

Fraunhofer IPA

Fraunhofer Institute for Manufacturing Engineering and Automation IPA

Advancing Systemic Efficiency

A Holistic Approach for Energy Resilience, Cost Savings, and Emission Reduction

Dr. Stefan M. Buettner (EEP / FhIPA)

ECEEE's Zero Carbon Industry – 31/01/2024, Antwerp

The Vision

"Increasing energy resilience, saving costs, and curbing emissions with systemic efficiency approaches."

© Dr. Stefan M. Buettner

University of Stuttgart
Institute for Energy Efficiency in Production EEP
Fraunhofer IPA

Advancing Systemic Efficiency

A Holistic Approach for Energy Resilience, Cost Savings, and Emission Reduction



Integration and Interaction for Systemic Efficiency



Empowering stakeholders



Industrial Sector Challenges and Opportunities



Storage and Demand-Side Flexibility



Digitalization for Enhanced Efficiency



Buildings, Urban Planning, Mobility and the Energy System

© Dr. Stefan M. Buettner

University of Stuttgart
Institute for Energy Efficiency in Production EEP
Fraunhofer IPA

Advancing Systemic Efficiency

A Holistic Approach for Energy Resilience, Cost Savings, and Emission Reduction



Integration and Interaction for Systemic Efficiency



Empowering stakeholders



Industrial Sector Challenges and Opportunities



Storage and Demand-Side Flexibility



Digitalization for Enhanced Efficiency



Buildings, Urban Planning, Mobility and the Energy System

© Dr. Stefan M. Buettner

University of Stuttgart
Institute for Energy Efficiency in Production EEP
Fraunhofer IPA

Lesson learned

“Systemic efficiency necessitates clarity about the aspired goal available and feasible input factors for the desired outcomes and knowledge of the current state.”

This principle applies regardless of….

the **sector**

the **level of flight**, whether it is **buildings, industry, mobility, the energy system, urban planning** or general **policy design**.

© Dr. Stefan M. Buettner
University of Stuttgart
Institute for Energy Efficiency in Production EEP
Fraunhofer IPA

Advancing Systemic Efficiency

A Holistic Approach for Energy Resilience, Cost Savings, and Emission Reduction



Integration and Interaction for Systemic Efficiency



Empowering stakeholders



Industrial Sector Challenges and Opportunities



Storage and Demand-Side Flexibility



Digitalization for Enhanced Efficiency



Buildings, Urban Planning, Mobility and the Energy System

© Dr. Stefan M. Buettner

University of Stuttgart
Institute for Energy Efficiency in Production EEP
Fraunhofer IPA

Lesson learned

“Success of energy efficiency programs hinges on promotion and facilitation.”

Targeted support for MSMEs is a crucial element…

- in **creating** awareness & a feel of urgency/responsibility.
- in **enabling** the ability of taking up systemic efficiency opportunities across businesses.
- in **breaking** the ice & creating trust among stakeholders.
- in **identifying** waste in form of resources & energy

Creating **perception** among **employees, users or household members** will embed the ability to recognize such waste and identify optimization opportunities

© Dr. Stefan M. Buettner

Advancing Systemic Efficiency

A Holistic Approach for Energy Resilience, Cost Savings, and Emission Reduction



Integration and Interaction for Systemic Efficiency



Empowering stakeholders



Industrial Sector Challenges and Opportunities



Storage and Demand-Side Flexibility



Digitalization for Enhanced Efficiency



Buildings, Urban Planning, Mobility and the Energy System

© Dr. Stefan M. Buettner

University of Stuttgart
Institute for Energy Efficiency in Production EEP
Fraunhofer IPA

Lesson learned

"The exploitation of unused waste heat potential is hampered by a lack of knowledge, so that large potentials remain unrecognized or neglected."

Which is tragic since **heating & cooling efficiency** are the biggest levers…

- in **reducing** energy related emissions in the industrial sector.
- in **easing** the energy crises.
- in **achieving** systemic efficiency.
- in **electrification** or **fuel switching** (e.g. gas to hydrogen).

Due to the associated costs and availability, the identification of unnecessary **consumption and utilization of waste heat** to reduce energy demand represents a huge **–** often untapped **- opportunity** for many.

© Dr. Stefan M. Buettner

Advancing Systemic Efficiency

A Holistic Approach for Energy Resilience, Cost Savings, and Emission Reduction



Integration and Interaction for Systemic Efficiency



Empowering stakeholders



Industrial Sector Challenges and Opportunities



Storage and Demand-Side Flexibility



Digitalization for Enhanced Efficiency



Buildings, Urban Planning, Mobility and the Energy System

© Dr. Stefan M. Buettner

University of Stuttgart
Institute for Energy Efficiency in Production EEP
Fraunhofer IPA

Lesson learned

“At both system and user level, the ability to adapt energy demand to an unstable supply and/or to use suitable storage types for one’s own forms of energy is essential in increasing energy resilience”

The ability to adapt one's energy demand….

- ensures a more stable energy system.
- increase the security of supply.
- enables proportional self-sufficiency in combination with local generation.

© Dr. Stefan M. Buettner

Advancing Systemic Efficiency

A Holistic Approach for Energy Resilience, Cost Savings, and Emission Reduction



Integration and Interaction for Systemic Efficiency



Empowering stakeholders



Industrial Sector Challenges and Opportunities



Storage and Demand-Side Flexibility



Digitalization for Enhanced Efficiency



Buildings, Urban Planning, Mobility and the Energy System

© Dr. Stefan M. Buettner

University of Stuttgart
Institute for Energy Efficiency in Production EEP
Fraunhofer IPA

Lesson learned

“Digital approaches, including monitoring the consumption of energy, are the basis for detecting anomalies, identifying potential, optimizing use and developing mixes of measures to achieve systemic efficiency.”

These types of energy include but are not limited to…

- Electricity
- Heating & Cooling
- Compressed Air
- Oil
- Gas
- Coal

© Dr. Stefan M. Buettner

Advancing Systemic Efficiency

A Holistic Approach for Energy Resilience, Cost Savings, and Emission Reduction



Integration and Interaction for Systemic Efficiency



Empowering stakeholders



Industrial Sector Challenges and Opportunities



Storage and Demand-Side Flexibility



Digitalization for Enhanced Efficiency



Buildings, Urban Planning, Mobility and the Energy System

© Dr. Stefan M. Buettner

University of Stuttgart
Institute for Energy Efficiency in Production EEP
Fraunhofer IPA

Lesson learned

“Preserving prosperity, enabling it elsewhere while addressing the climate crisis requires heightened awareness of system interactions and solutions that transcend disciplines.”

It requires…

- the procurement of knowledge, resources & skilled labor.
- affordable & accessible technology.
- a consideration of technical, economic, strategic, and psychological measures, required as a foundation of sustainable, robust, and emission-neutral operations.
- overcoming the perceived risks that come with “unfamiliarity”, that’s keeps companies from adopting technological solutions

© Dr. Stefan M. Buettner

Moving forward

Advancing Systemic Efficiency

Register for Bi-Monthly-Series:
https://forms.office.com/e/ThWMNNnByt

Visit the UNECE Group of Experts:
https://unece.org/sustainable-energy/energy-efficiency

Get more detailed insights into this discussion:
https://unece.org/sed/documents/2023/10/reports/report-energy-efficiency-tenth-session

© Dr. Stefan M. Buettner





Thank you!

Dr. Stefan M. Buettner
Co-Lead Circular Economy & Climate Neutral Manufacturing,
Fraunhofer IPA
Director Global Strategy & Impact, EEP
Chair UN ECE Task Force on Industrial Energy Efficiency

ECEEE's Zero Carbon Industry – 31/01/2024, Antwerp