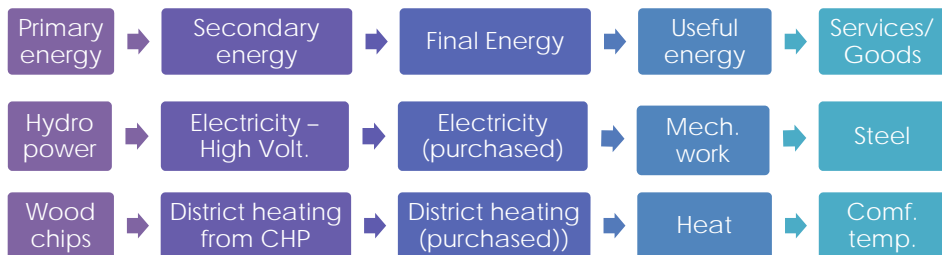
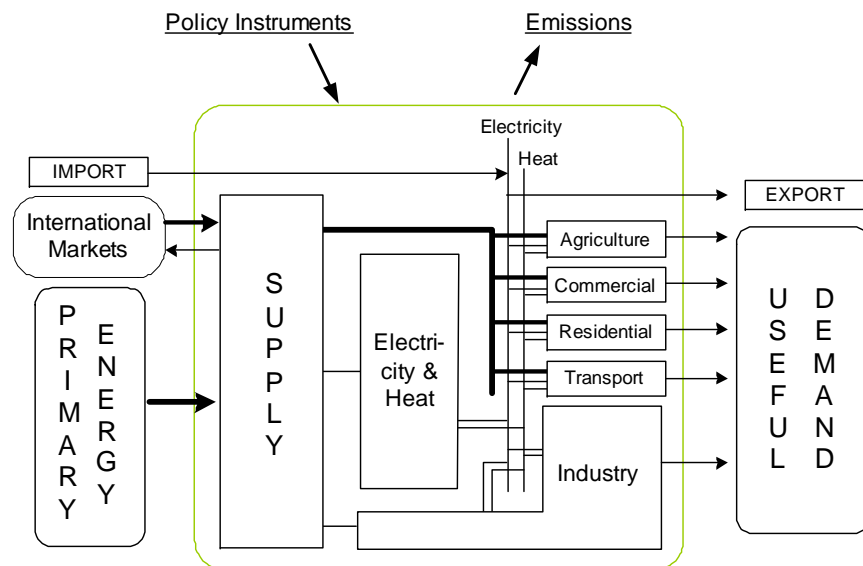


TIMES-Sweden

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TIMES: The Integrated MARKAL-EFOM System

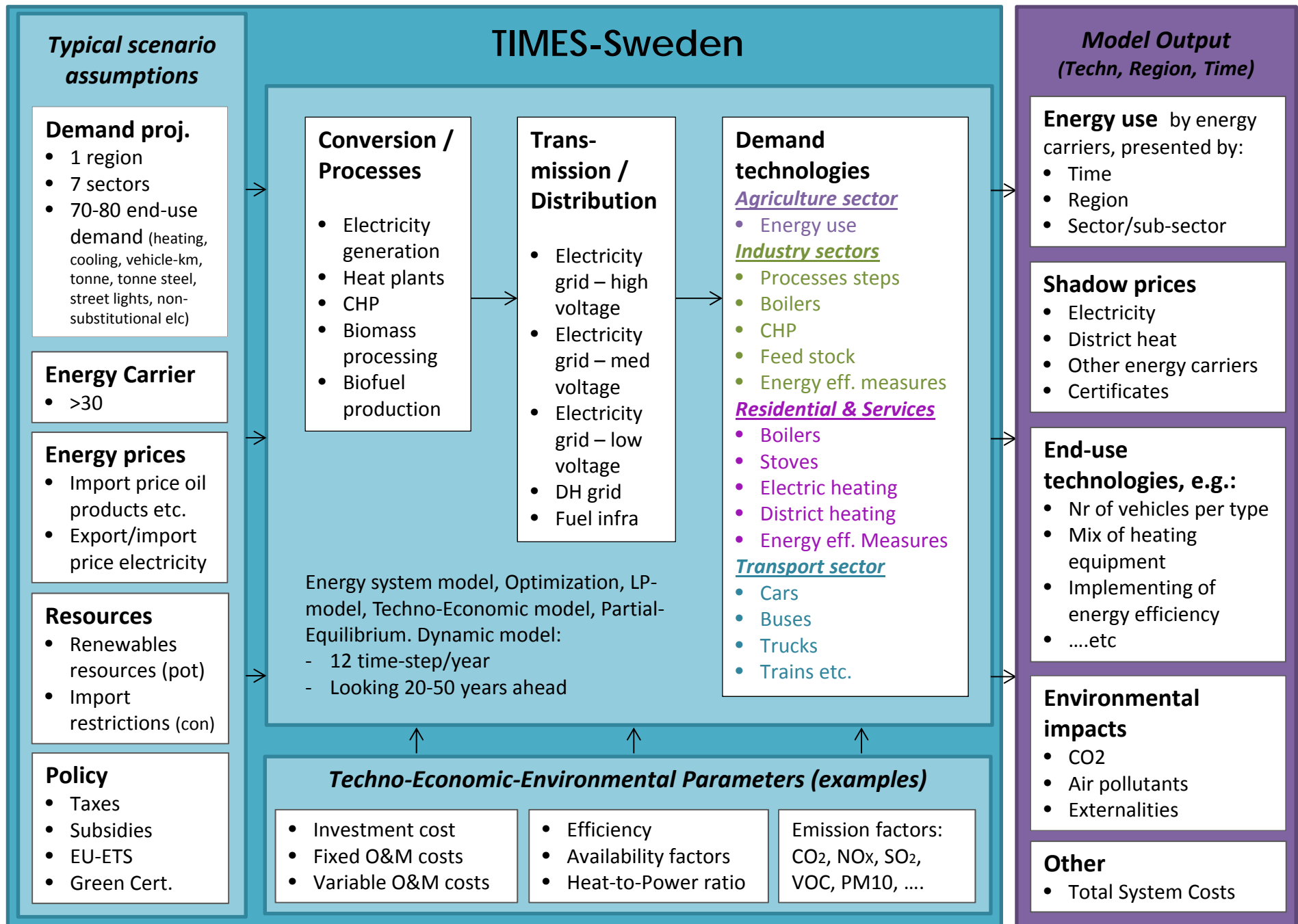
TIMES-Sweden identifies how limited resources can be allocated in order to minimize the **total system costs**.

TIMES-Sweden is used to analyse how the development of the Swedish energy system change under different scenarios, e.g. different emissions targets, different taxes or other energy or environmental policies. **Policy analysis!** Environmental analysis!

TIMES-Sweden is a comprehensive energy system model represented by **7 main sectors**: Industries, Residential, Services, Agriculture, Transports, ELC&DH and Energy supply and fuel production. The model is driven by a given demand which either is represented by useful energy (PJ/year) or by services or commodities (pers km/year, ton/year, etc).

TIMES-Sweden is based on the TIMES-platform (IEA-ETSAP) and share the main structure with the JRC-EU-TIMES etc.

- **Energy system model**
- Dynamic LP-model (12 per/year, 50 years)
- Bottom-up/**Techno-economic model**
- Cost minimisation
- Partial equilibrium model
- Technology rich



TIMES: The Integrated MARKAL- EFOM System (www.iea-ETSAP.org)

TIMES-Sweden: Chapter 5 in (Krook-Riekkola, 2015) (anna.krook-riekkola@LTU.se)

TIMES-Sweden

- **Based on the TIMES platform (The Integrated MARKAL- EFOM System):**
TIMES-Sweden was initially developed as a part of the Pan European TIMES model (**PET model**), within two EU funded projects (NEEDS and RES2020). In the model each country is represented as one model, and all the country models are then hard-linked into one big model. There are several European models still being used, e.g. the JRC-EU-TIMES model (**JET model**) documented by Simoes et al. (2013).
- **The EU national models share the same:**
 - RES-structure (Reference Energy System) and naming convention
 - Techno-economic data-base
 - Approaches/Methods to estimate underlying assumptions such as: Base-year calibration, demand projections, potential of biomass, emission-factors etc.
- **TIMES-Sweden has been further developed to better represent Swedish conditions:**
 - Emissions-factors/Ancillary benefits (Krook-Riekkola et al. 2011),
 - Iron- and steel industry (2012)
 - District heating (Krook-Riekkola & Söderholm, 2013), (Pädam et al., 2013)
 - Demand through soft-linking with EMEC (Krook-Riekkola et al. 2013a, 2013b)
 - Residential sector (Boverket, 2015)
 - Biomass (Fjärrsyn project, 2015-2017)
 - Transportation (on-going PhD project/Jonas Forsberg)
 - Industry sectors incl CCS (on-going PhD project/Erik Sandberg)

European TIMES model (JET model): <http://publications.jrc.ec.europa.eu/repository/handle/JRC85804>
TIMES-Sweden: Chapter 5 in (Krook-Riekkola, 2015)

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