The Importance of Efficiency in the Building Sector for the Achievement of long-term Climate Protection Targets

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Overarching question: What are the consequences for buildings, energy systems and networks if the planned savings measures for buildings are *not* implemented, but instead more heat pumps, synthetic fuels or other renewables are (have to be) used to achieve the climate target?

Methodical approach:
- National economic perspective, climate target of -87.5 % GHG compared to 1990
- Compliance with the building target for 2030 of the climate protection plan (72 Mt CO2)
- Energy system optimisation with a realistically ambitious energy efficiency scenario as reference and four alternative scenarios
Current Discussion for the German Building Sector

<table>
<thead>
<tr>
<th>Thesis</th>
<th>Technological openness enables less insulation</th>
<th>PtX enables us to use existing technologies</th>
<th>Today's incentives and requirements for buildings are sufficient</th>
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<td>The future is either &quot;all electric&quot; or &quot;all gas&quot;</td>
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Comparison of the Efficiency² scenario with scenarios in which reduced efficiency is compensated by other RES options.

- Efficiency²
- Efficiency + RES
- Efficiency + HP
- Efficiency + PtG
- BAU + PtG
Schematic Approach

Evaluation of scenario modeling in two ways

Macroeconomic Costs

Specific Opportunities and Risks
Coupling of four models to calculate consistent and comparable scenarios.
Comparison of Scenarios

Total Cost Difference against Efficiency²

Difference of average annuities for the period 2017 bis 2050 at an interest rate of 1,5 %
Comparison of Scenarios
Total Cost Difference against Efficiency²

Cost savings for less efficiency (less insulation and air tightness)

Difference of average annuities for the period 2017 bis 2050 at an interest rate of 1,5 %
Comparison of Scenarios
Total Cost Difference against Efficiency²

Additional costs for required RES
Cost savings from cheap gas boilers

Difference of average annuities for the period 2017 bis 2050 at an interest rate of 1.5%
Comparison of Scenarios
Total Cost Difference against Efficiency²

Difference of average annuities for the period 2017 bis 2050 at an interest rate of 1,5 %
Comparison of Scenarios
Total Cost Difference against Efficiency²

Additional costs for electricity grids

Difference of average annuities for the period 2017 bis 2050 at an interest rate of 1,5 %
Comparison of Scenarios
Total Cost Difference against Efficiency$^2$

PtG imports cause largest cost block

Difference of average annuities for the period 2017 bis 2050 at an interest rate of 1.5 %
Schematic Approach

Evaluation of scenario modeling in two ways

Macroeconomic Costs

Specific Opportunities and Risks
Evaluation Criteria

- Macroeconomic Cost
- Quality of the Building Stock
- Energy Import
- Market Ramp Up
- Fault Tolerance
- Ressource Consumption
- Cost Reduction Potential
- Acceptance
- Controllability
- Flexibility
- Specific Opportunities and Risks
- Health social Aspects
- Comparison of Scenarios
• Lower efficiency must always be compensated by an EVEN STEEPER growth in renewable energies.

• Efficiency AND renewables must be ambitiously implemented in the short term.

• The decisive factor is which technology meets the requirements with realistic effort.
Market Ramp Up

- **Insulation Materials**
  - Mio. m³

- **Heat Pumps**
  - BAU + PtG
  - Efficiency + PtG
  - Efficiency + RES
  - Efficiency + HP
  - Efficiency²

- **New District Heating connections**

- **PtG-Import**
  - TWh/a

- **Efficiency²**: annually installed insulation volume in Germany must triple in short term
Market Ramp Up

- **Efficiency + RES**: solar thermal systems must grow fifteenfold by 2030
- number of buildings supplied via heating networks must increase fourfold
Market Ramp Up

- **Efficiency + PtG:** 102 GW of generation capacity from renewable power plants by 2050
- **BAU + PtG:** 178 GW
- Current capacity in Germany: 118 GW
Market Ramp Up

**Insulation Materials**

- Mio. m³
- 2017 to 2030

**Heat Pumps**

- BAU + PtG
- Efficiency + PtG
- Efficiency + RES
- Efficiency + HP
- Efficiency²

**New District Heating connections**

- 2017 to 2030

**PtG-Import**

- TWh/a
- 2020 to 2050

- **Efficiency + HP:**
  - Annual sales must rise from 78,000 (2017) to 200,000 and by 2030 to 620,000
Specific Opportunities and Risks
Fault Tolerance and Flexibility

- Scenario Efficiency² enables even more ambitious climate targets (-100% GHG).

- Efficiency² enables to react flexibly to unexpected changes
  - RES potentials are not fully exploited
  - efficiency raises RES potentials

Quelle: Kay Ploch