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Towards zero-CO_2 production and practices in the supply chains for buildings and infrastructure – first experiences from a Swedish case study

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MISTRA
CARBON
EXIT

PROJECT

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CARBON
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Main features:

- **Supply chain focus**. From basic materials to products and services
- **Buildings, transportation infrastructure** and **transportation**, including **energy carriers** and **basic materials**
- **Interdisciplinary**: technologies, policies and governance, behavior and markets
- **Case studies** – close collaboration with end users. Supported by academic work packages
- Close collaboration with industry, authorities and civil society: 10 academic centers, 16 companies, 1 municipality, 2 regions and 2 NGO:s

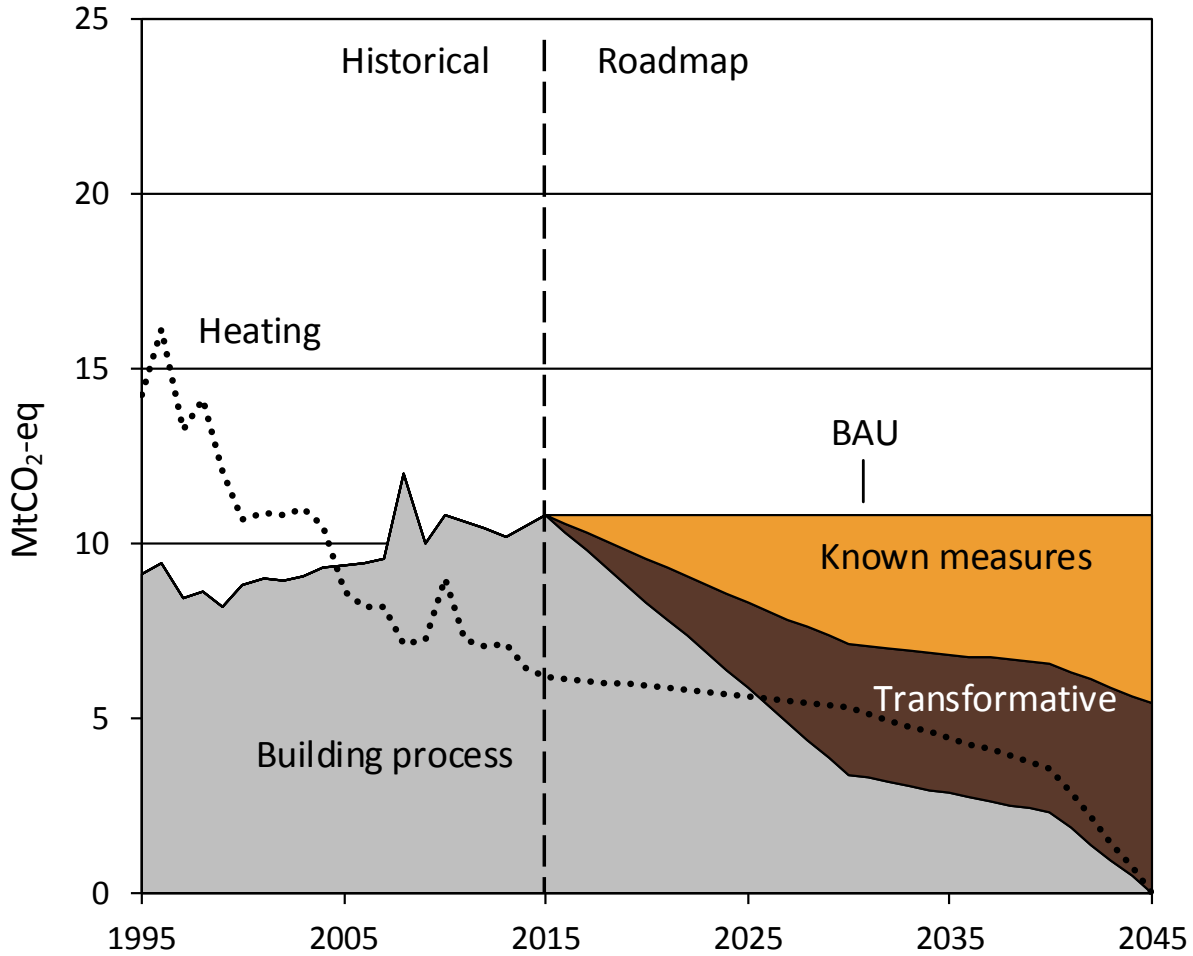
BACKGROUND

Case studies: Buildings and Transportation infrastructure

- Sweden has, in line with the Paris agreement, committed to reducing domestic GHG emissions to net-zero by 2045 and to pursue negative emissions thereafter.

- The total climate impact of building and construction processes (includic the supply of building materials) in Sweden is around 10 $MtCO_2$-eq per year - 1/5 of the total domestic GHG emissions

BACKGROUND



- GHG emissions related to the construction phase today exceeds emissions related to the user phase (heating and electricity)

Adapted from: Erlandsson et al., 2017

AIM

METHOD

- **The case study work gathers some 30 stakeholders, along the supply chain from building materials to end products in the form of buildings and infrastructure.**

- **Structured as a participatory integrated assessment**

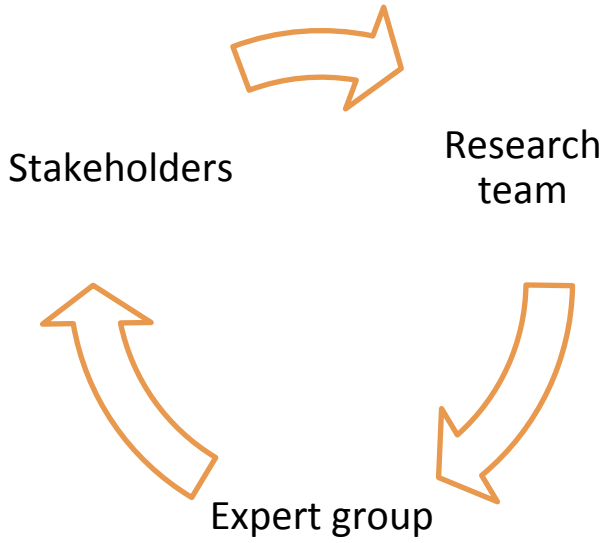
I. Preparation

II. Framing and identification of key challenges and opportunities

III. Case study assessments

IV. Development of analysis of potential Roadmap(s), and

V. Evaluation



THE SUPPLY CHAIN APPROACH

Public and private business tenants, housing consumers

PRIMARY PRODUCTION **CONSTRUCTION** **END-USE**

ENERGY AND RAW MATERIAL

FURTHER PROCESSING

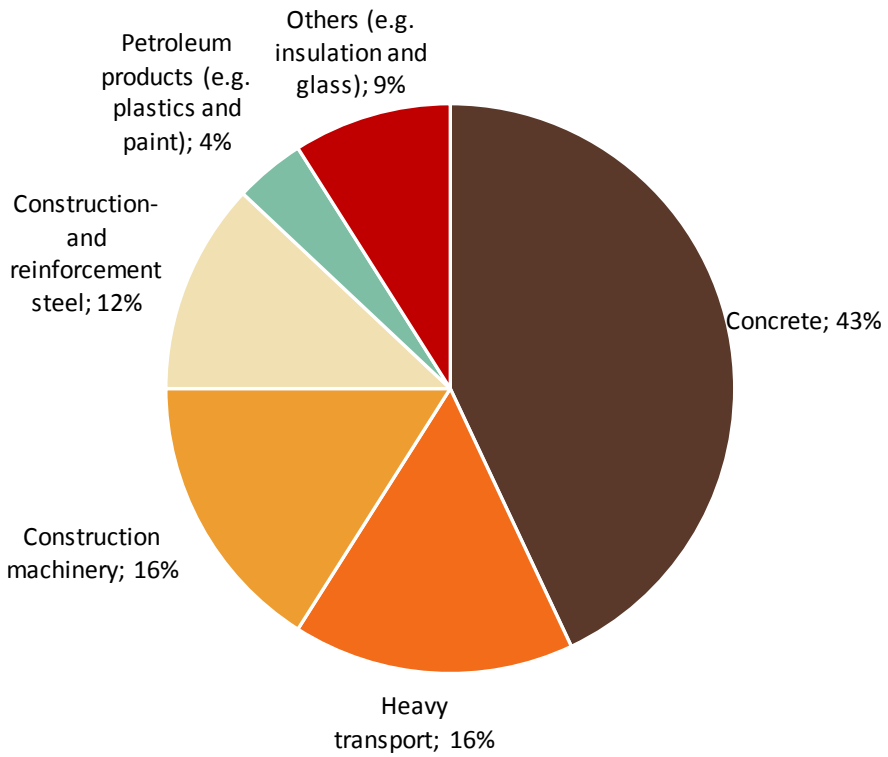
PLANNING AND PROCUREMENT

Cement producer

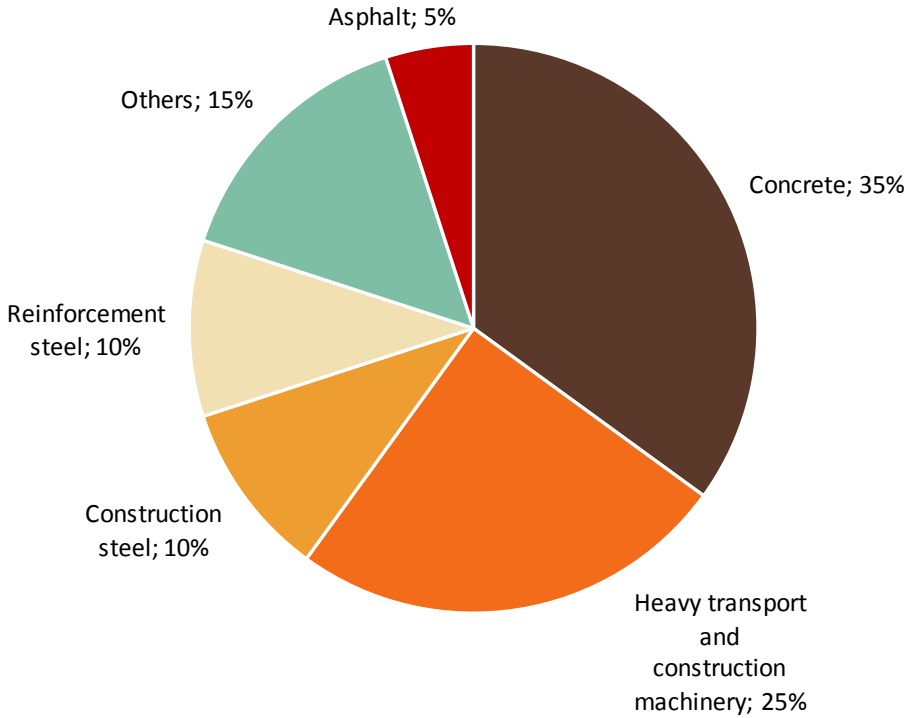
Concrete manufacturing, include manufacturers of ready-mix and precast concret

Actors involved in construction and construction planning, e.g. construction companies and consultancy firms

a) GHG emissions from building construction – tot. ~7 MtCO2-eq/year



b) GHG emissions from infrastructure construction – tot. ~3 MtCO2-eq/year



- Increased use of cement clinker substitutes,
- Shifts to alternative fuels in heavy transport/construction machinery
- Material efficiency
- Recycling of asphalt
- Shifts to more CO_2-lean materials (e.g. wood)

Failure to realise the potential for existing emission reduction measures tends to be explained by factors such, e.g,

- risk aversion associated with the adoption of new technologies
- implicit or explicit constraints within organisations of individual companies
- inadequate communication between actors in the supply chain
- overly conservative regulations and norms
- lack of information

- Fuel shift and/or electrification in the cement industry
- Implementation of Carbon Capture and Storage (CCS) in the cement industry
- Alternative steel production process, e.g. Hydrogen based steel making/ CCS
- Shift to biomass based renewable bitumen
- Shifts to alternative drivetrains in heavy transport/construction machinery

This involves, e.g. adaptation of legislation, innovative schemes to share the risk and costs associated with developing and implementing new technology.

FINDINGS

A transformation towards zero-CO_2 production and practices in the supply chains for buildings and infrastructure will require:

- Increased coordination and collaboration along the supply chains, so as to facilitate collective action
- Public actors taking the lead in the transformation, for example by means of innovative procurement practices
- Innovative financing and risk sharing arrangements
  Inclusion of Consumption into EU ETS, Transformation fund…

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TACK!

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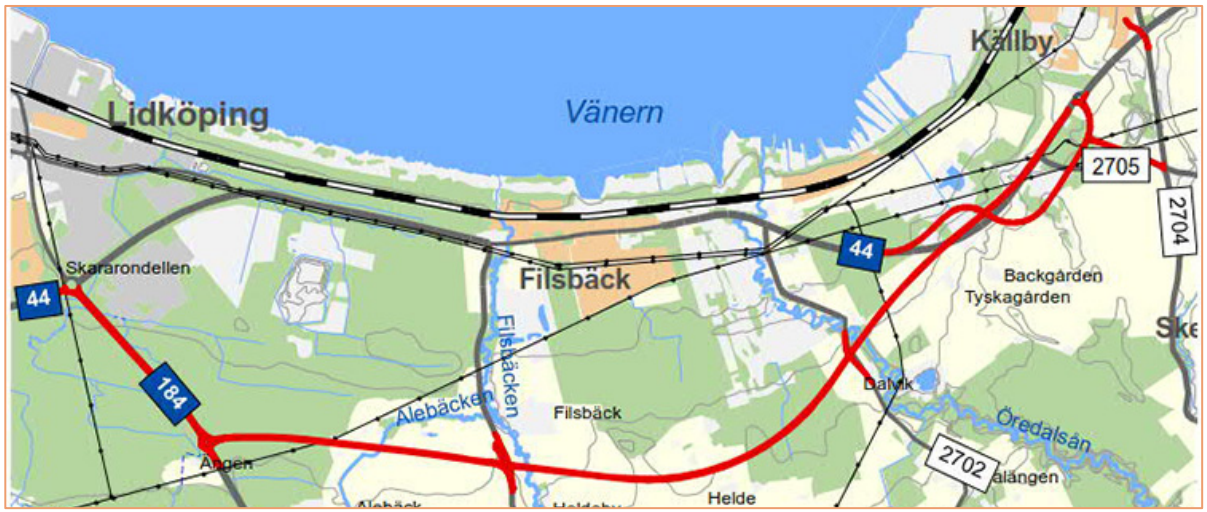
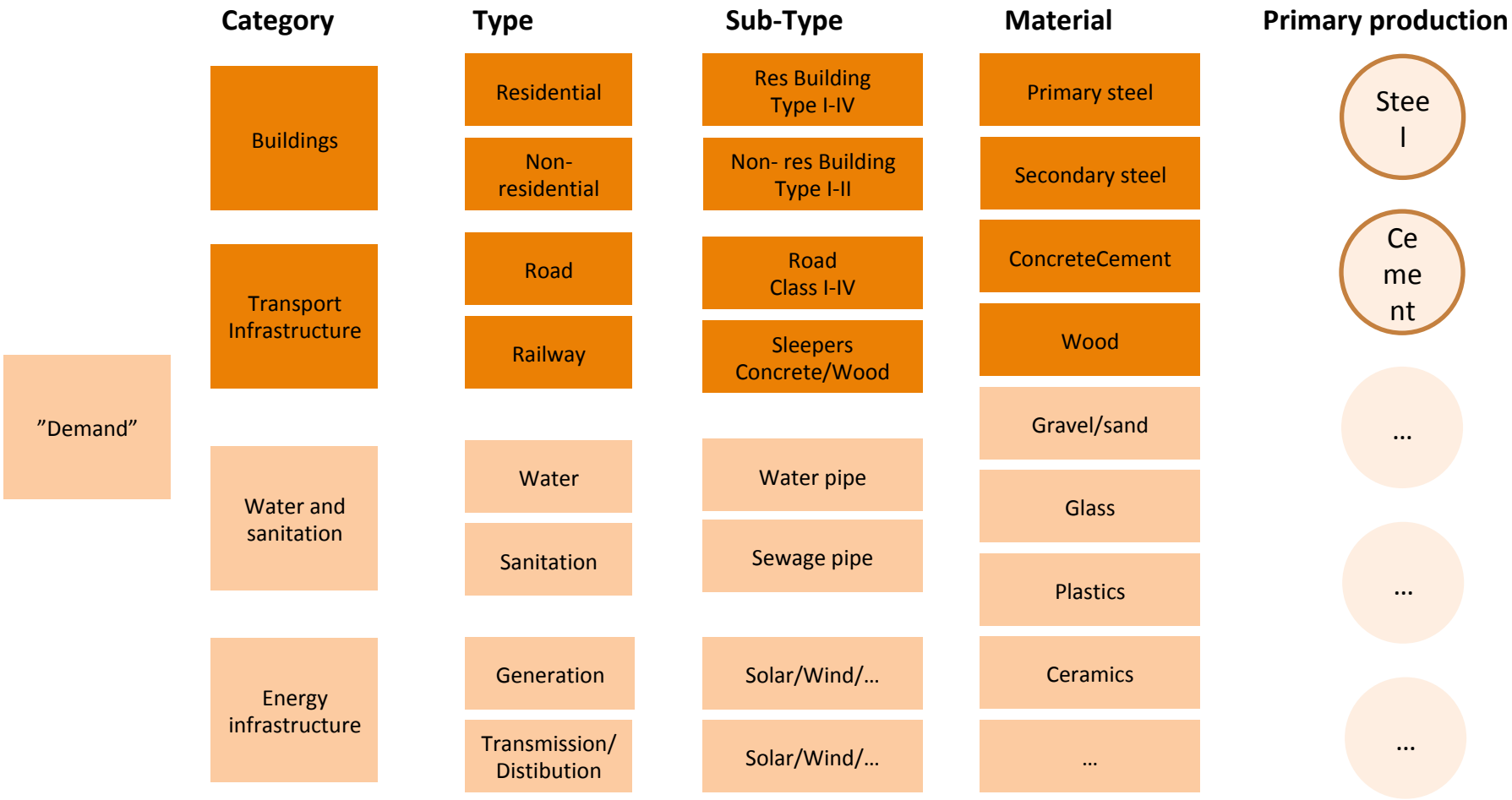
Introduction to VÄG 44

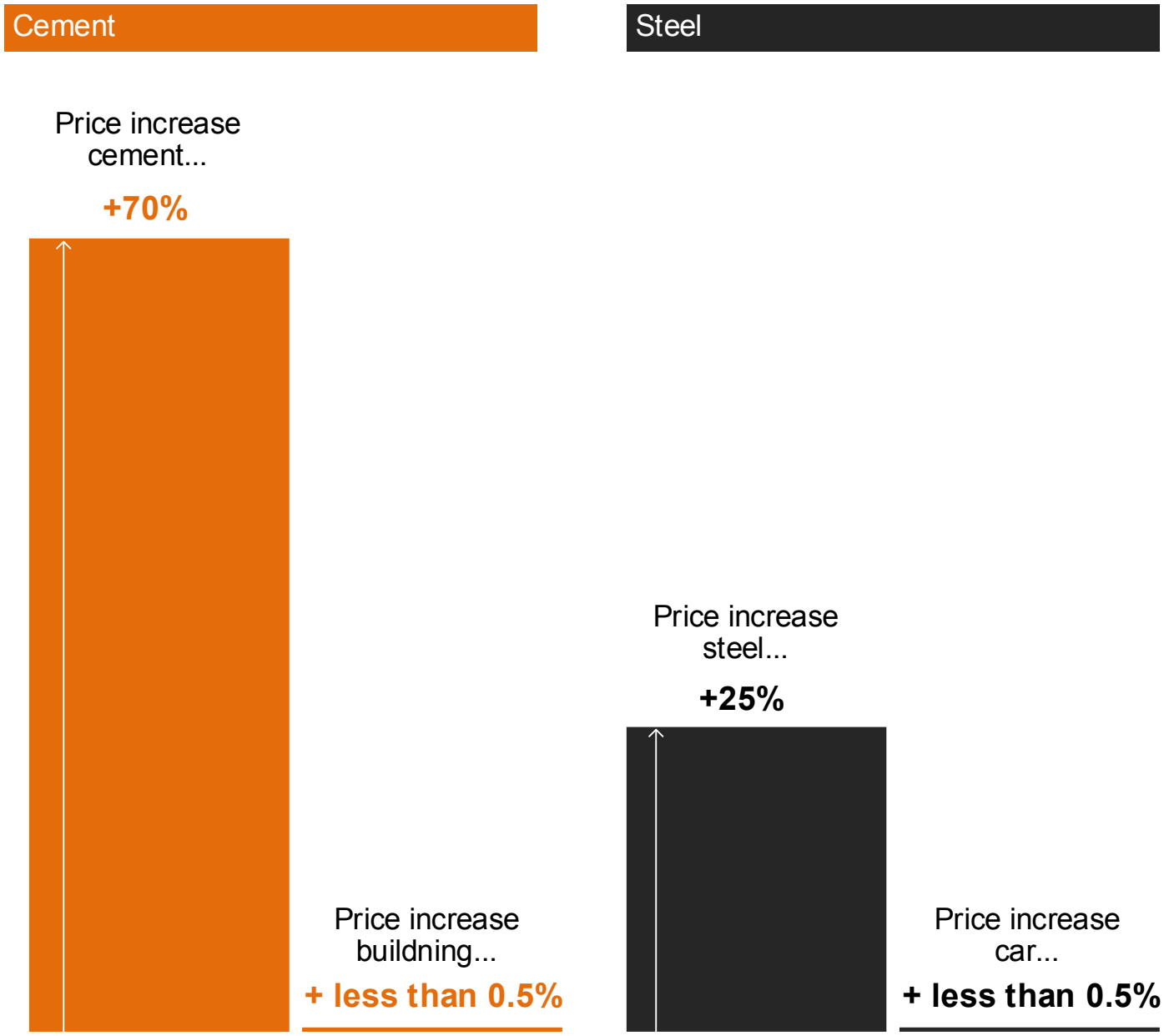
- New 2+1 road being built in a new stretch between Lidköping and Källby in the middle of Sweden



- Road plan developed in 2014 and construction started in 2016. Still ongoing.
- One of the first Trafikverket projects with climate requirements:
  - Development and agreement of Klimatkalkyl with contractor
  - Bonus with reduction of up to 10% (1% of contractual value)


Category
Type
Sub-Type
Material
Primary production
”Demand”
Buildings
Transport Infrastructure
Water and sanitation
Energy infrastructure
Residential
Non-residential
Road
Railway
Water
Sanitation
Generation
Transmission/ Distibution
Res Building Type I-IV
Non- res Building Type I-II
Road Class I-IV
Sleepers Concrete/Wood
Water pipe
Sewage pipe
Solar/Wind/…
Solar/Wind/…
Primary steel
Secondary steel
ConcreteCement
Wood
Gravel/sand
Glass
Plastics
Ceramics
…
Steel
Cement
…
…
…

Investing in new low-CO_2 steel- and cement-making processes would require substantial increases in the selling prices of steel and cement, but the price increase facing a car buyer or a procurer of a building would be marginal...



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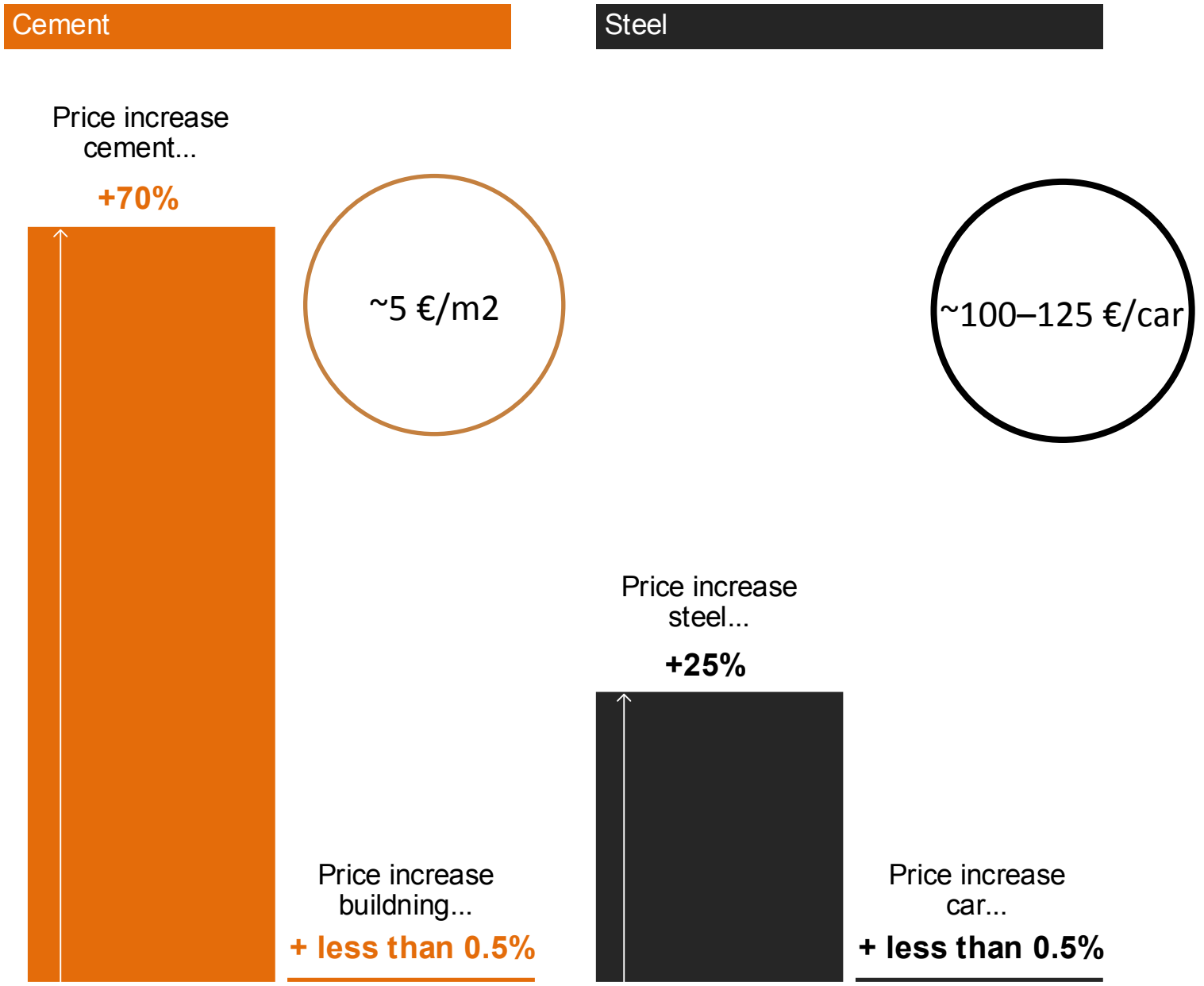

- 50% of the climate impact from the construction process could be mitigated by measures/technologies that already exists today.

- many of these measures could come at a low- or in some cases negative cost, cut carbon – cut costs (Enzer, 2016; DBW, 2017).

Experiences from similar analyses in the energy efficiency field has not seldom proven to be overly optimistic

Potential to tap the full 'technical'-potential limited due to, eg:
Transaction costs, principal-agent problems, bounded rationality, behavioural anomalies, consumer heterogeneity, split incentives, opportunity costs and the risk aversion associated with the adoption of new technologies

(see e.g. Jaffe and Stevins, 1994 and Ó Broin et al. 2015 and references therein)

- **Carbon management Buildings and Infrastructure:** Method development and system boundaries
- **Materials - Cement/Concrete:** Supplementary Cementitious Materials
- **Organization/Business model innovation:** Co-op w/ WP3
- **Policies and Funding Mechanisms for transformative change:** Co-op w/WP4