

German Environment Agency

Umwelt   
Bundesamt

# Designing a resource efficient pathway towards a greenhouse gas neutral Germany

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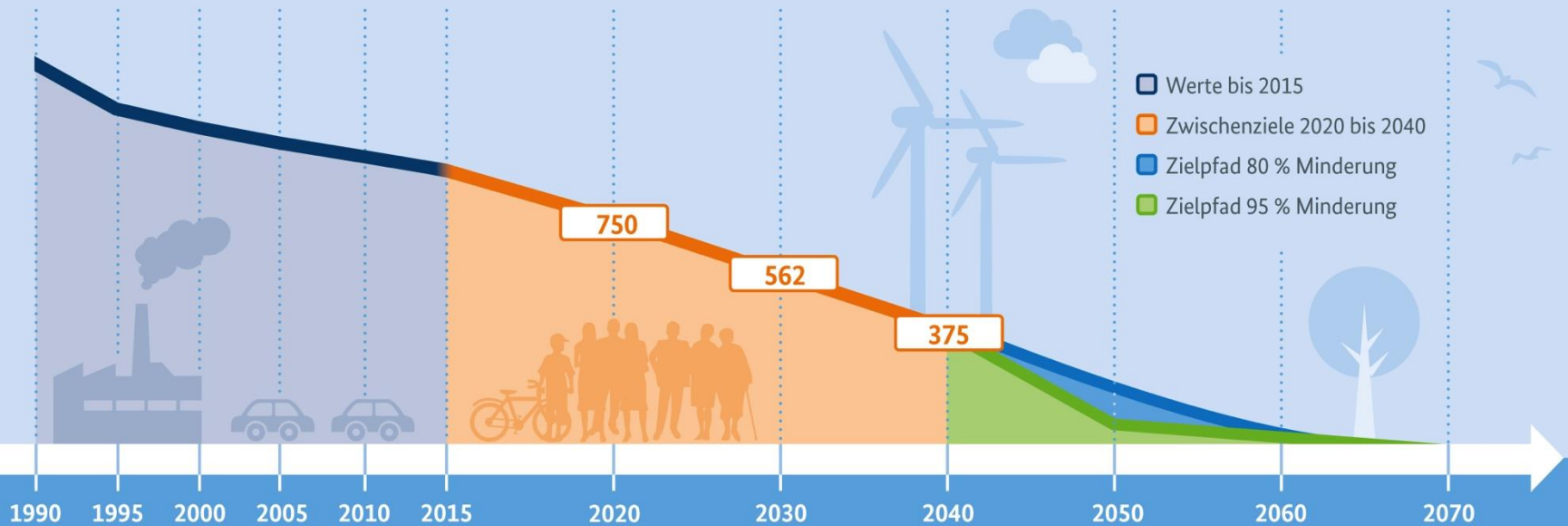
Jens Günther, Ullrich Lorenz, Katja Purr, Katja Purr, Diana Nissler

Wolfgang Butz, Ulrike Döring, Eric Fee, Reinhard Herbener, Tim Hermann, Katja Hofmeier, Kai Kessler, Guido Knoche, Matthias Koller, Jan Kosmol, Kora Kristof, Martin Lambrecht, Martin Lange, Uwe Leprich, Lars Mönch, Nathan Obermaier, David Pfeier, Sebastian Plickert, Bettina Rechenberg, Martin Schmied, Jens Schuberth, Jan Seven, Sue Martina Starke, Max Werlein



And others ...

# Climate Action Plan 2050



\*bis 2015 Ist-Werte (2015 Schätzung UBA), ab 2020 Ziele

# Climate Action Plan 2050



**SUSTAINABLE DEVELOPMENT GOALS**  
17 GOALS TO TRANSFORM OUR WORLD

|  |  |  |  |  |  |
|--|--|--|--|--|--|
| <b>1</b> NO POVERTY<br>                  | <b>2</b> ZERO HUNGER<br>                     | <b>3</b> GOOD HEALTH AND WELL-BEING<br>              | <b>4</b> QUALITY EDUCATION<br>                       | <b>5</b> GENDER EQUALITY<br>                     | <b>6</b> CLEAN WATER AND SANITATION<br>              |
| <b>7</b> AFFORDABLE AND CLEAN ENERGY<br> | <b>8</b> DECENT WORK AND ECONOMIC GROWTH<br> | <b>9</b> INDUSTRY, INNOVATION AND INFRASTRUCTURE<br> | <b>10</b> REDUCED INEQUALITIES<br>                   | <b>11</b> SUSTAINABLE CITIES AND COMMUNITIES<br> | <b>12</b> RESPONSIBLE CONSUMPTION AND PRODUCTION<br> |
| <b>13</b> CLIMATE ACTION<br>             | <b>14</b> LIFE BELOW WATER<br>               | <b>15</b> LIFE ON LAND<br>                           | <b>16</b> PEACE, JUSTICE AND STRONG INSTITUTIONS<br> | <b>17</b> PARTNERSHIPS FOR THE GOALS<br>         |  |

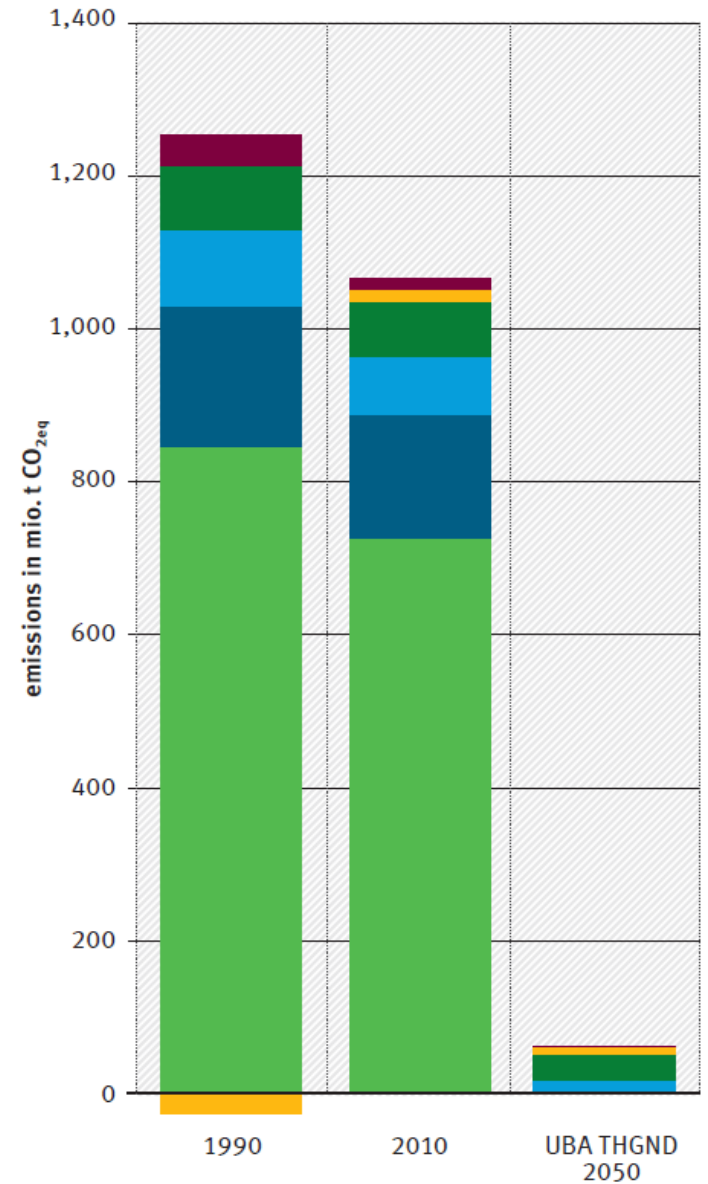
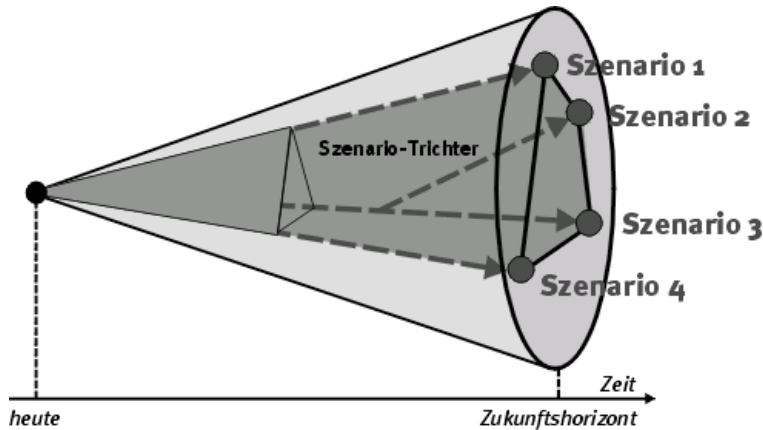
1990

\*bis 20

www.bmub.b

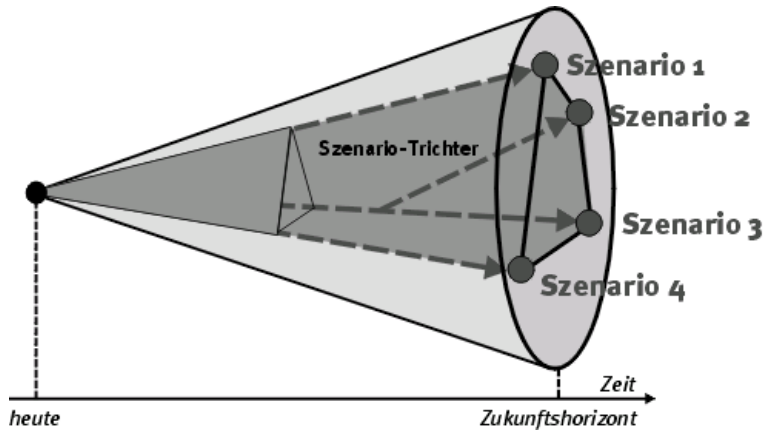
Umwelt,  
Sicherheits

# Goals and Scenarios



- Energy (excluding transport)
- Transport
- Industrial processes, solvents and other product applications
- Agriculture
- LULUCF
- Waste and wastewater

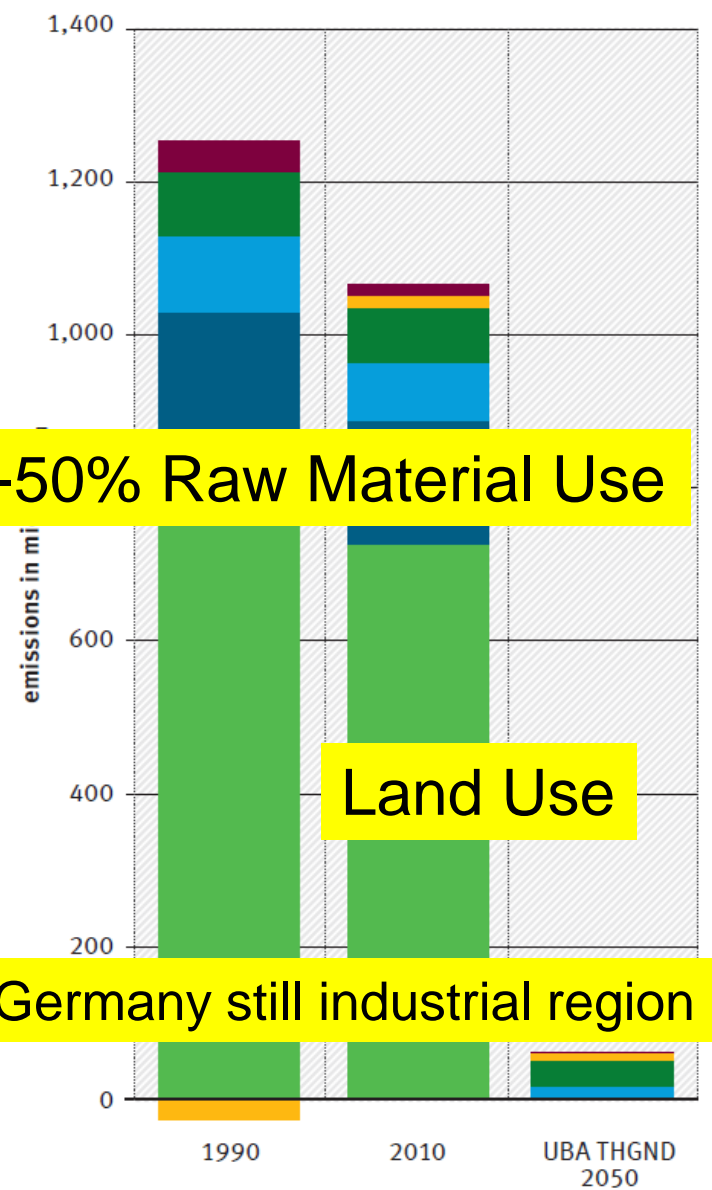
# Goals and Scenarios



**-50% Raw Material Use**

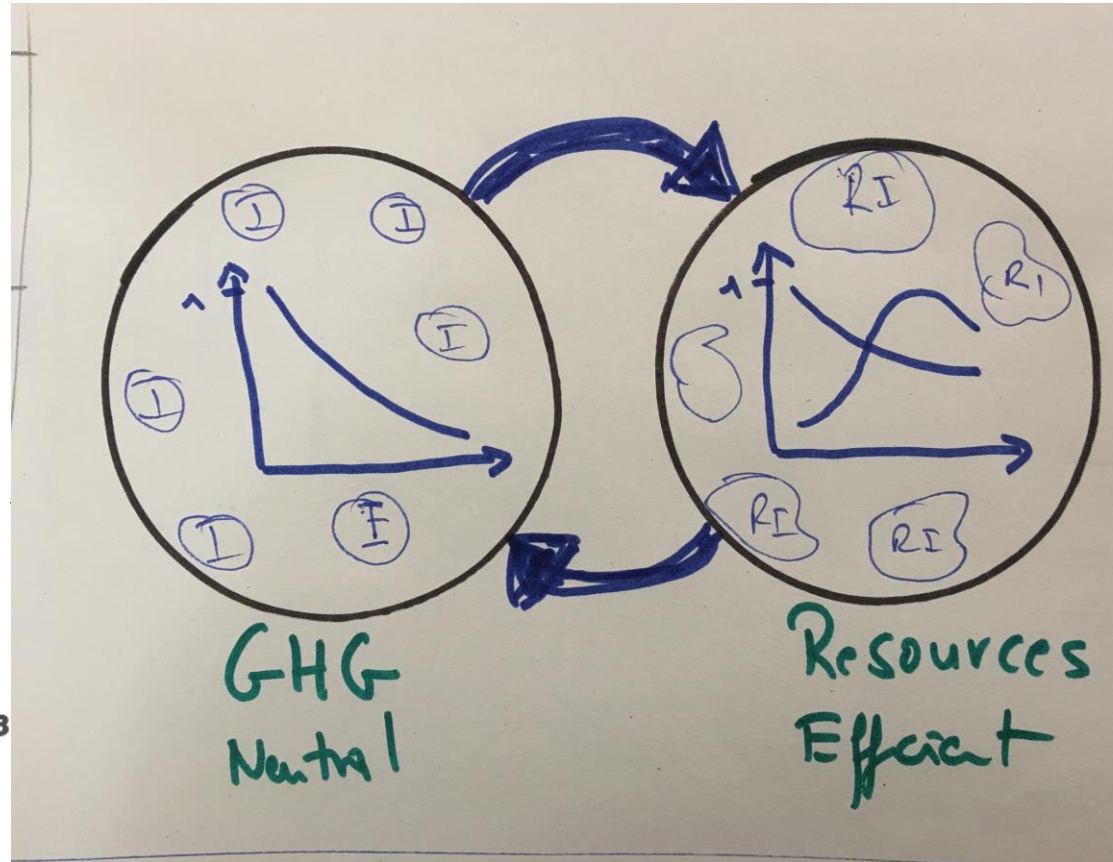
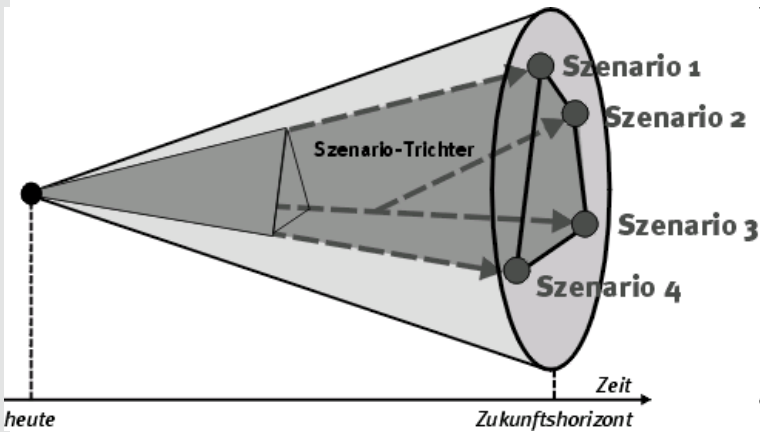
**Land Use**

**Germany still industrial region**



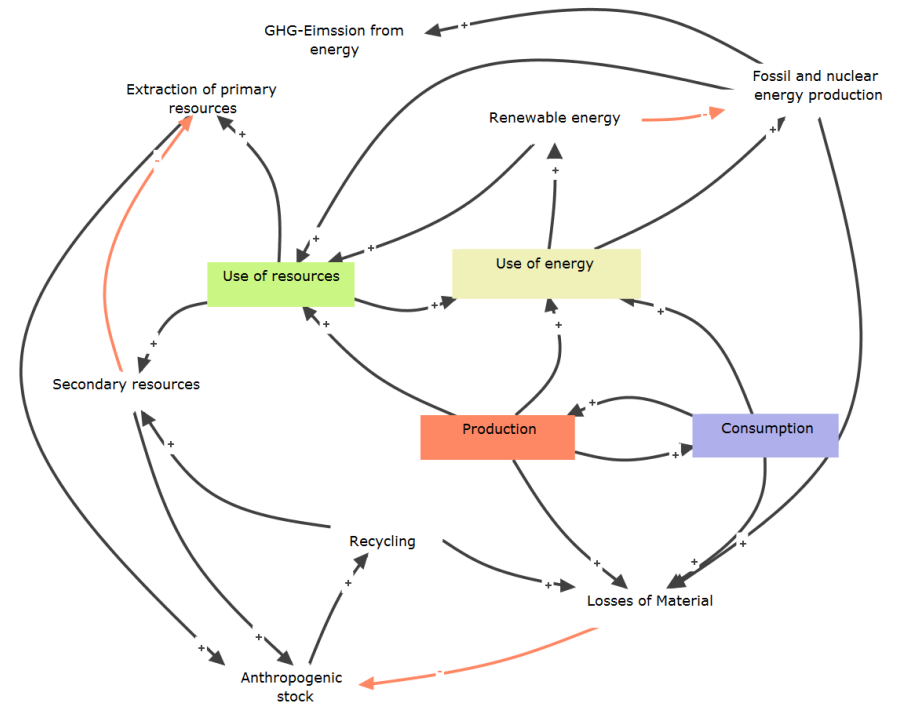
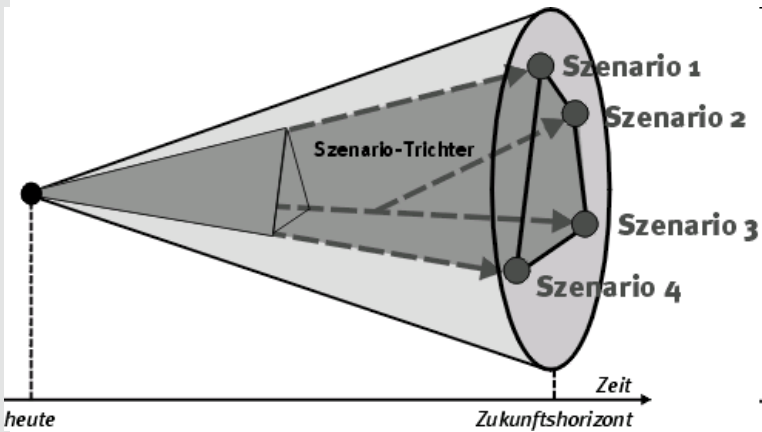
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# Goals and Scenarios



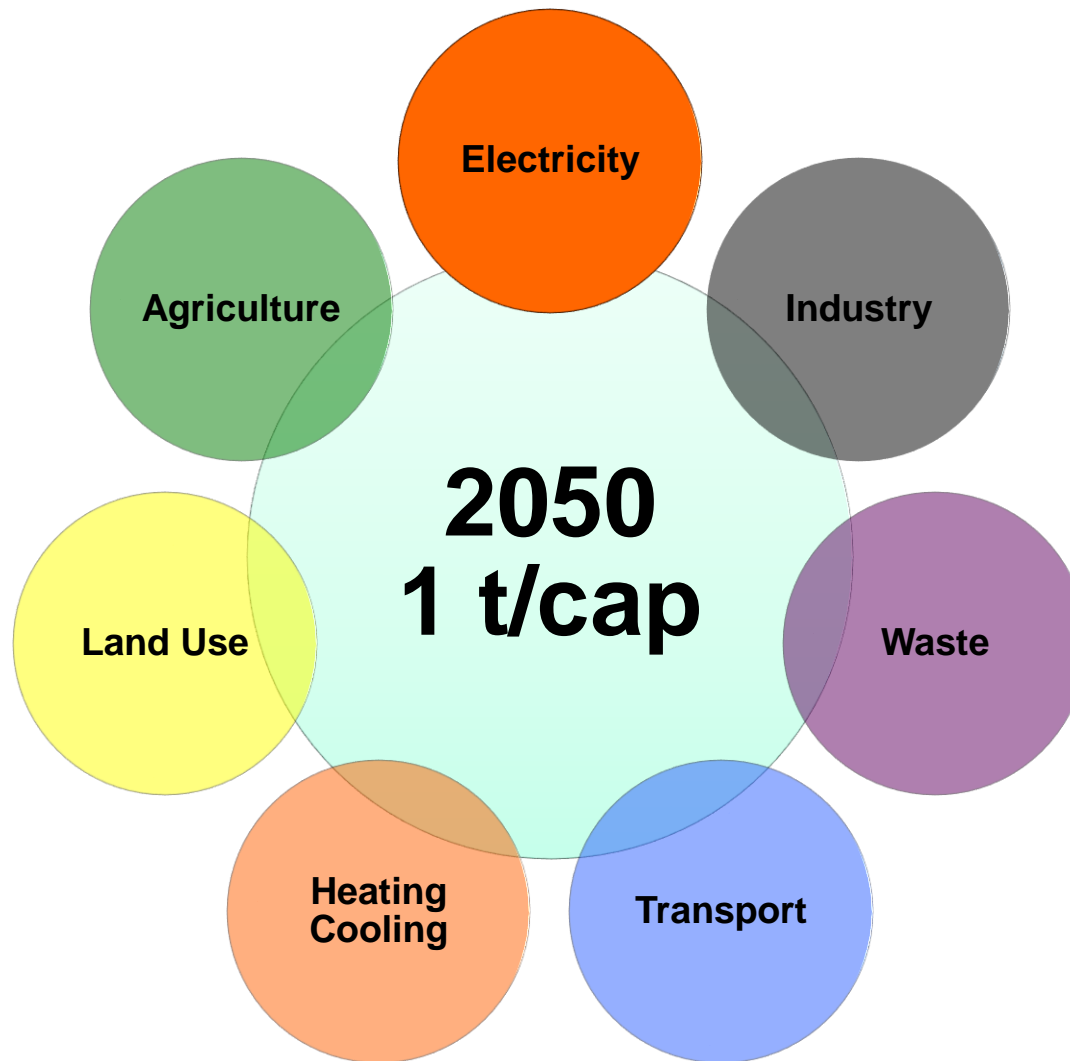
Komplex System

# Goals and Scenarios



## Komplex System

# A resource efficient pathway towards a greenhouse gas neutral Germany





## Scenario variations

|  | GreenEe   | Green     | GreenMe   | GreenLife | GreenSupreme |
|--|-----------|-----------|-----------|-----------|--------------|
| <b>Greenhouse gas reduction 2050</b>   | very high | very high | very high | very high | very high    |
| <b>Level of ambition on climate protection measures in the pathway (2030 and 2040)</b> | high      | medium    | high      | high      | very high    |
| <b>Ultimate energy demand</b>  | low       | high      | low       | very low  | low          |
| <b>Raw material use</b>  | medium    | high      | low       | low       | low          |
| <b>Raw material efficiency</b>   | high      | medium    | very high | high      | very high    |
| <b>Behavioral changes</b>  | medium    | medium    | medium    | very high | high         |

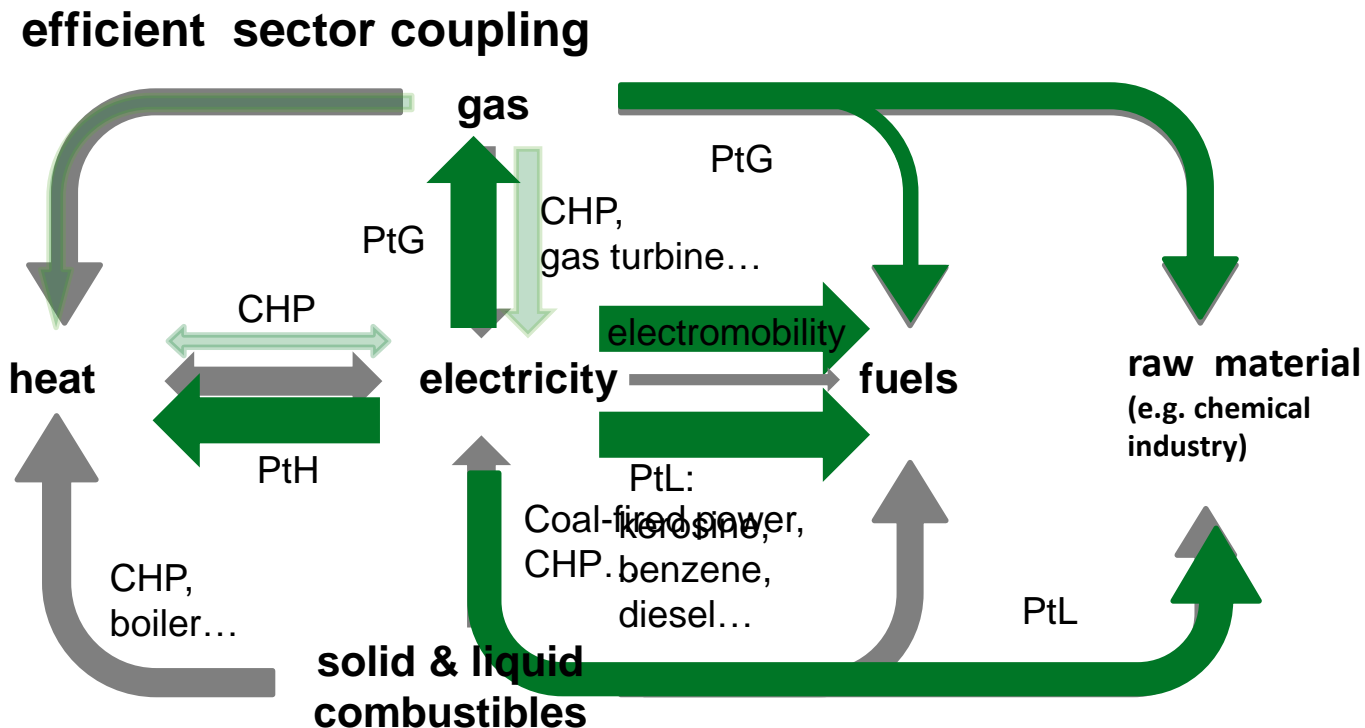
## Basic assumptions in the GreenEe - Scenario

- **Population** in 2050 around 72 Mio.
- Germany is still a strong **industrialised** country with an export orientation
- **Economic** development 0,7 % annual growth in GDP
- Net zero built-up **area** in 2050

# A resource efficient pathway towards a greenhouse gas neutral Germany

## Energy System Transformation -

- **Sustainable energy system**  
(no CCS, nuclear energy and crop-based bioenergy (to end after 2030))
- Fast introduction of **renewables**
- full exploitation of the potential for increasing **efficiency**

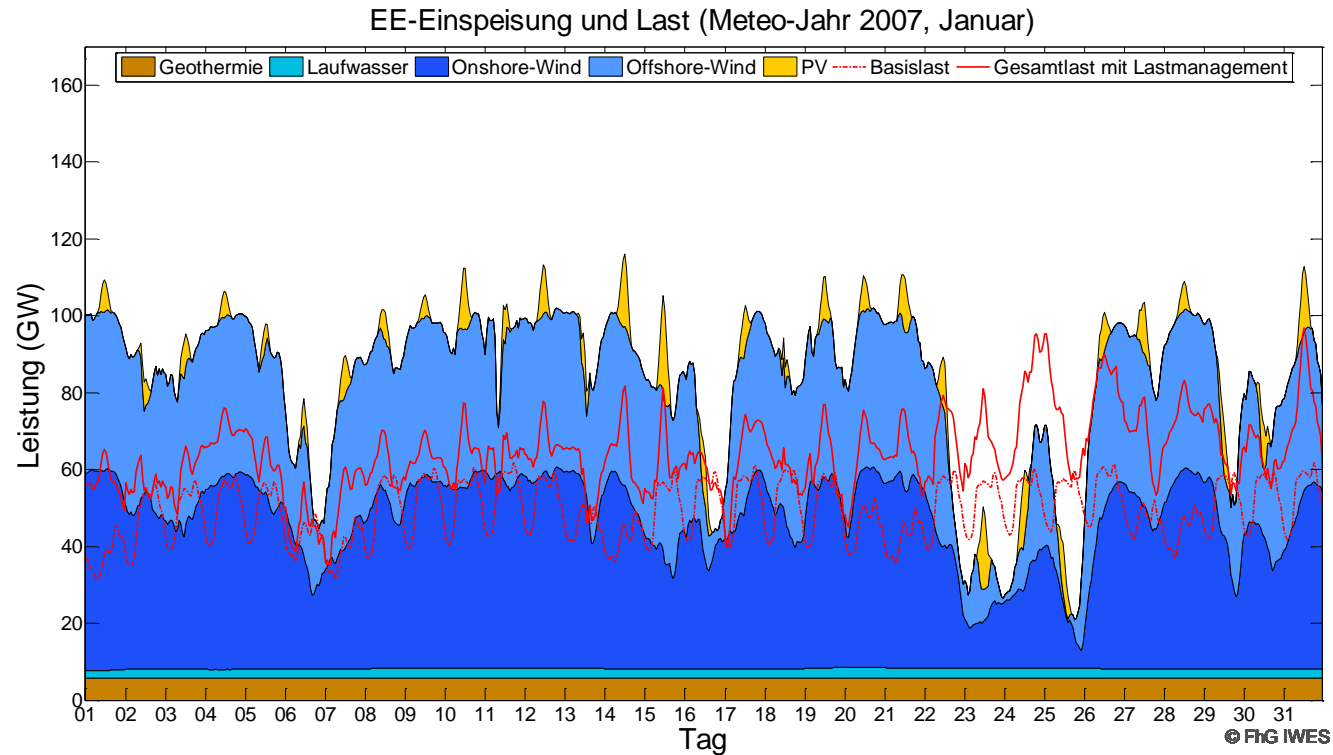


Quelle: UBA 2010 ff

# A resource efficient pathway towards a greenhouse gas neutral Germany

## Energy System Transformation -

### efficient sector coupling

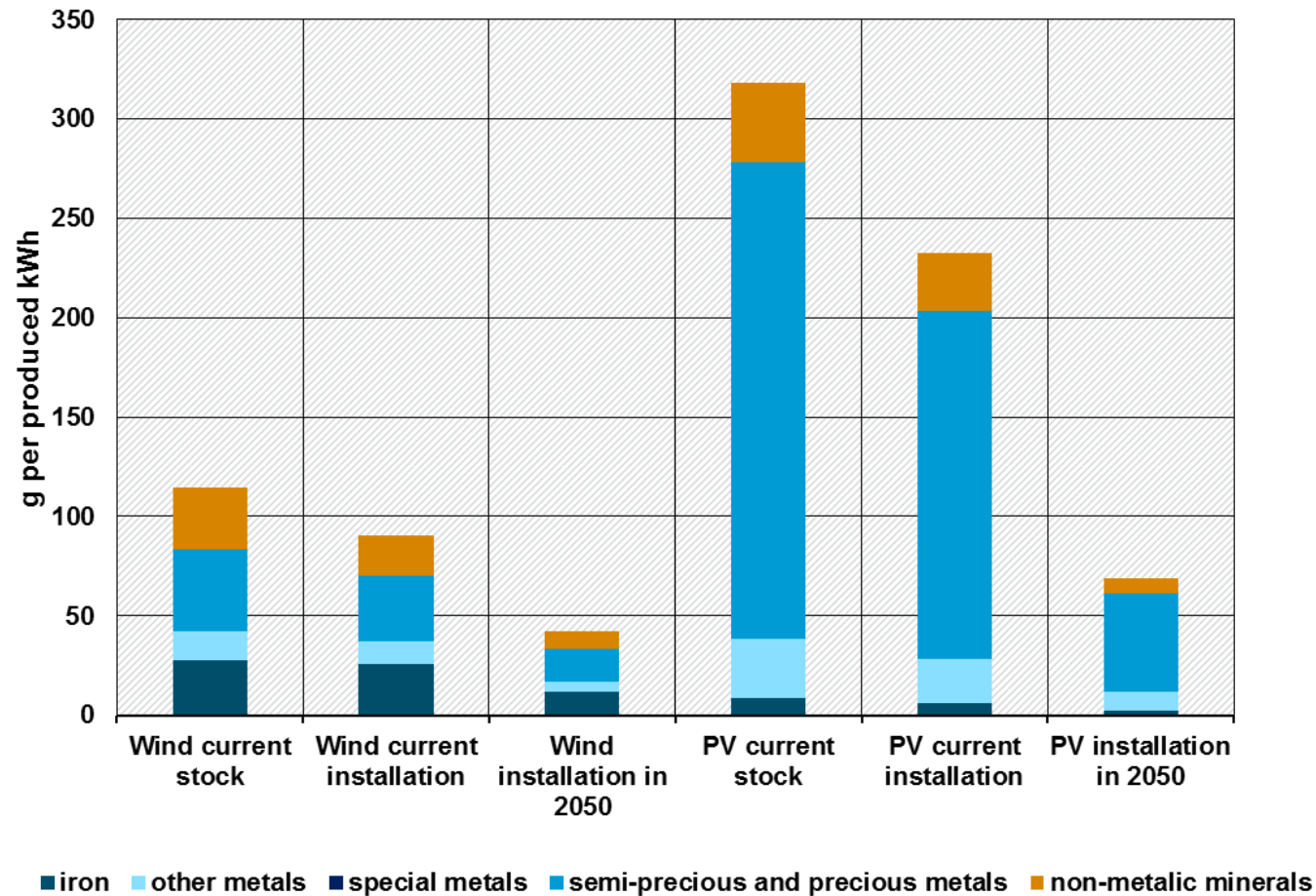


Quelle: UBA 2010 ff

Harry Lehmann UBA

# A resource efficient pathway towards a greenhouse gas neutral Germany

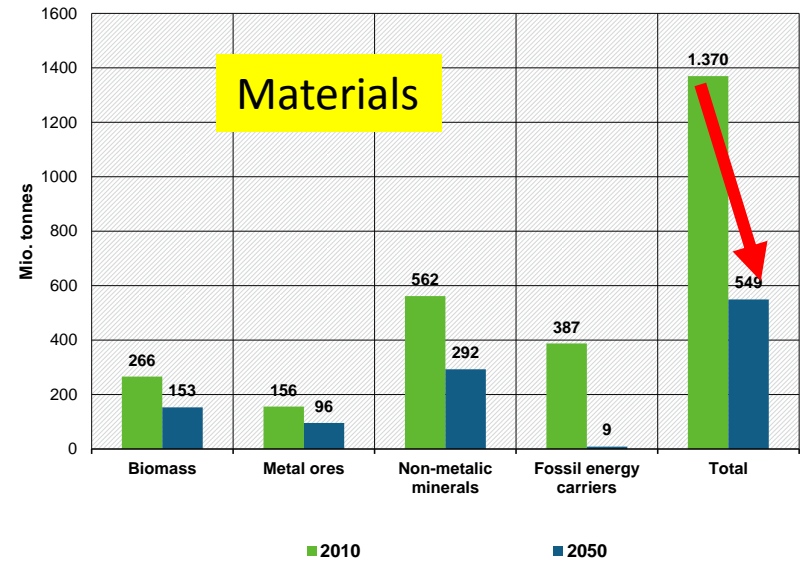
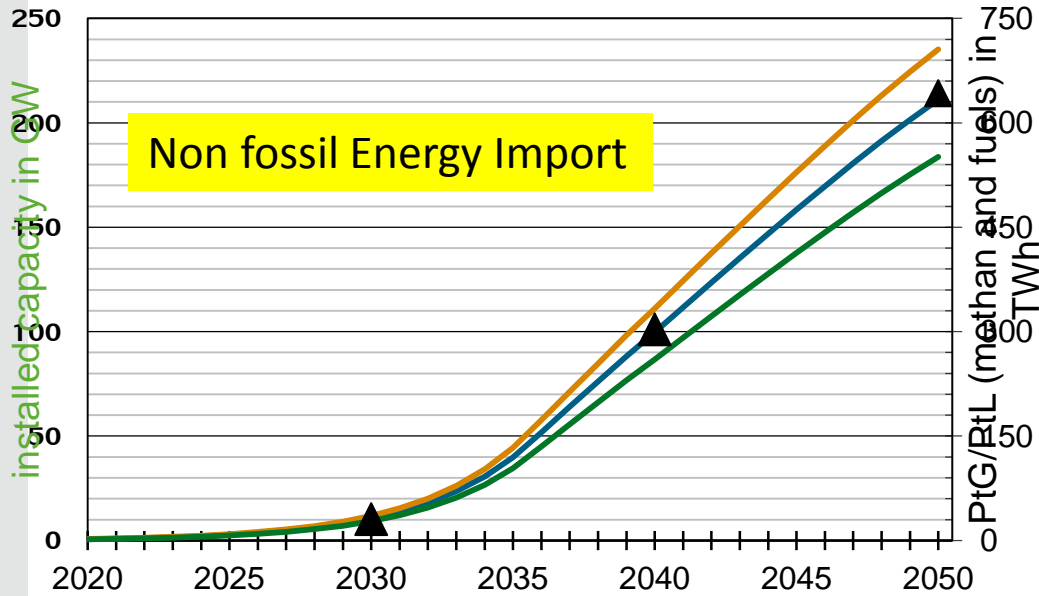
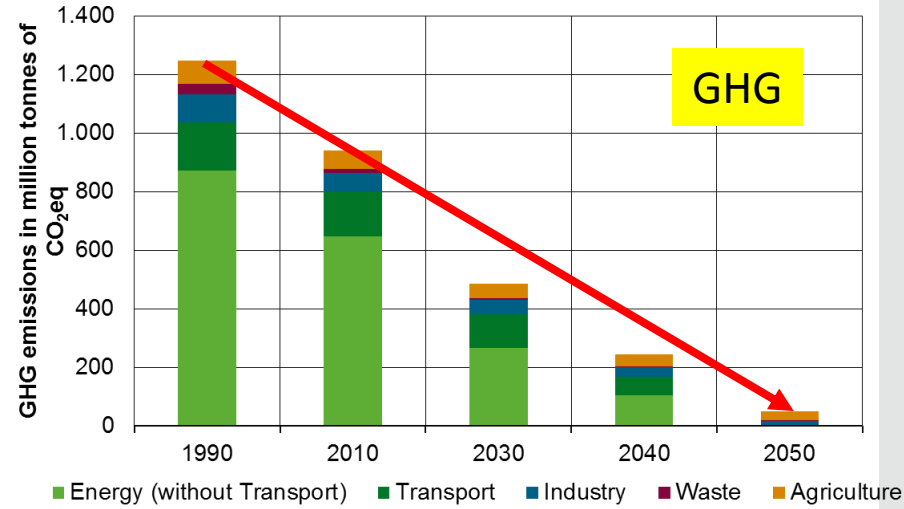
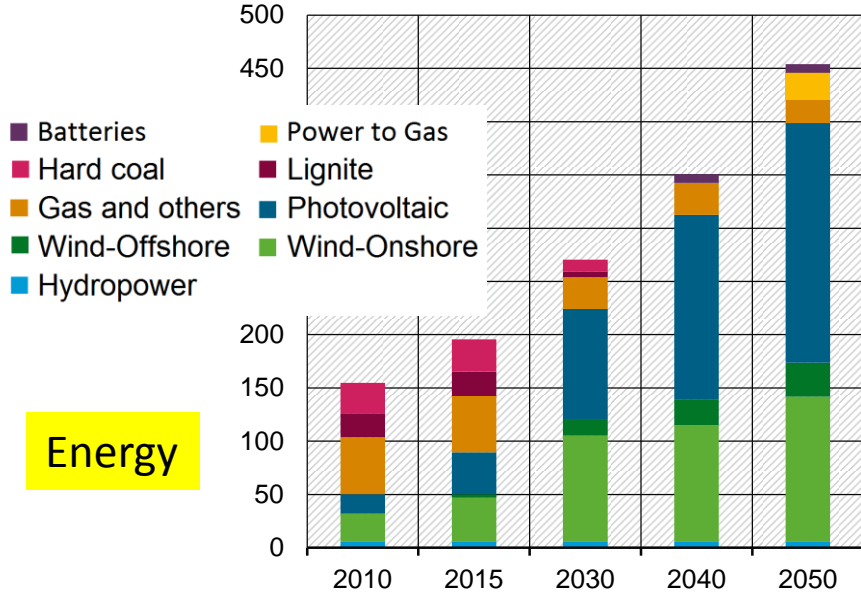
## Raw material demand of technologies



Wiesen, Klaus, et al. „Analyse des Rohstoaufwandes der Energieinfrastruktur in Deutschland.“  
Sachverständigen Gutachten im Auftrag des Umweltbundesamtes – Wuppertal, Dessau-Roßlau, 2017l.

# Goals and Scenarios -

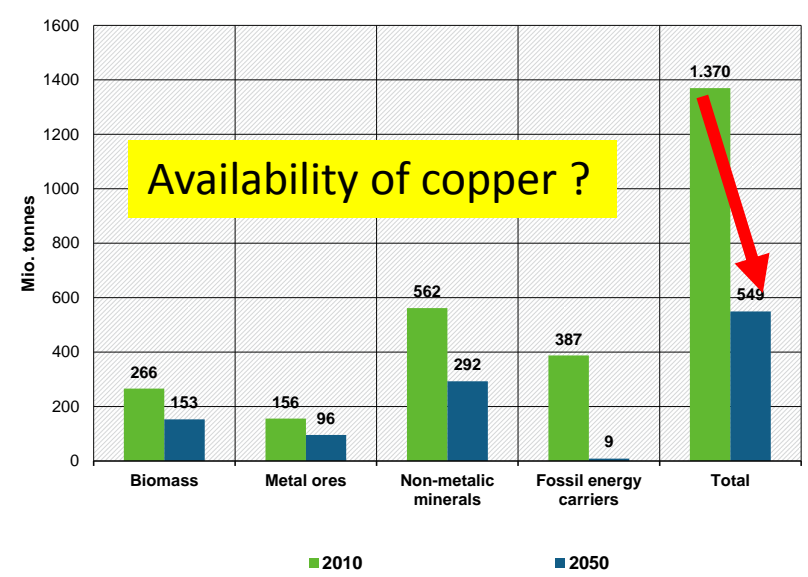
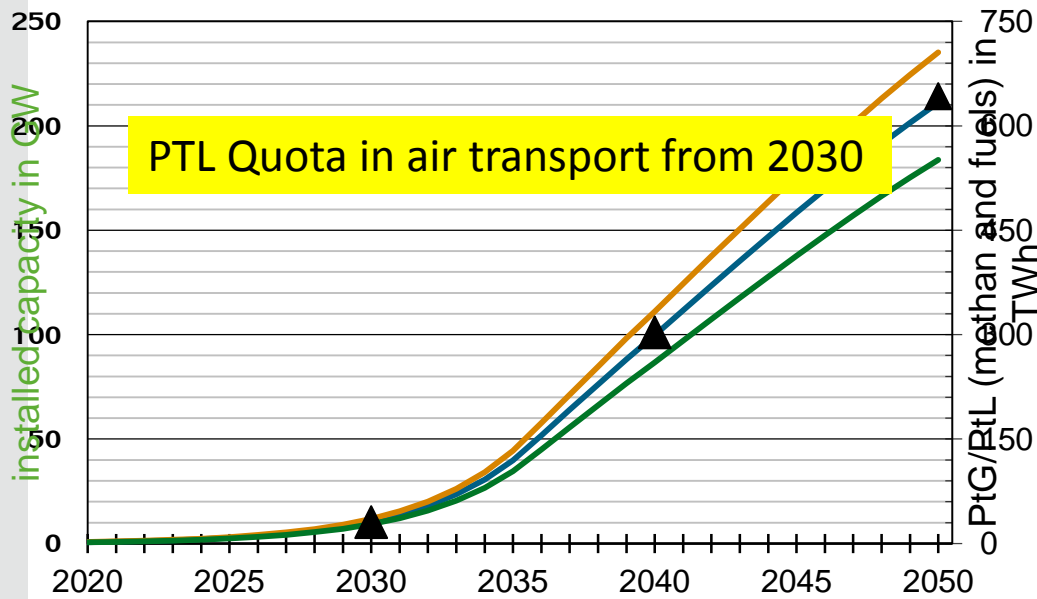
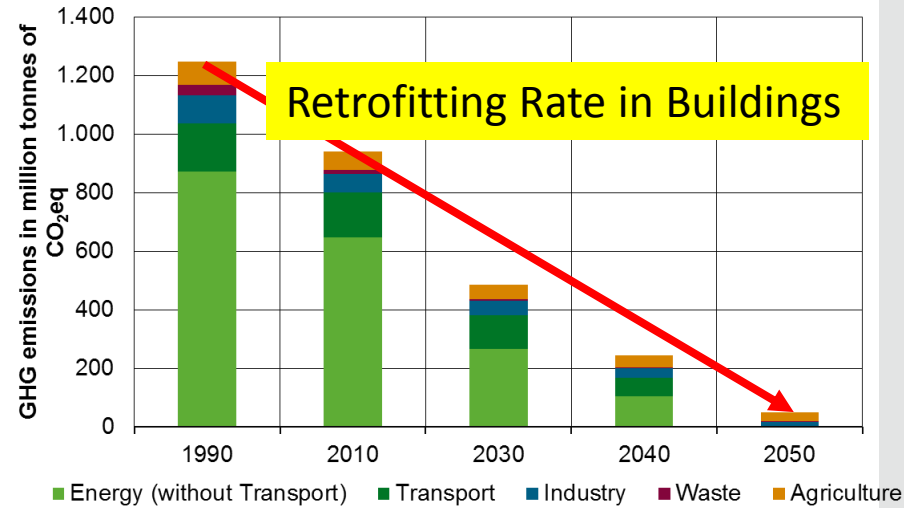
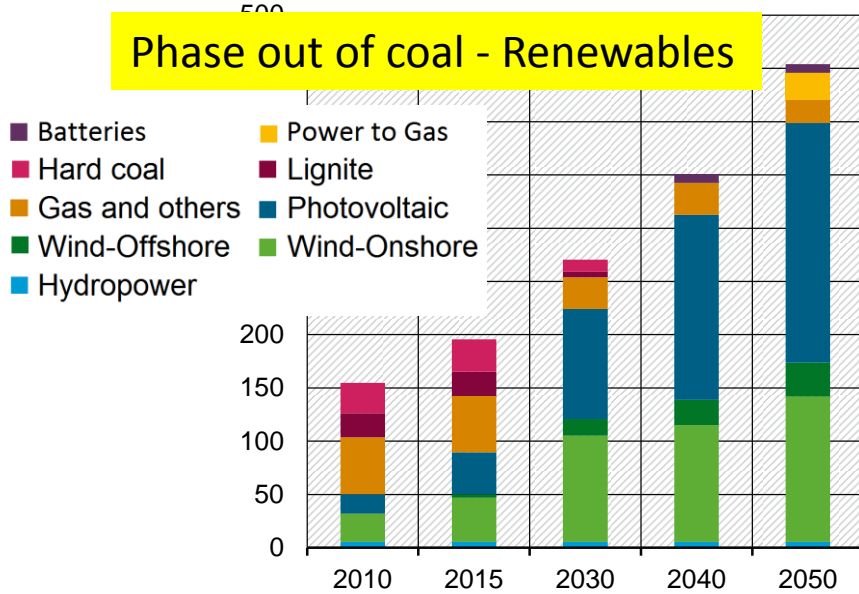
# Results



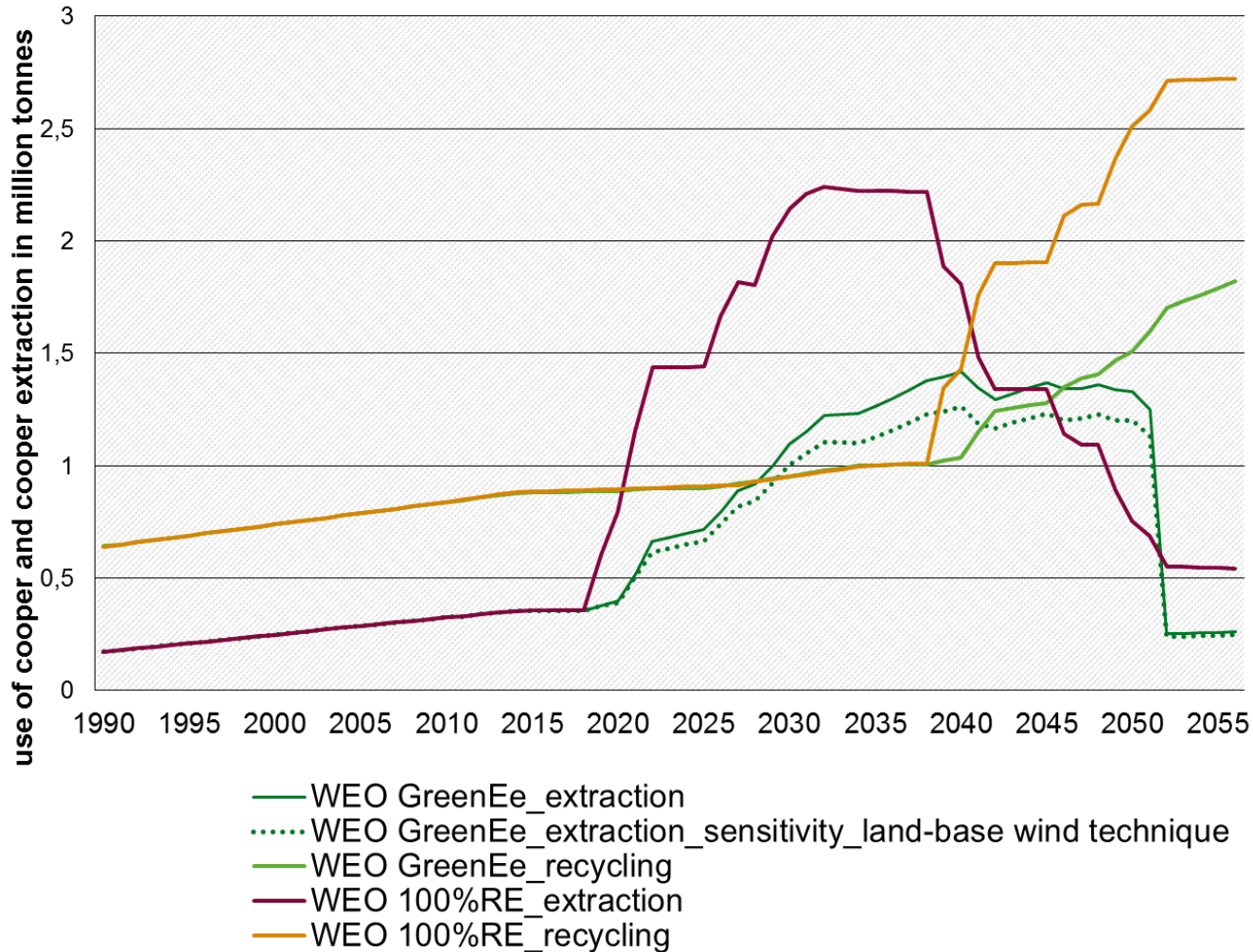
# Goals and Scenarios –

# Policies

## Phase out of coal - Renewables

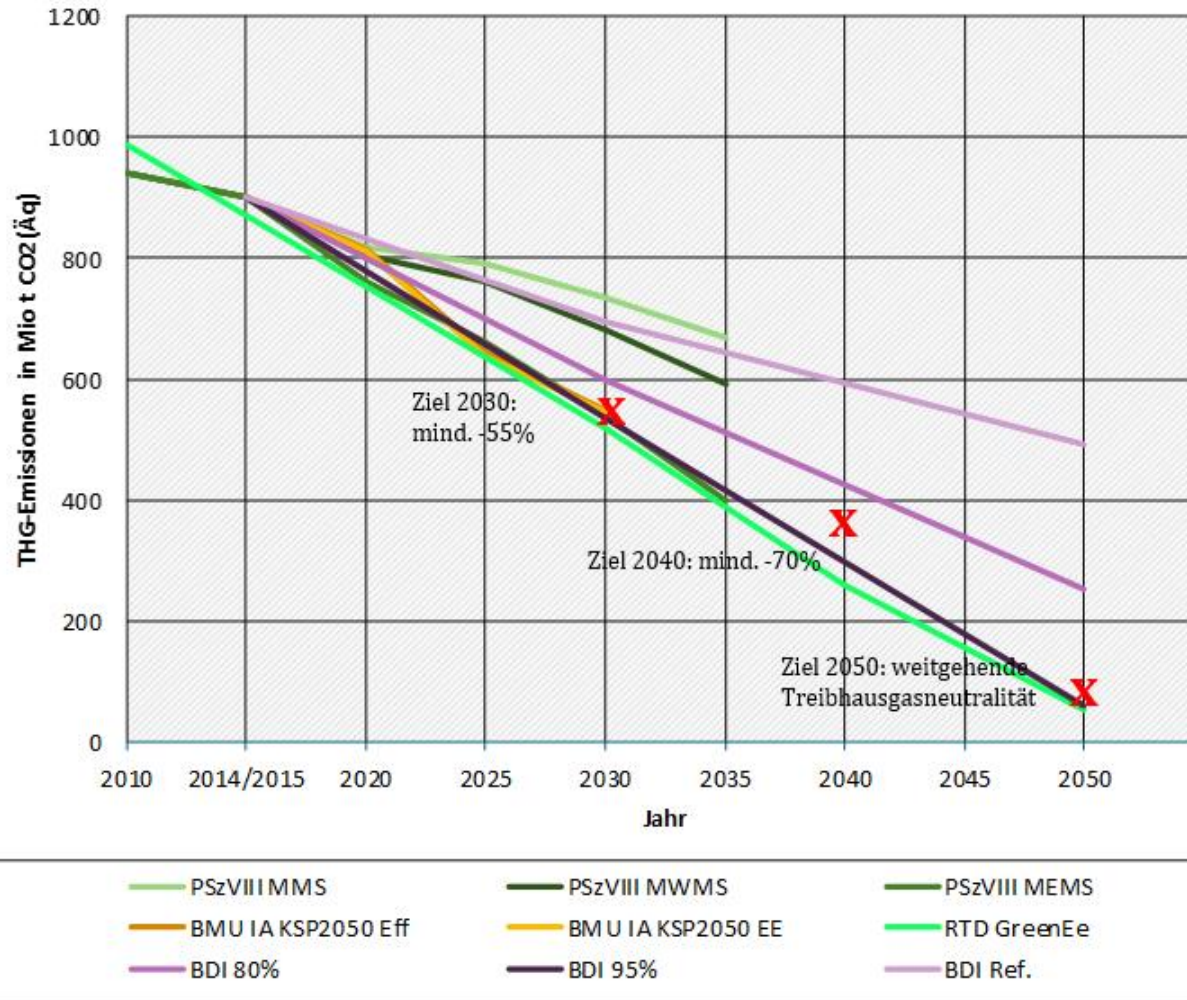


## Global transferability– a system dynamic view - copper



- „Zooming in“ semi-precious metals
- demand(= extraction) strongly increase through extension of renewable energies („copper mountain“)
- recycling capacities need to follow rapidly
- Persisting „gap“ must be closed with primary raw materials
- Sensitivity (green dotted line) shows influence of technological assumptions

# Comparison of Climate Protection Scenarios



Quelle: Bundesregierung (2017): Projektionsbericht, UBA (2018): Politikszenerien\*\*, BMU: Folgenabschätzung Sektorziele 2030 im Klimaschutzplan\*\*, UBA (2017): Den Weg zu einem treibhausgasneutralen Deutschland ressourcenschonend gestalten, BDI (2018): Klim



# A resource efficient pathway towards a greenhouse gas neutral Germany

