave room for innovation, e.g. many washing machines are already in the best performance classes A and B. The authors propose that the analysis may serve as reference for future in-depth evaluations as soon as the EPREL data export feature will be available (announced by the European Commission for late 2021 or in 2022).

Two decades after the first regulation for household appliances, the EU adopted S&L also for appliances in the business-to-business (B2B) market: for professional refrigerated storage cabinets in 2016, followed by commercial refrigerating appliances with a direct sales function in March 2021. Voluntary initiatives like Topten support the market transformation e.g. with the implementation of rebate schemes and the continuous monitoring of best available technology (BAT) on the market. Hepp et al. (peer-reviewed paper 9-021-21) discuss what lessons may be transferred from household to commercial appliances and where they see potential of further product regulations in the B2B market.

While Switzerland has a successful mandatory energy label for residential coffee machines since 2015, this product group still remains unregulated in the EU. The label is thought to have boosted the adoption of better insulation of boilers and the very effective flow through-type heaters. Gross & Bush (peer-reviewed paper 9-023-21) present results from a recent Swiss study on commercial coffee machines. They formulate recommendations to expand S&L to further residential and commercial coffee machines, in particular in the EU.

Product regulation: becoming digital, environmental and system-oriented

Adisorn et al. (extended abstract 9-061-21) sketch the design of a Digital Product Passport (DPP) as envisioned today. The DPP is supposed to provide information on a product's origin, its composition, repair and disassembly possibilities as well as on handling at the end of its service life. Depending on its exact design and intended granularity of information, a DPP would require an adaptation and partial rethinking of current product policies (i.e. further development of already existing information requirements).

Policies with a broader scope on systems instead of single products could address a larger share of the energy consumption in an integral way to increase saving potentials. Siderius et al. (peer-reviewed paper 9-008-21) explore a methodological approach for transforming product efficiency policy into system efficiency policy. They provide a definition of a system, and a classification of systems that is used to analyse options for regulating them. Examples from regulatory approaches in the EU (for water pump units), and in the US and Canada (for walk-in coolers and freezers) illustrate possible solutions. The authors find that verification procedures and test methods in particular need to be more flexible to fit systems.

The EU's Restriction of Hazardous Substances Directive (RoHS) has the inherent opportunity that its scope can be expanded to all mercury-containing fluorescent lighting products (including some still allowed under EU Ecodesign regulations) to accelerate the phase-out of those products due to their toxicity rather than their energy efficiency or least life-cycle costs. In their paper, Scholand & Bennich (peer-reviewed paper 9-218-21) offer a case study of banning fluorescent lighting by the RoHS Directive in Europe and present an analysis of environmental benefits if the international Minamata Convention could achieve a global phase out of toxic fluorescent lamps.

Suzaly et al. (peer-reviewed paper 9-006-21) investigate the electricity consumption of network-connected household appliances. An existing bottom-up model is extended in this study to calculate upstream energy use, defined as the energy required by data centres and the access network's efficiency in transferring data. The consumption of different operation states is examined by further separating operation and standby usage into conventional (non-connected) and network-connected usage. The authors find that the additional energy demand of network-connected devices and their upstream energy demand is relatively low. They see large potential for smart devices to assist in achieving energy policy targets.