

**INDICATORS FOR SUSTAINABLE ENERGY
DEVELOPMENT FOR AUSTRIA (ISED-AT)
RESIDENTIAL BUILDINGS AND ELECTRICITY AND HEAT SUPPLY**

ISEE Conference 2016, Washington, 29th June 2016

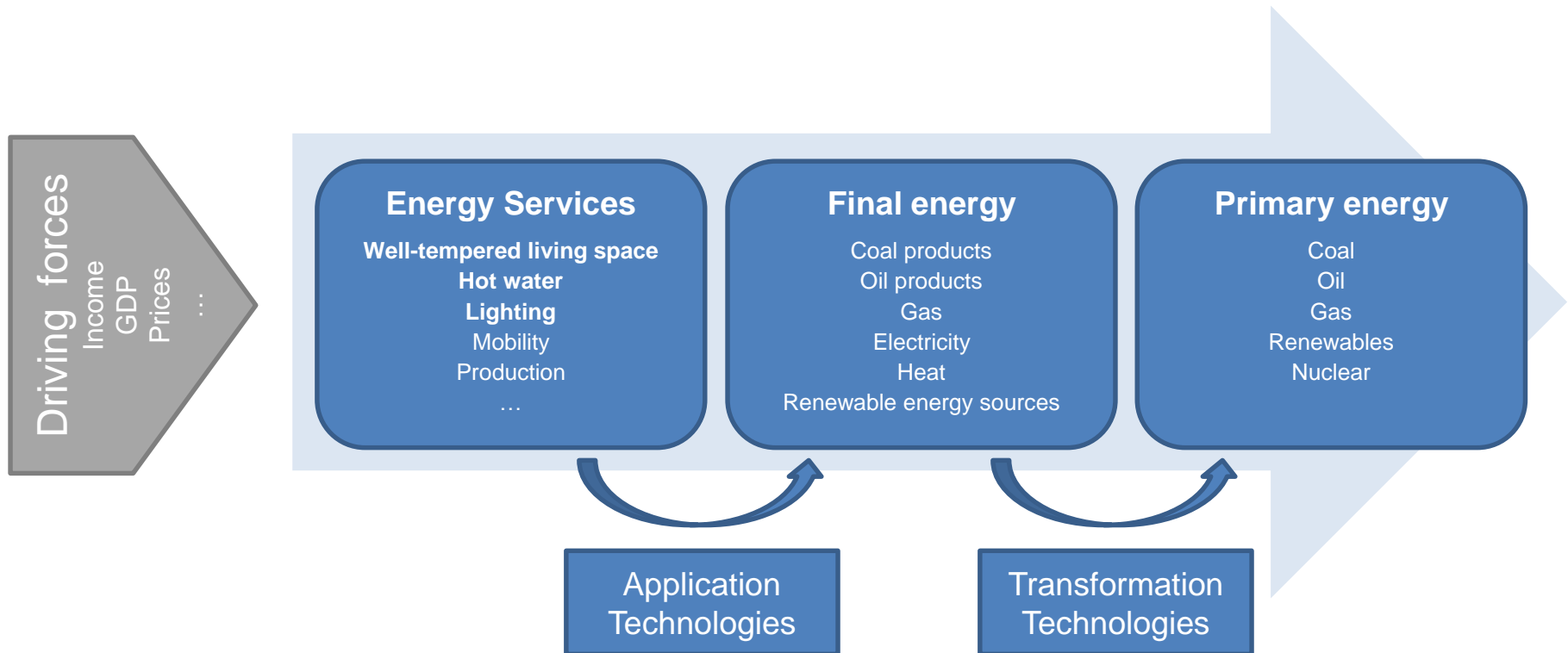
Claudia Kettner

- For reaching the long-run emission reduction targets a fundamental transformation of our societies and energy systems is indispensable
- The energy transition requires adequate information and measurement systems in order to monitor the transformation pathways
- Indicator sets are considered an appropriate tool to steer an energy transition
- ➔ They account for the complexity arising from the interaction between economy, society and ecosystems

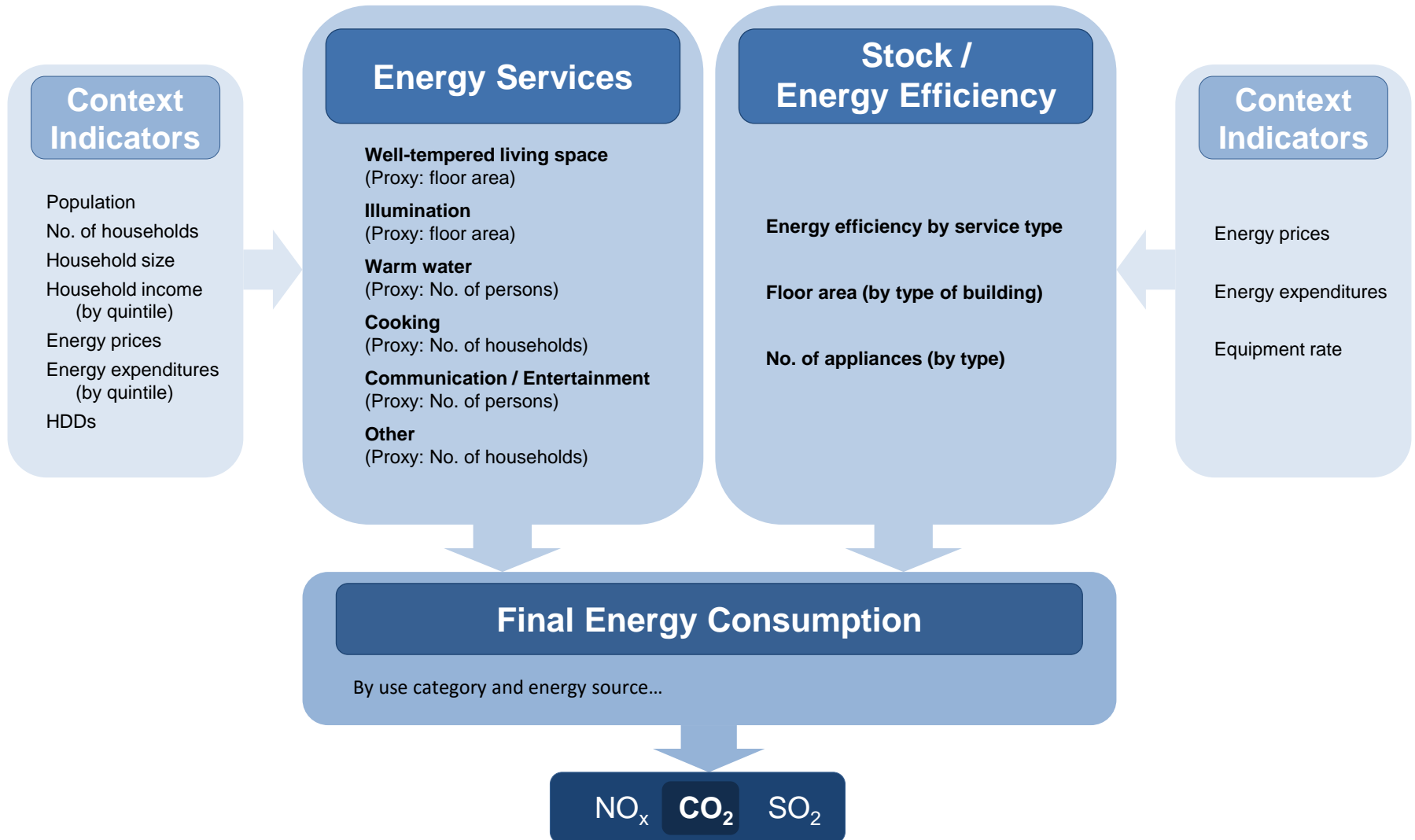
- Central role of energy is recognized in prominent SD indicator sets (EU SDIs, UN SDGs,)
- Other indicator sets focus on energy as a key element of sustainable development, e.g.
 - Sustainable Energy Development (SED) Indicators (IAEA/IEA, 2001)
 - 41 indicators covering the whole energy system as well as the driving forces of energy use and supply
 - Structured according to the three dimensions of sustainable development
 - Focus on economic dimension
 - Energy Indicators for Sustainable Development (IAEA et al., 2005)
 - 30 indicators; refinement of SED indicator set
 - Aggregation of SEDs to composite indices (Davidsdottir et al., 2007; Ibarrarán Viniegra et al., 2009; Mainali et al., 2014)

- Development of an indicator system on the basis of specific energy services for residential buildings and electricity and heat supply
- Compilation of the indicators for Austria
- The comprehensive indicator concept proposed by IEA and IAEA (2001) and IAEA et al. (2005) serves as starting point, but is advanced in several respects:
 - Emphasis of the role of energy services instead of energy flows for welfare
 - Integrated perspective of the energy system that covers the whole energy chain from energy services to primary energy supply
 - Aggregation of a selection of indicators to composite indices

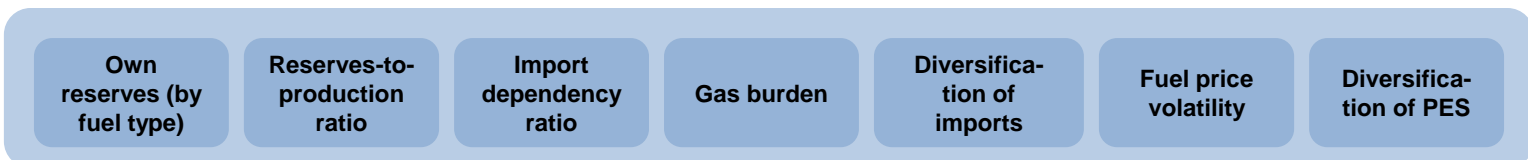
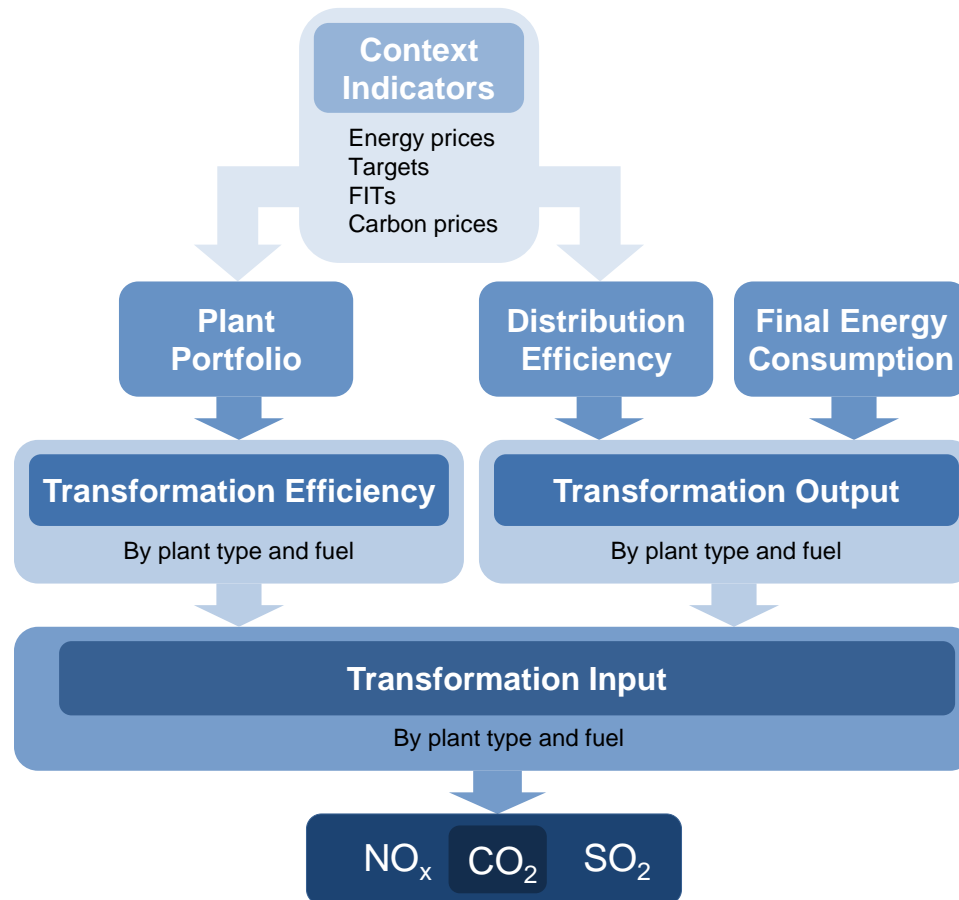
- Energy services as welfare-relevant outcome of the energy system are at the centre of our research approach
- Energy services, like well-tempered living space, are provided by capital stocks (such as buildings, heating systems, etc.) and energy flows
- A certain level of energy services can be provided by different combinations of technologies (incorporated in the capital stocks) and energy flows
- The range of available transformation and application technologies and energy sources thus opens up a spectrum of options



The ISED-AT Approach Indicators for Residential Buildings

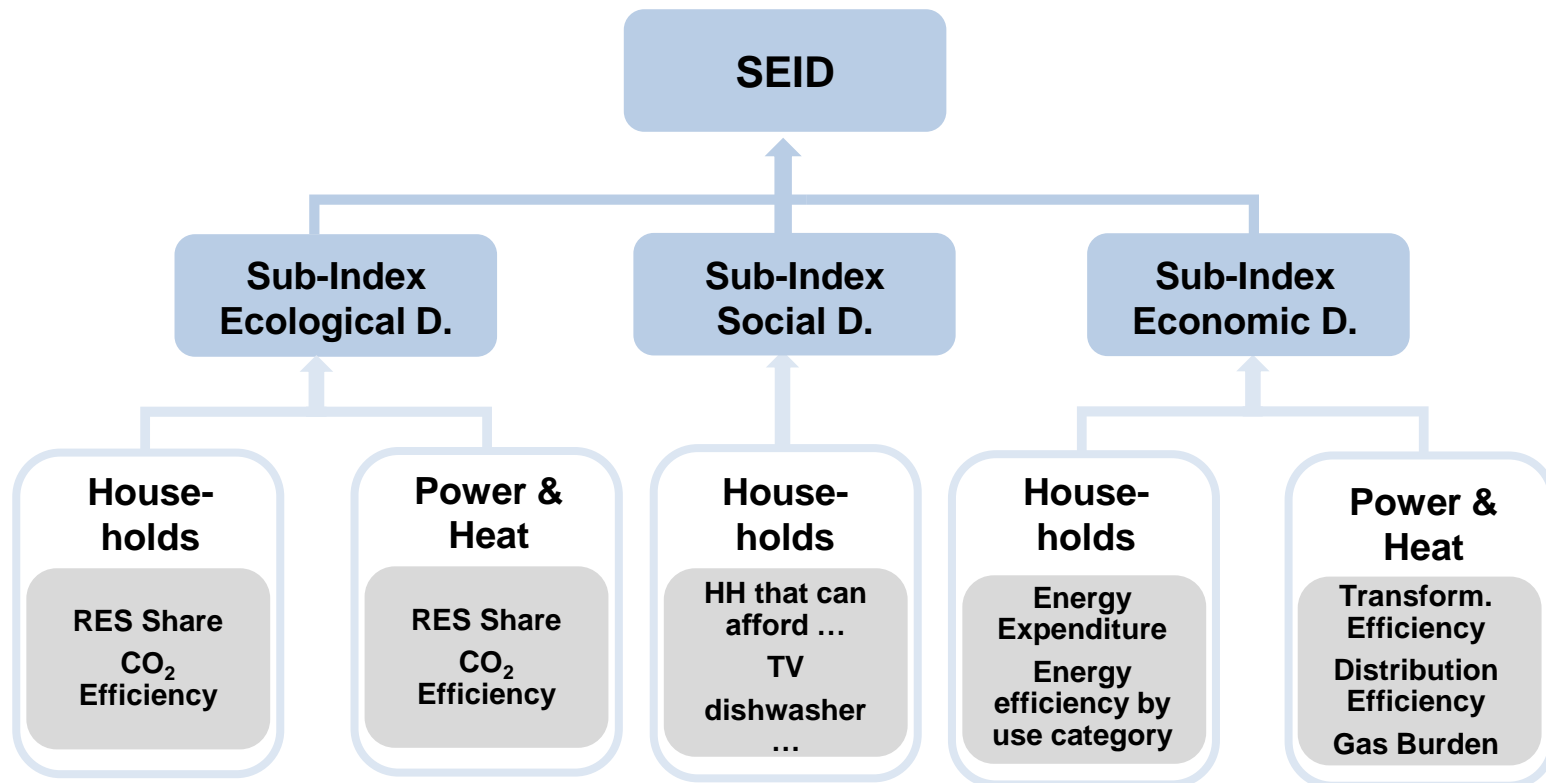


The ISED-AT Approach Indicators for Residential Buildings

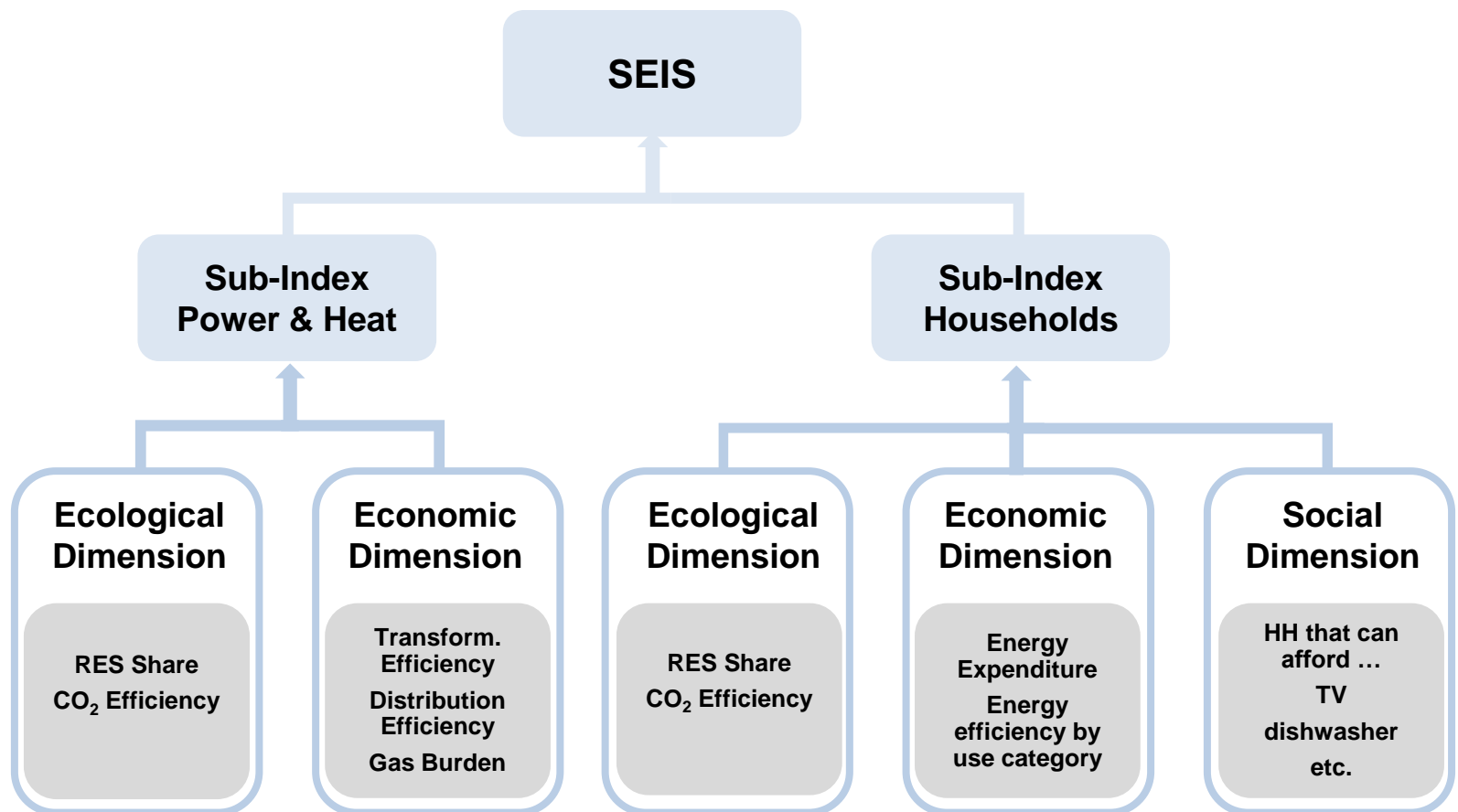


| Indicator | Dimension of sustainability | Sector |
|---|-----------------------------|-----------------------------|
| Share of RES in final energy consumption | Ecological | Residential |
| CO ₂ efficiency of final energy consumption | Ecological | Residential |
| Share of RES in electricity and heat supply | Ecological | Electricity and heat supply |
| CO ₂ efficiency of electricity and heat supply | Ecological | Electricity and heat supply |

*Sustainable Energy Index aggregated by
sector and dimension (SEID)*

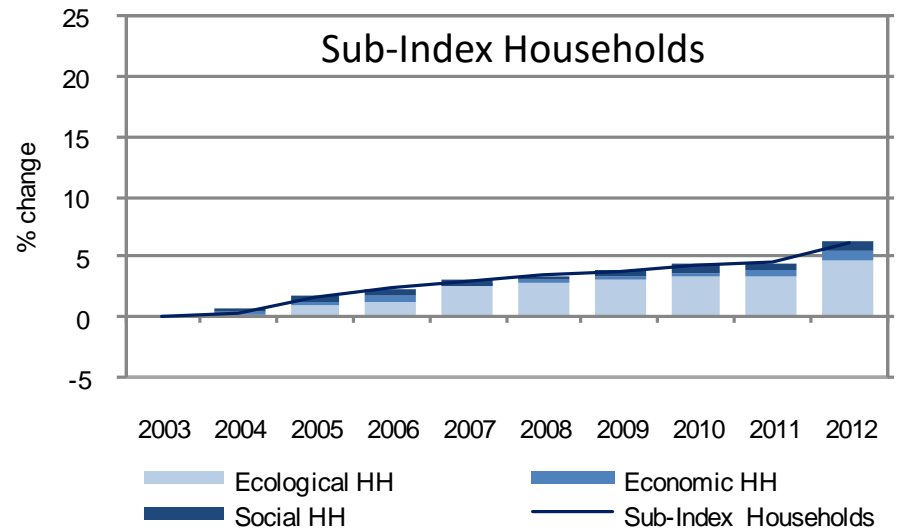
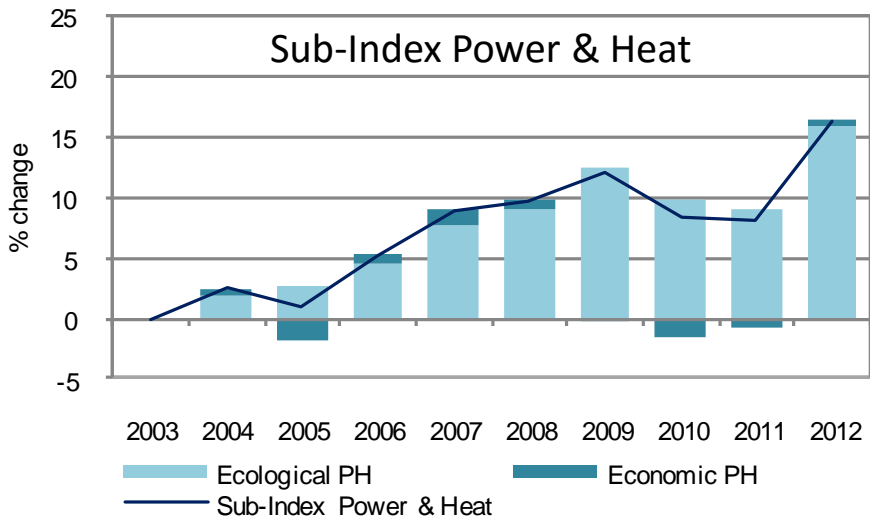
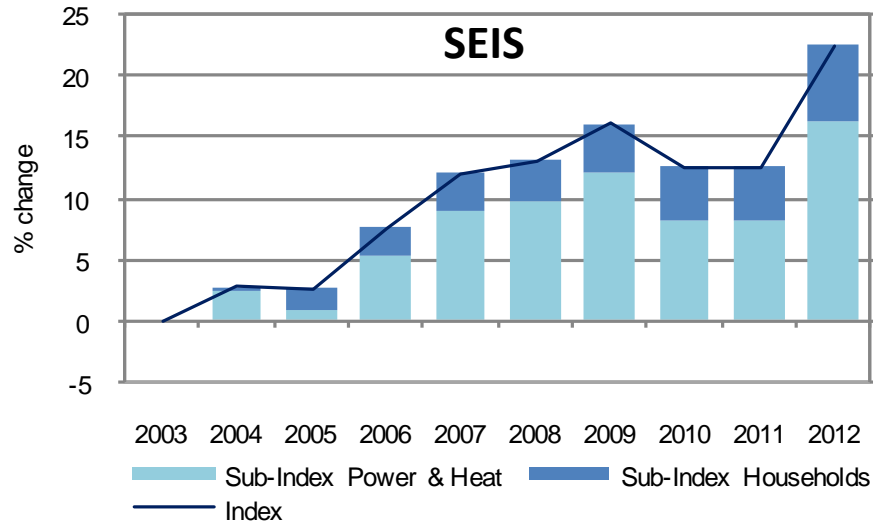


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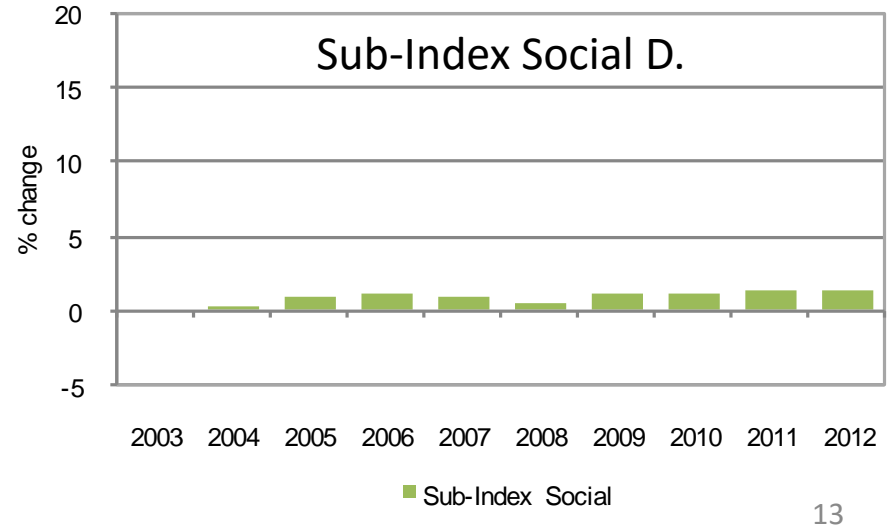
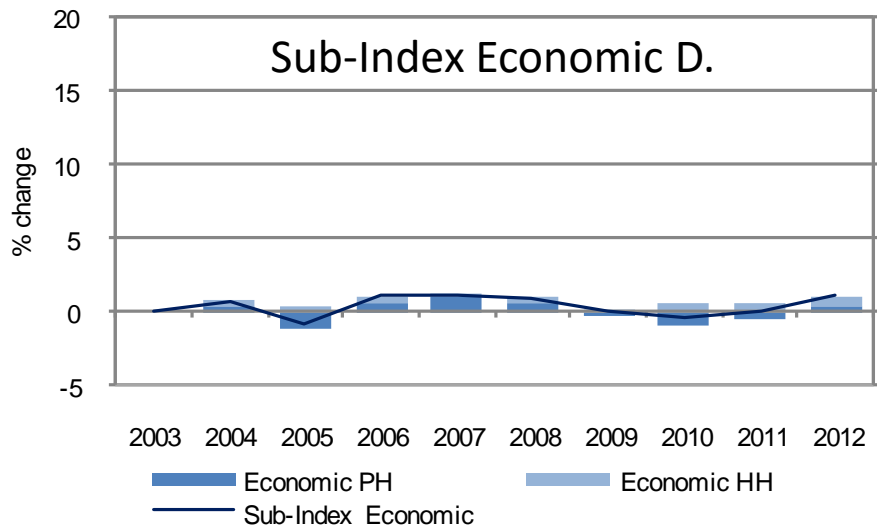
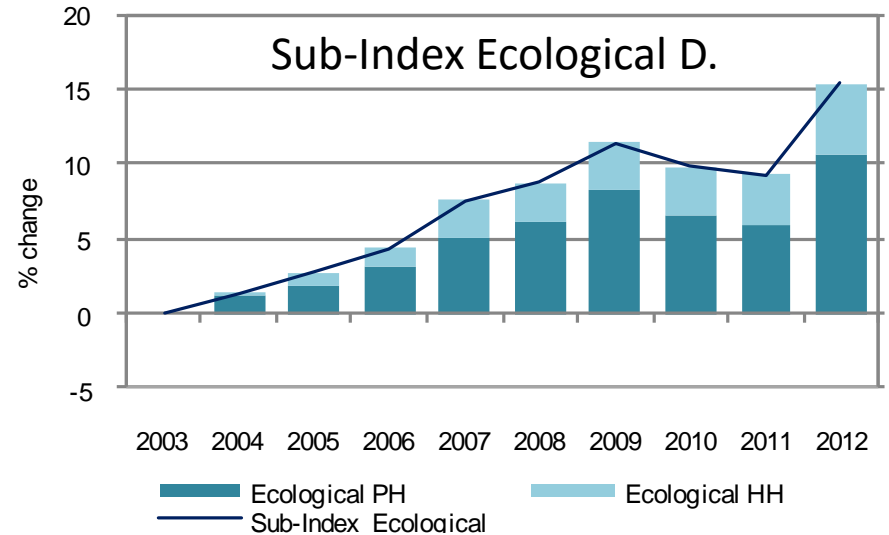
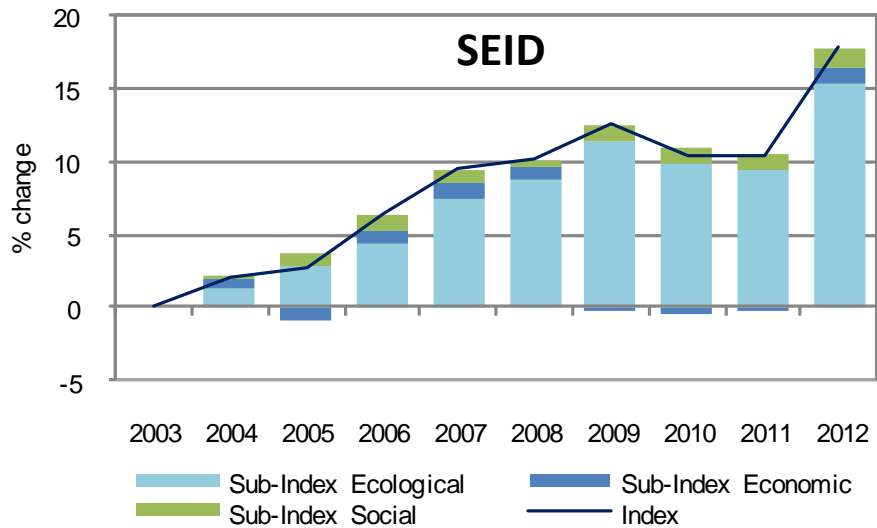


- Statistics Austria:
 - Household and Population Statistics
 - Housing Census
 - Energy Balances
 - Useful Energy Balances
 - Consumption Expenditures Statistics
 - Community Statistics on Income and Living Conditions
- UNFCCC Inventory Submissions: Energy-related CO₂ emissions
- Odyssee Database: Stock of household appliances

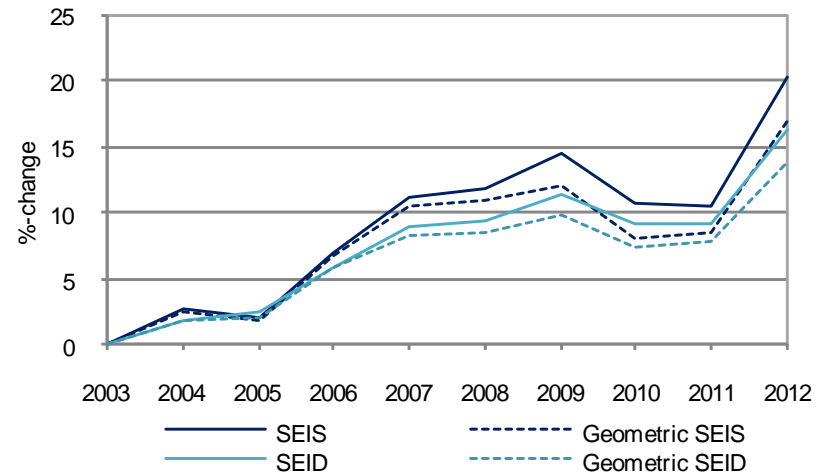
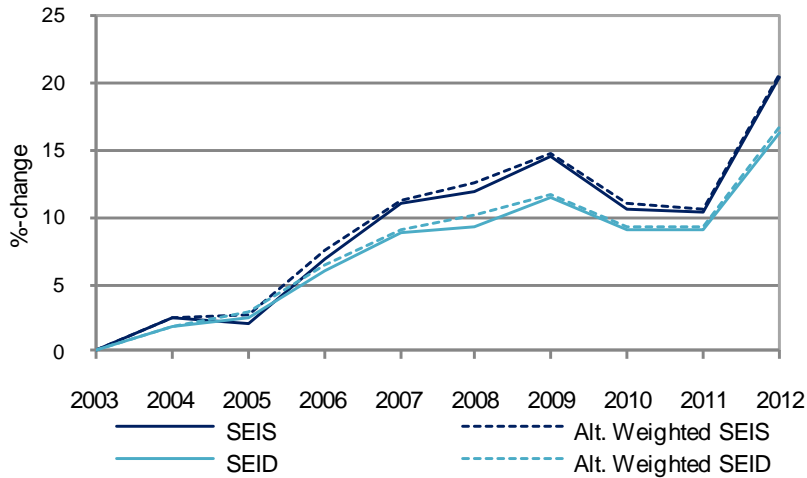
The Austrian Sustainable Energy Index by sector (SEIS), 2003–2012



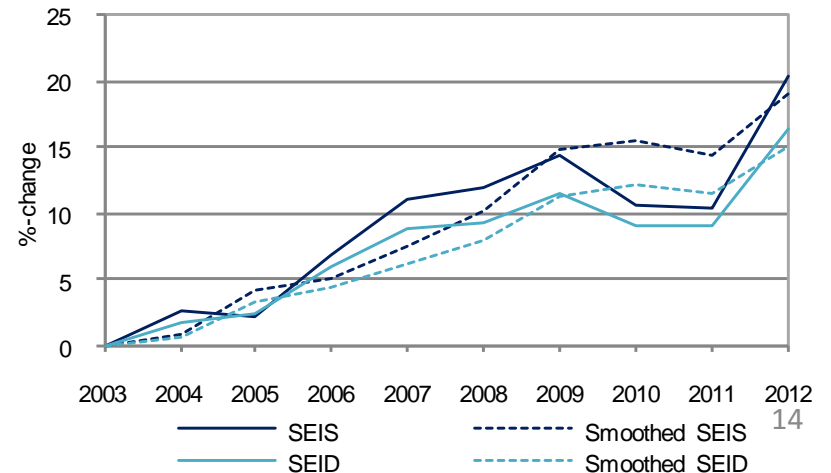
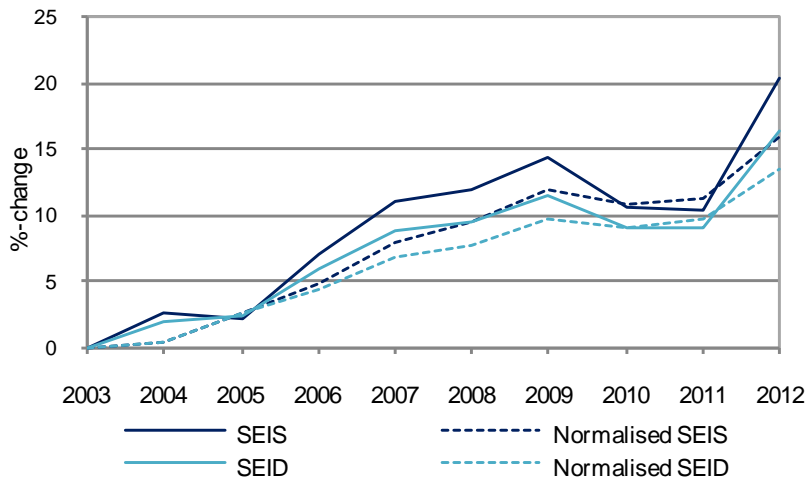
The Austrian Sustainable Energy Index by dimension (SEID), 2003–2012



Implications of alternative weighting factors and aggregation methods



Implications of normalisation and exponential smoothing



- The energy service-centred perspective makes the indicators and the index effective tools for monitoring and guiding an energy transition
- ➔ It allows the analysis of the whole range of technology options for providing a particular energy service
- The conceptual framework can easily be extended to include other sectors such as transport or manufacturing
- ISED-AT addresses all three dimensions of sustainable energy development
 - Data availability is adequate for the ecological and economic dimension
 - For the social dimension little information is provided in official statistics
- A further challenge lies in the definition of adequate proxy indicators for energy services
 - Adequate data on the household appliance stock needed
 - Population or the number of households are only inaccurate proxies for energy service demand and quality

- Empirical results indicate that Austria has performed particularly well with respect to the expansion of renewable energy sources
 - The feed-in tariff system contributed to the increase of "new" RES-E generation
 - Investment subsidies for small-scale PV plants and solar biomass heating systems
- Further efforts need to be undertaken w.r.t. energy efficiency, especially in the area of final energy demand
 - For space heating and cooling energy efficiency has been increasing, but final energy consumption was not substantially reduced
 - In other areas of residential final energy consumption, energy demand rose due to growing energy service demand
- Comprehensive policy mix is needed for absolute decoupling between energy service demand and final energy consumption, including
 - Reorientation of housing subsidies from new buildings towards thermal refurbishment
 - Energy-efficient urban and regional planning
 - Policy instruments targeting household electricity use

Thank you!

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Paper available at:

http://www.wifo.ac.at/publikationen?detail-view=yes&publikation_id=57857

(A) Aggregation by sector and dimension
(SEID)

$$SI_{s,t} = \sum_{j,t} w_j * \left(\frac{E_{s,j,t}}{E_{s,j,t=0}} - 1 \right)$$

$$SI_{d,t} = \sum_{s,t} w_s * \left(\frac{SI_{s,t}}{SI_{s,t=0}} - 1 \right)$$

$$I_t = \sum_{d,t} w_d * \left(\frac{SI_{d,t}}{SI_{d,t=0}} - 1 \right)$$

(B) Aggregation by dimension and sector
(SEIS)

$$SI_{d,t} = \sum_{j,t} w_j * \left(\frac{E_{d,j,t}}{E_{d,j,t=0}} - 1 \right)$$

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