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Energy Efficiency and Renewable Fuels

The two Keys for the Energy Transition in the Transportation Sector

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A3PS Conference 2014
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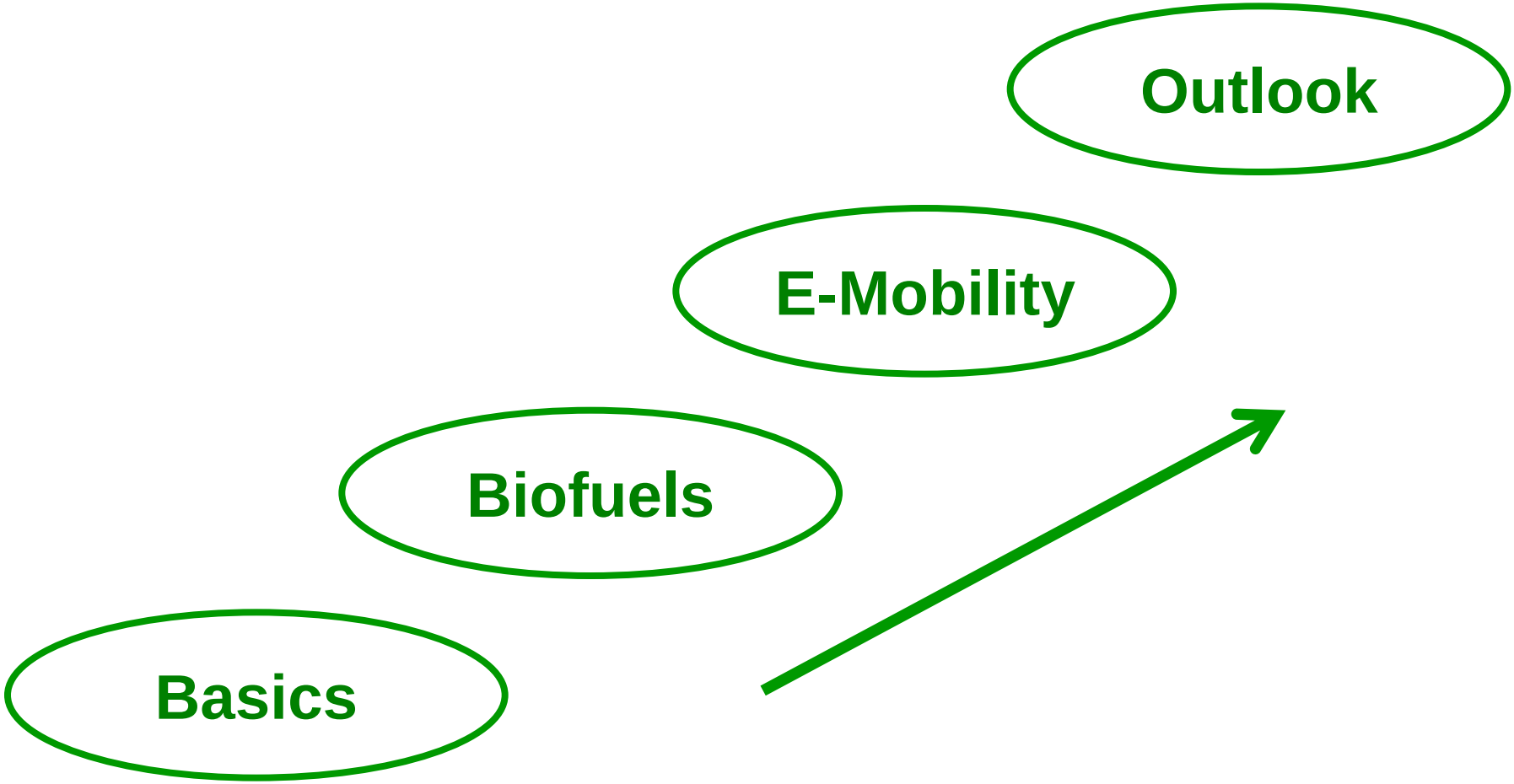
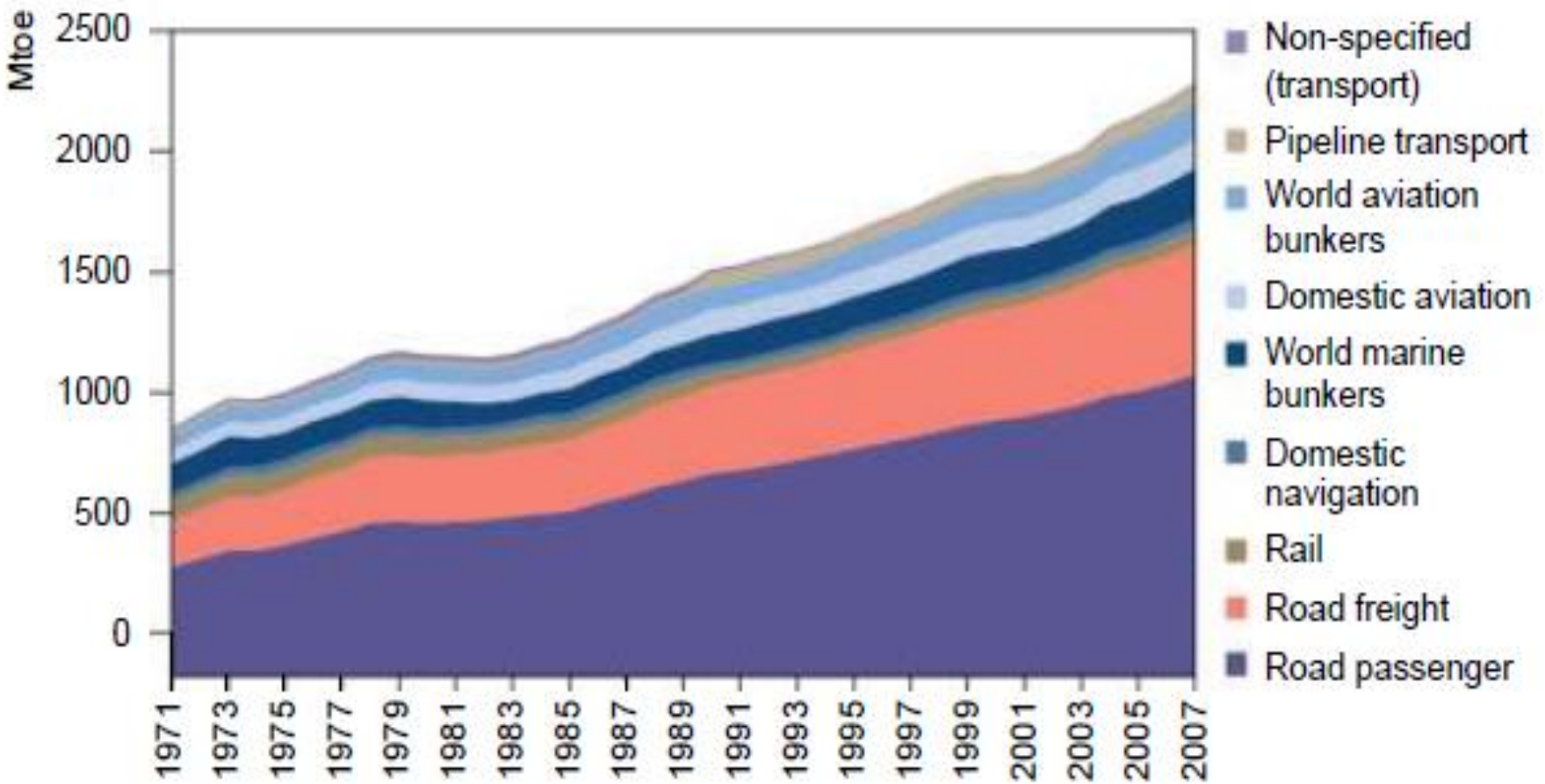
Overview



Global Transport Final Energy Use by Mode (Mtoe)



Note: 1 toe = 6.5 to 7.9 boe, depending on the type of oil

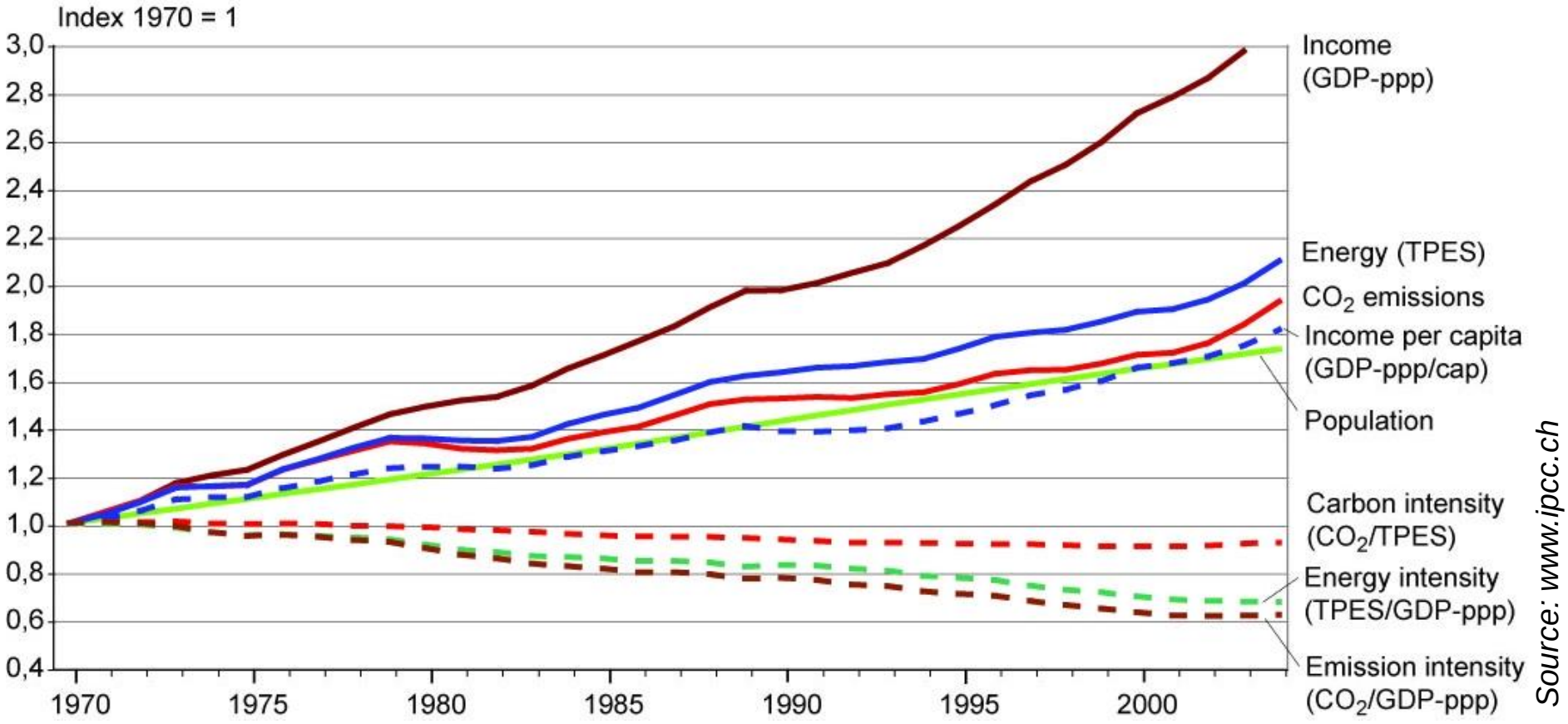
Source: WEC 2011

Factors Influencing CO_2-emissions of Transportation Service

Emission factor (e.g. renewable energy)	Energy conversion efficiency	Transportation service demand per person	Number of persons

$$CO_2 = (CO_2/MJ) \times (MJ/km) \times (km/cap) \times cap$$

Development of Indicators: Increasing Renewable Energy & Energy Efficiency, but……



Source: www.ipcc.ch

TPES .....total primary energy consumption, GDP.....gross domestic product

Statement on Environmental Assessment of Transportation Services

“There is international consensus that the environmental effects of transportation services can only be analyzed on the basis of

life cycle assessment (LCA)

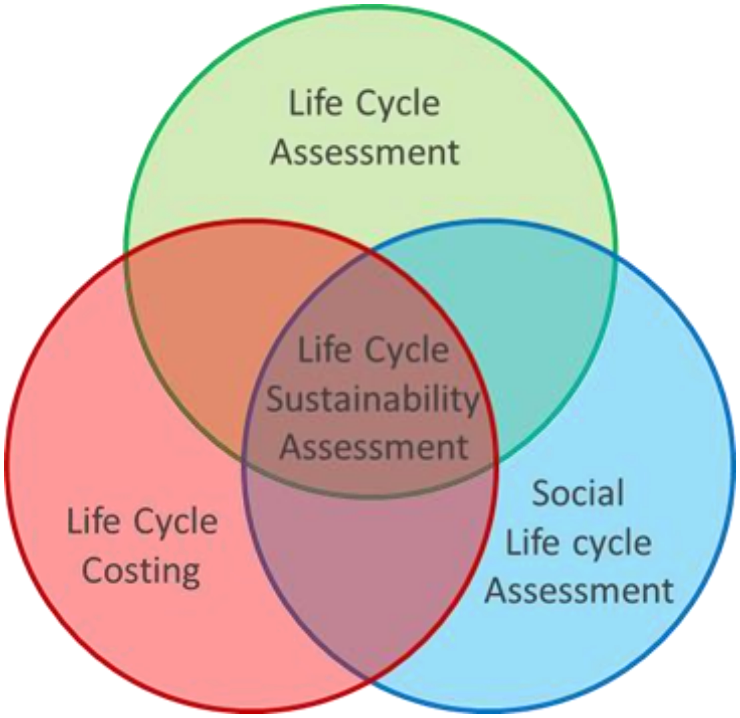
including the production, operation and the end of life treatment of the transportation system”

“….and in comparison to conventional transportation services”

Sustainabilityt in the Life Cycle

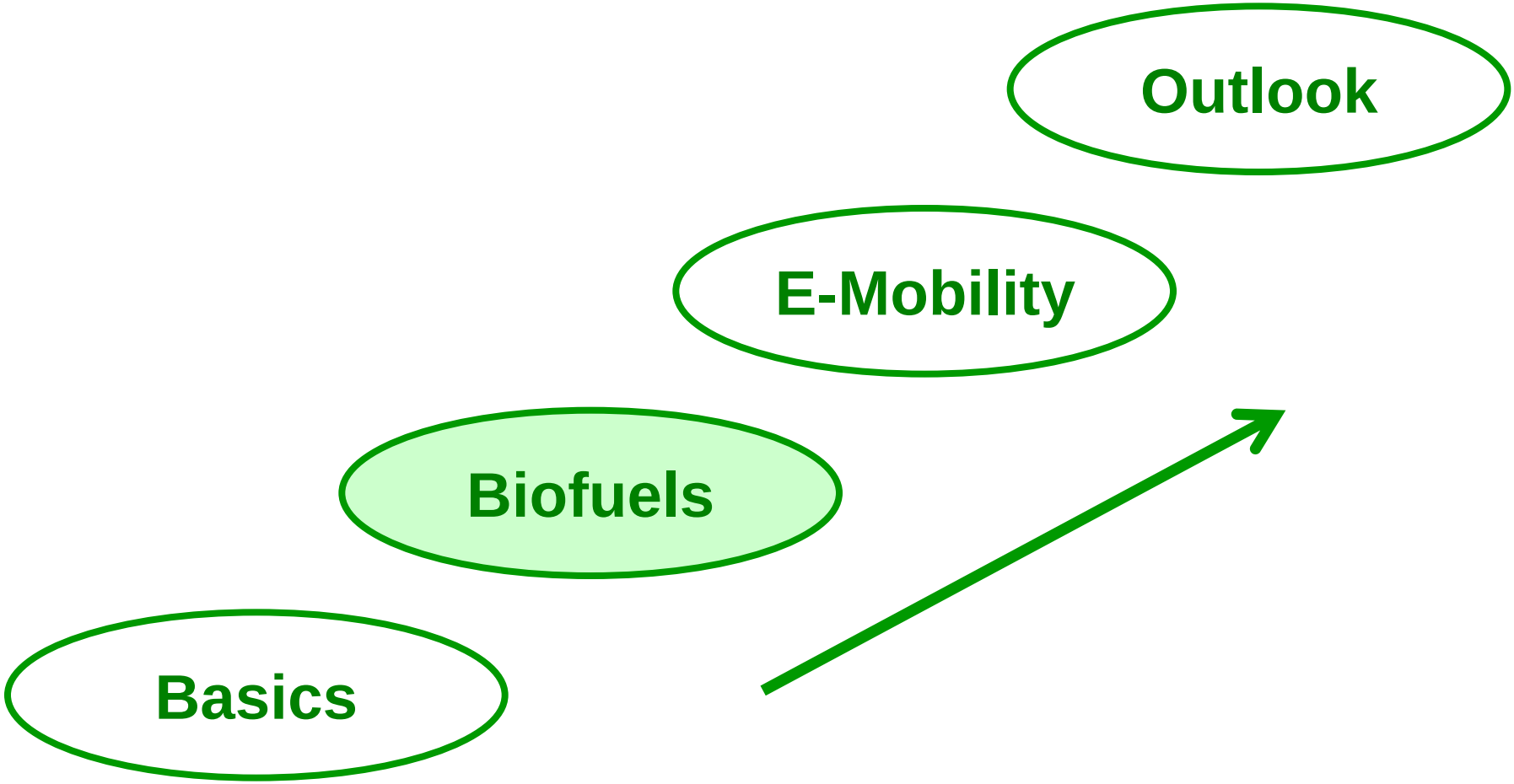
The Methods of Sustainability Assessment

- **Life Cycle Sustainability Assessment (LCSA):**
  - **Environment**: LCA – Life Cycle Assessment
  - **Economy:** LCC – Life Cycle Costing)
  - **Gesellschaft:** sLCA – Social Life Cycle Assessment



Environmental, economic and social assessment of sustainability based on scientific indicators

Overview



Key Drivers for 2020: Two European Directives: 10% Renewable Fuels & 6% GHG reduction

Renewable Energy Directive 2009/28/EC[15]

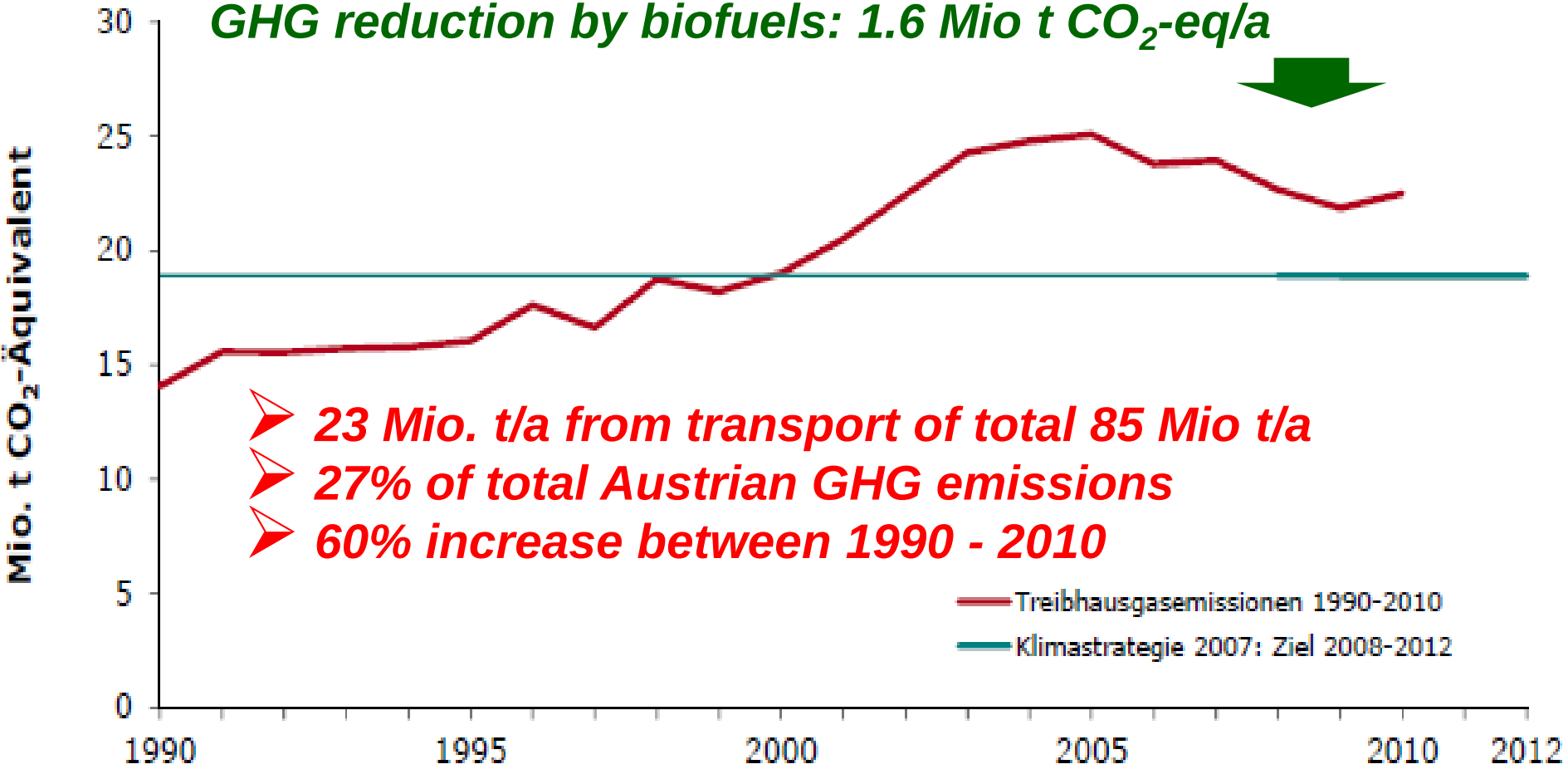
- By 2020, mandatory targets of 20 % share of RES in final energy consumption, 20 % increase in energy efficiency and 10 % of RES in transport in each Member State.
- Harmonised approach with Fuel Quality Directive
- No biofuels from carbon rich or bio-diverse land. EC has to report on compliance with environmental and social sustainability criteria of major biofuel exporting countries.
- Minimum GHG reduction for biofuels of 35% and 50% from 2017 onwards, and 60 % for new installations from 2017 onwards. For plants already operating in January 2008 GHG requirement will start in April 2013.
- Bonus of 29g CO_2/MJ for biofuels from degraded/ contaminated land.
- Biofuels from waste, residues, non food cellulosic material, and lignocellulosic material will count twice for RES transport target.
- Member State Implementation into national legislation by December 2010.

Source: European Biofuel Technology Platform 2010

Fuel Quality Directive 2009/30/EC

- Further tightening of environmental quality standards for a number of fuel parameters.
- Enabling more widespread use of ethanol in petrol (E10) with transitory regulations (protection grade E5) for older cars and derogations for petrol vapour pressure, subject to EC approval.
- Increase of allowed biodiesel content in diesel to 7% (B7) by vol., with an option for more than 7% with consumer info.
- Introducing a mechanism for reporting and reduction of the life cycle GHG emissions from fuel.
- Reduction in life cycle GHG emissions from energy supplied. Binding target of 6% between 2011-2020 as first step, while leaving open the possibility to increase future level to 10 %.
- In a 2012 review, the Commission will need to assess a further increase of the level of 2% from other technological advances, such as the supply of electricity for use in transport. A further 2% is envisaged by the use of CDM credits for flaring reductions not linked to EU oil consumption.

GHG Emission of Austrian Transportation Sector



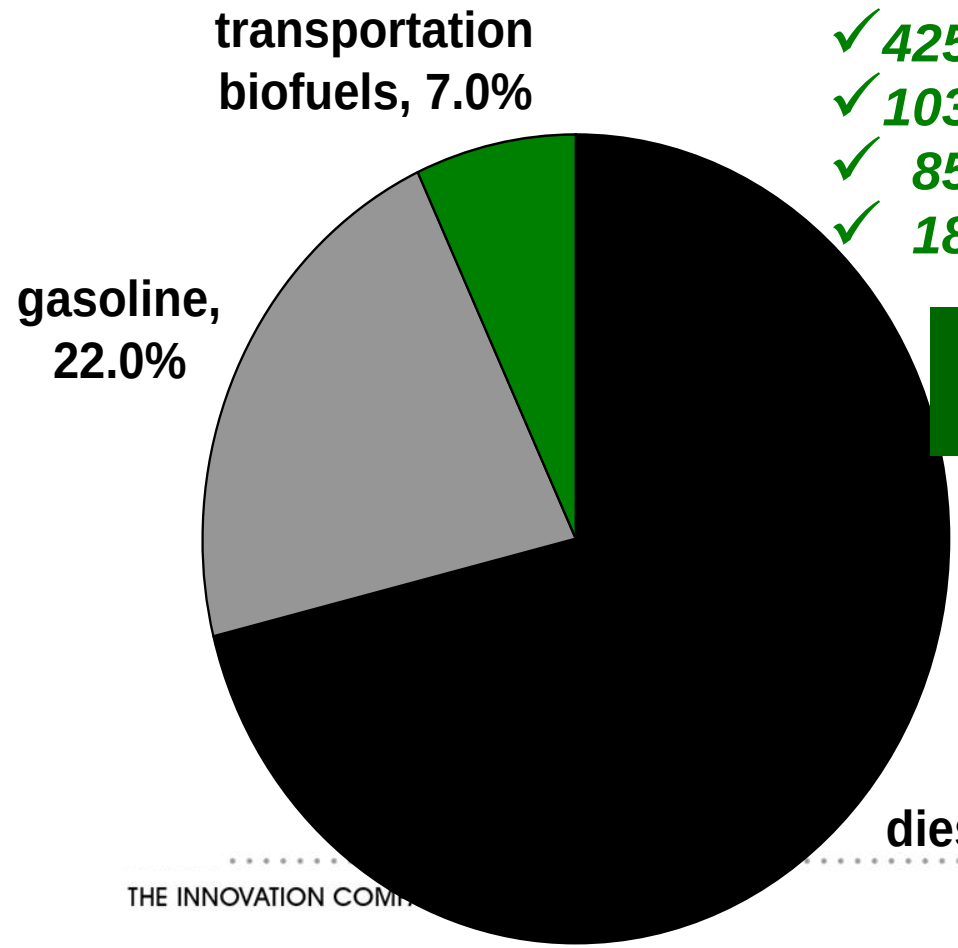
- *23 Mio. t/a from transport of total 85 Mio t/a*
- *27% of total Austrian GHG emissions*
- *60% increase between 1990 - 2010*

Quelle: Umweltbundesamt (2012)

Biofuels are Already Part of the Austrian Transportation Sector 2010

Transportation biofuels:

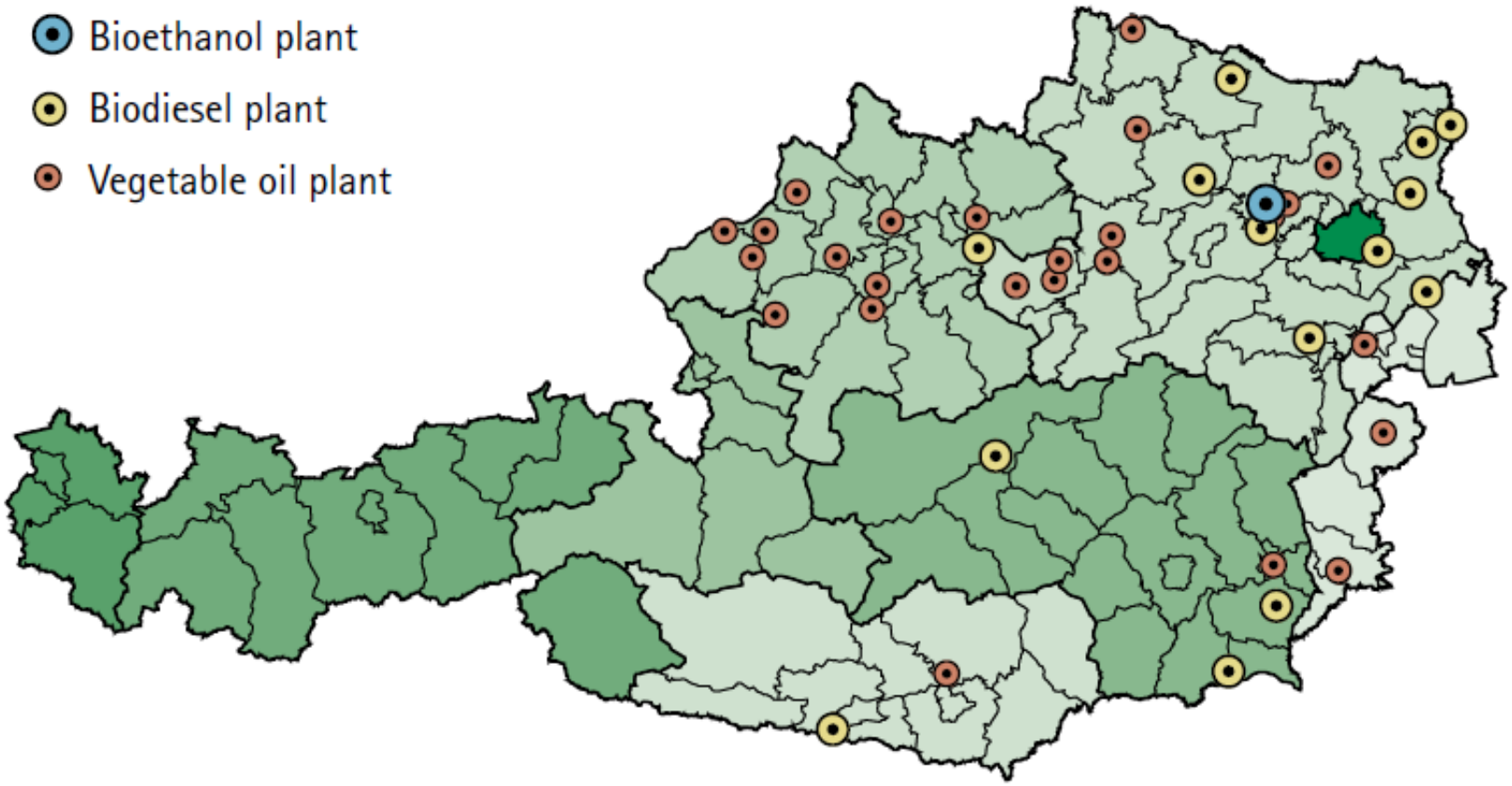
- ✓ ***425,000 t/a biodiesel to diesel (B7)***
- ✓ ***103,000 t/a bioethanol to gasoline (E5)***
- ✓ ***85,000 t/a pure biodiesel (B100)***
- ✓ ***18,000 t/a pure vegetable oil***



3.1%-reduction GHG intensity of road transportation fuels

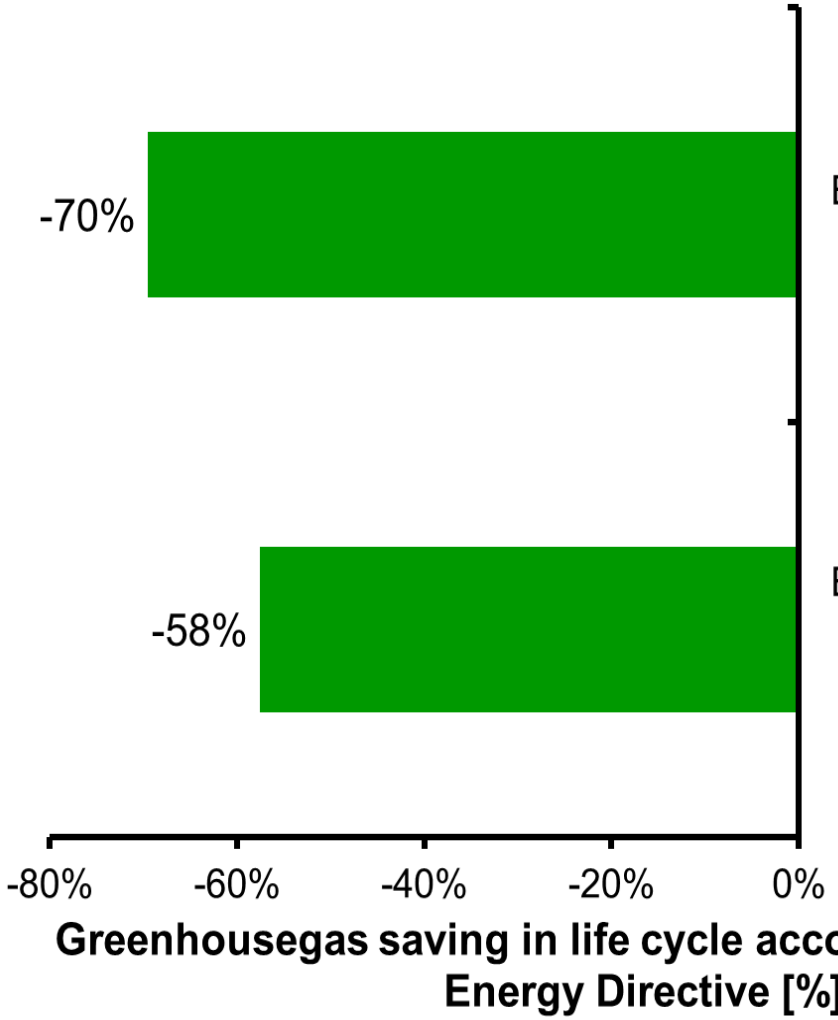
Source: Biokraftstoffe im Verkehrssektor 2011, UBA; own calculations

Biofuel Plants in Austria 2009



Source: Chamber of Agriculture Austria

Greenhouse Gas Saving of Transportation Biofuels Made in Austria



Own calculations of Austrian plants (2008 - 2013) according to RED-methodology
Source feedstock mix 2011: ARGE Biokraft 2012

IEA Bioenergy
Task 42 Biorefining

Maize What For? Two Green Arguments

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This plastic bag is made from maize, a renewable resource, and decomposes naturally

This biofuel is made from maize, a renewable resource to reduce GHG emissions

Direct (dLUC) and indirect Land Use Change (iLUC)

IEA Bioenergy
Task 42 Biorefining

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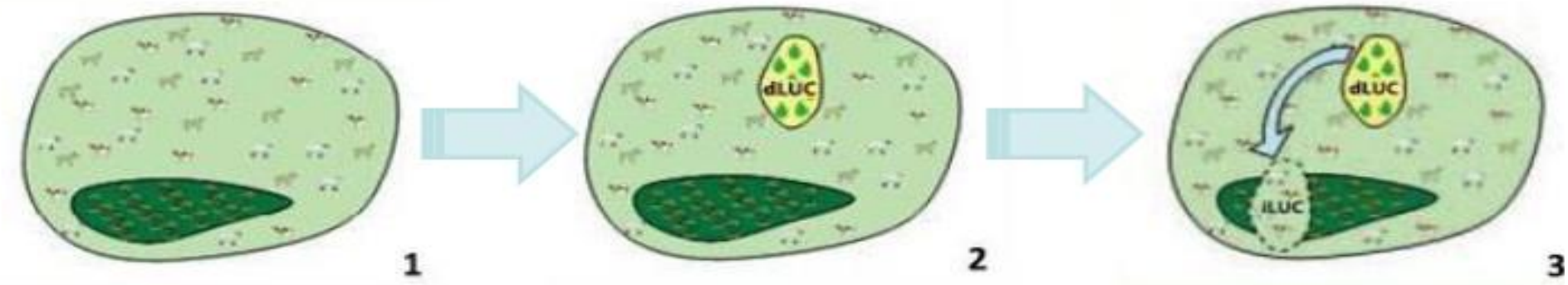
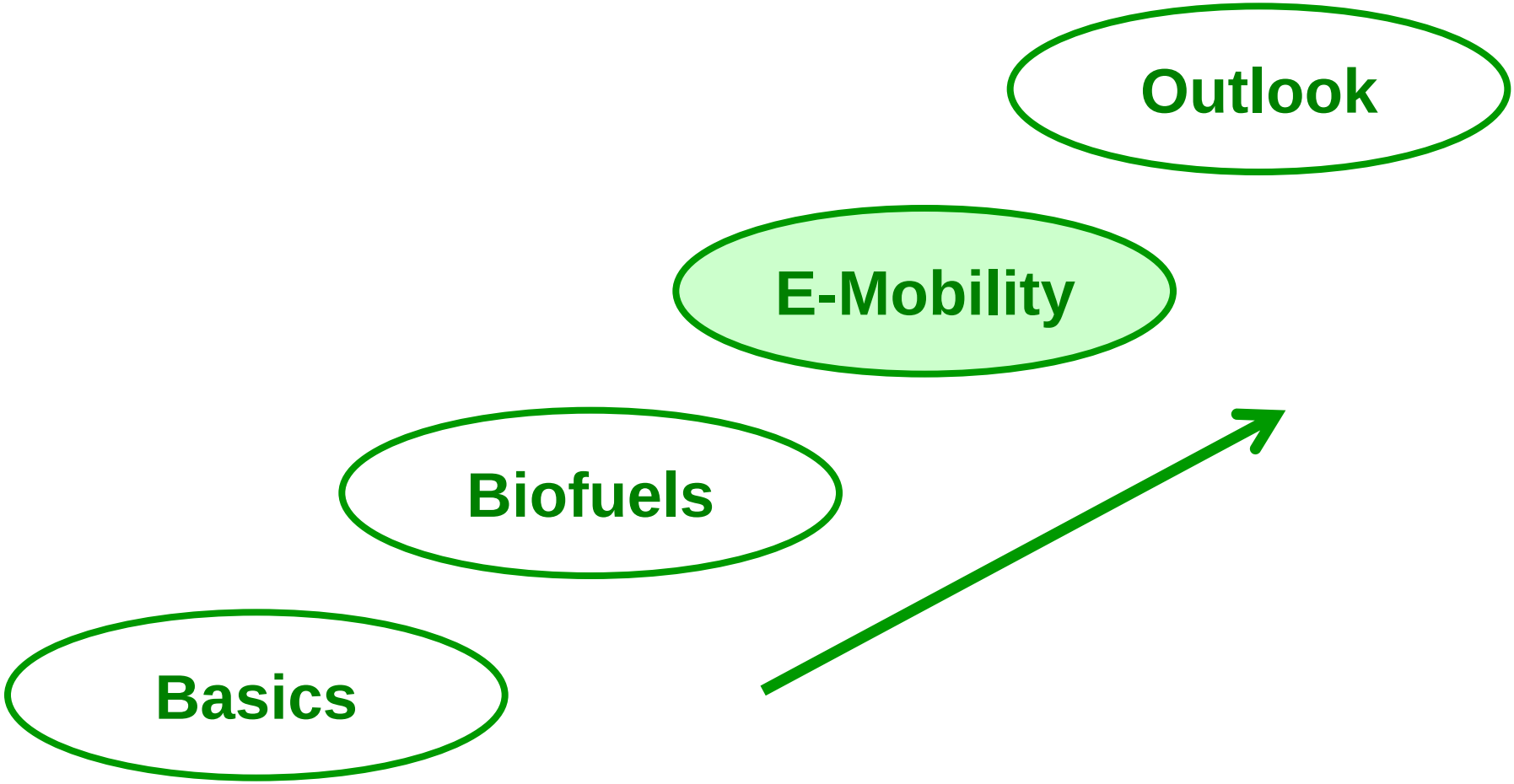


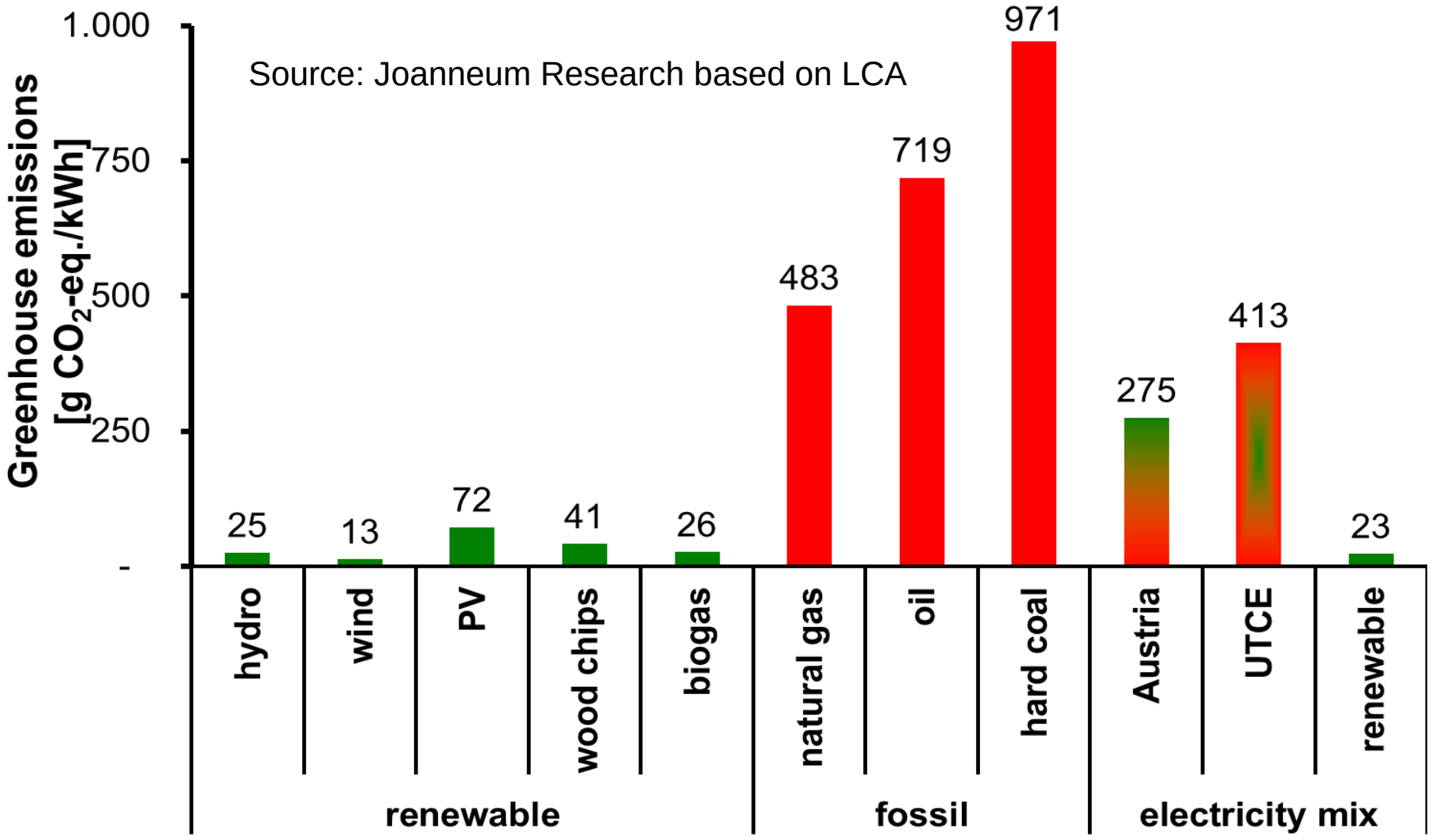
Direct Land Use Change (dLUC):
If for cultivation of energy crops a direct land use change takes place, e.g. from pasture agricultural land. Direct effects can be calculated, e.g. change of carbon storage pools.

Indirect Land Use Change (iLUC):
if existing agricultural land is now used for energy crops, which was used for other product before. The demand for these products remain and additional land is used causing land use change on global scale, e.g. conversion of natural forests into agricultural land. Indirect effects can be calculated after localisation, which is difficult on global level.

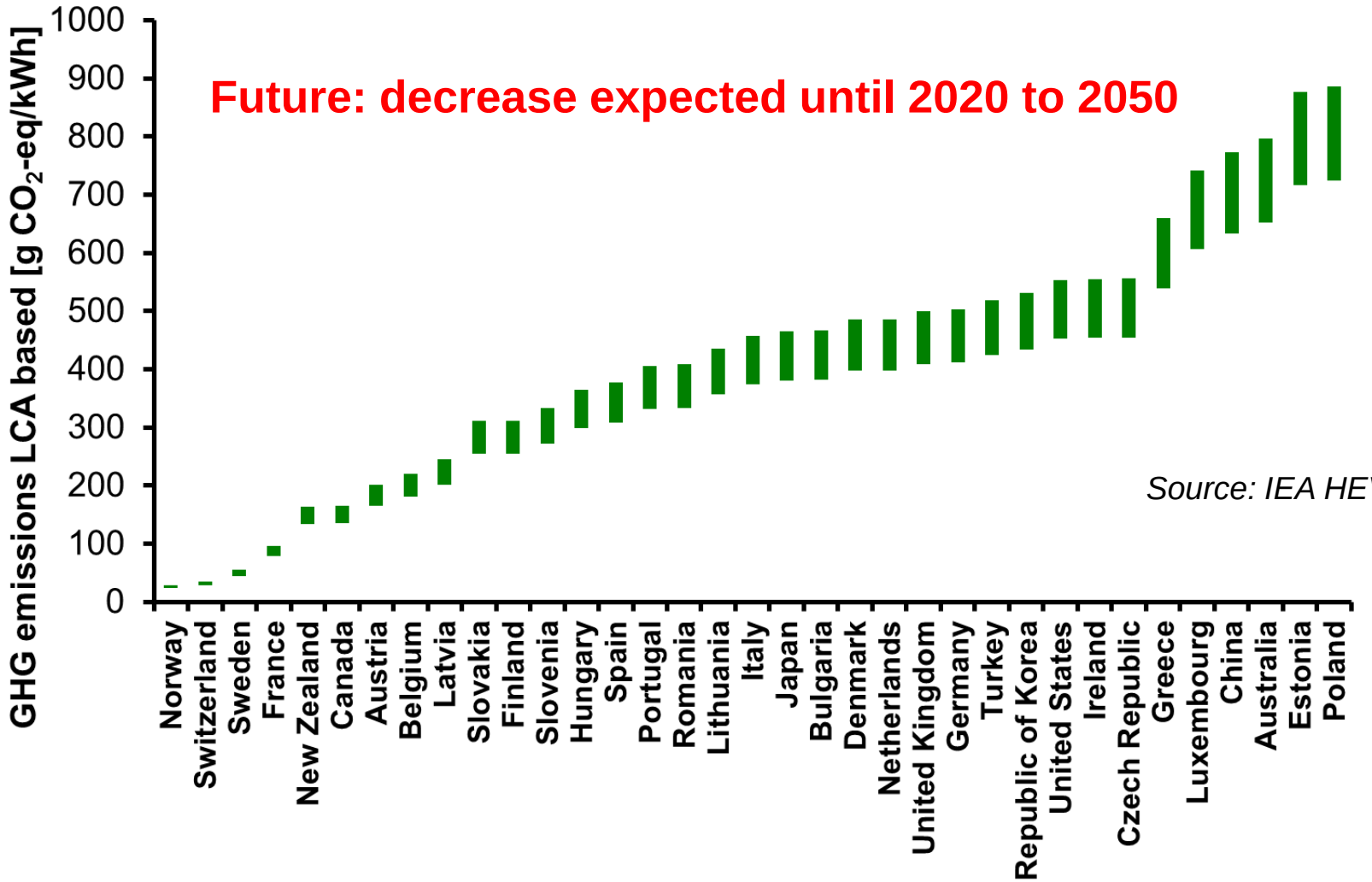
Overview



All Types of Electricity Generation Have GHG Emissions

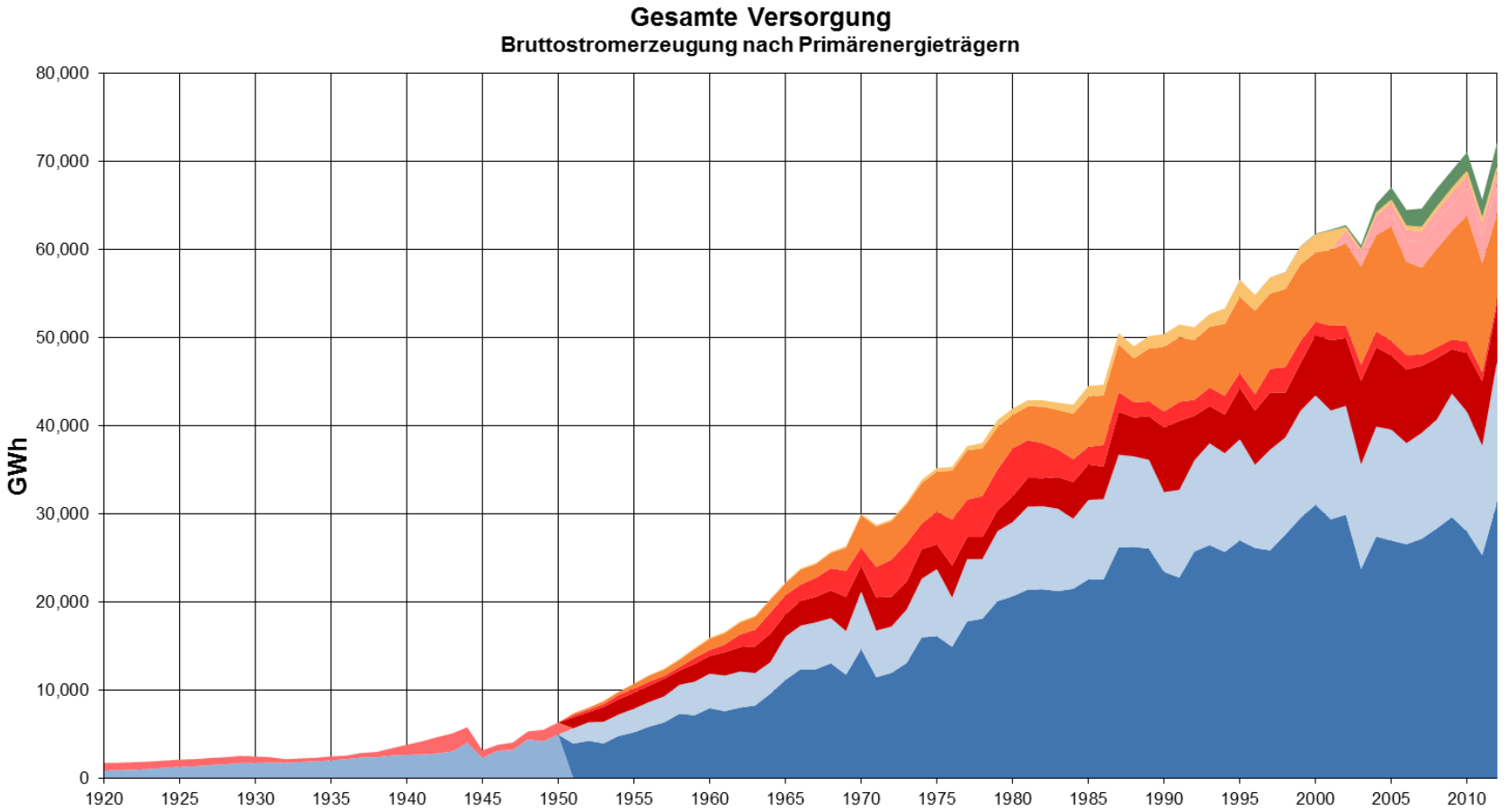


LCA Based GHG Emissions of Current Average National Electricity Mix



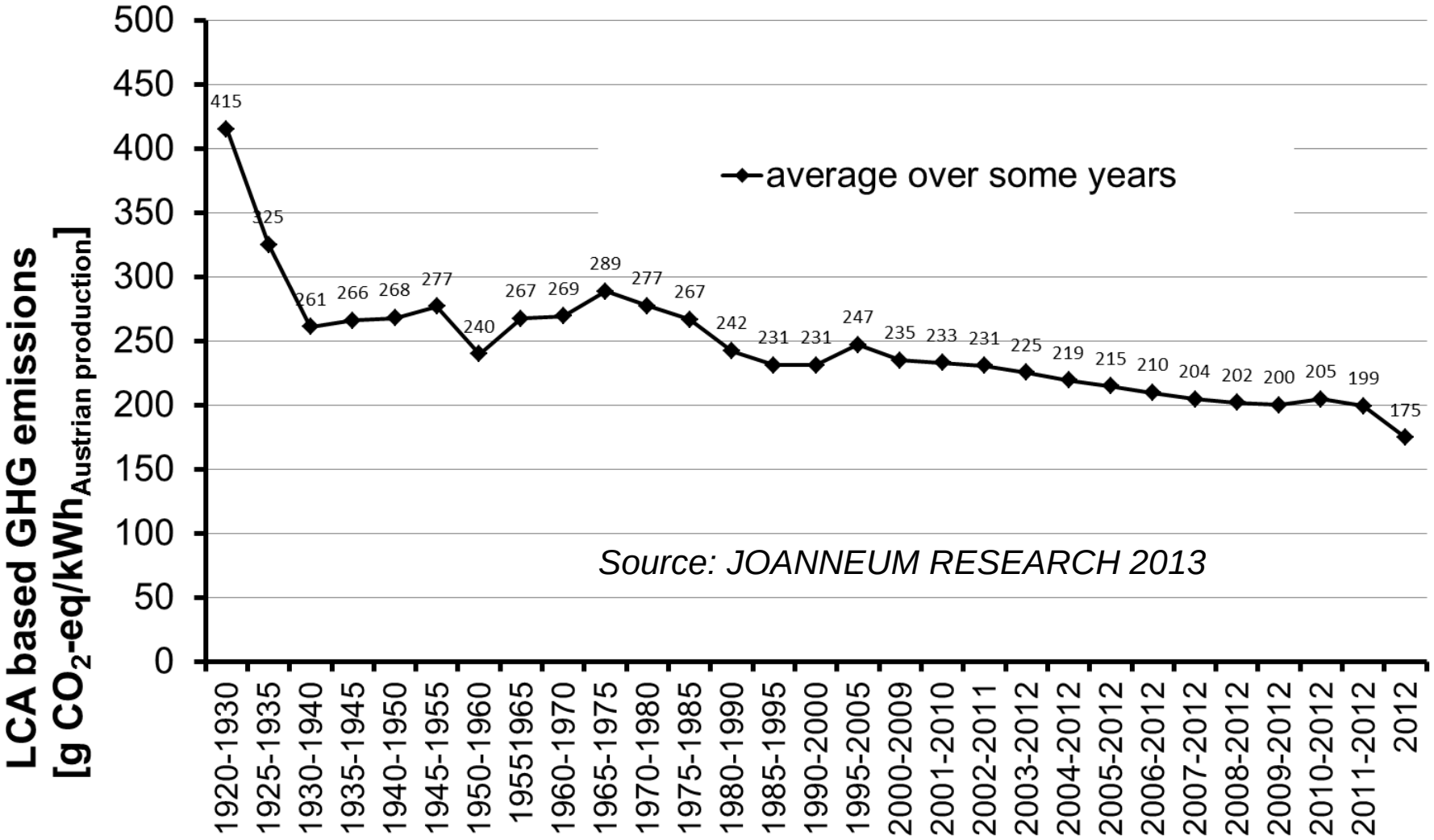
Source: IEA HEV Task 19

Development of Austrian Electricity Production



Quelle:
Energie-Control

Development of GHG Emissions of Averaged Austrian Electricity Production



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Assessment of LCA-Aspects over Full Value Chain

Primary Energy

Electricity production

Electricity grid

Charging infrastructure

Production of vehicle

Production of battery

Electric vehicle

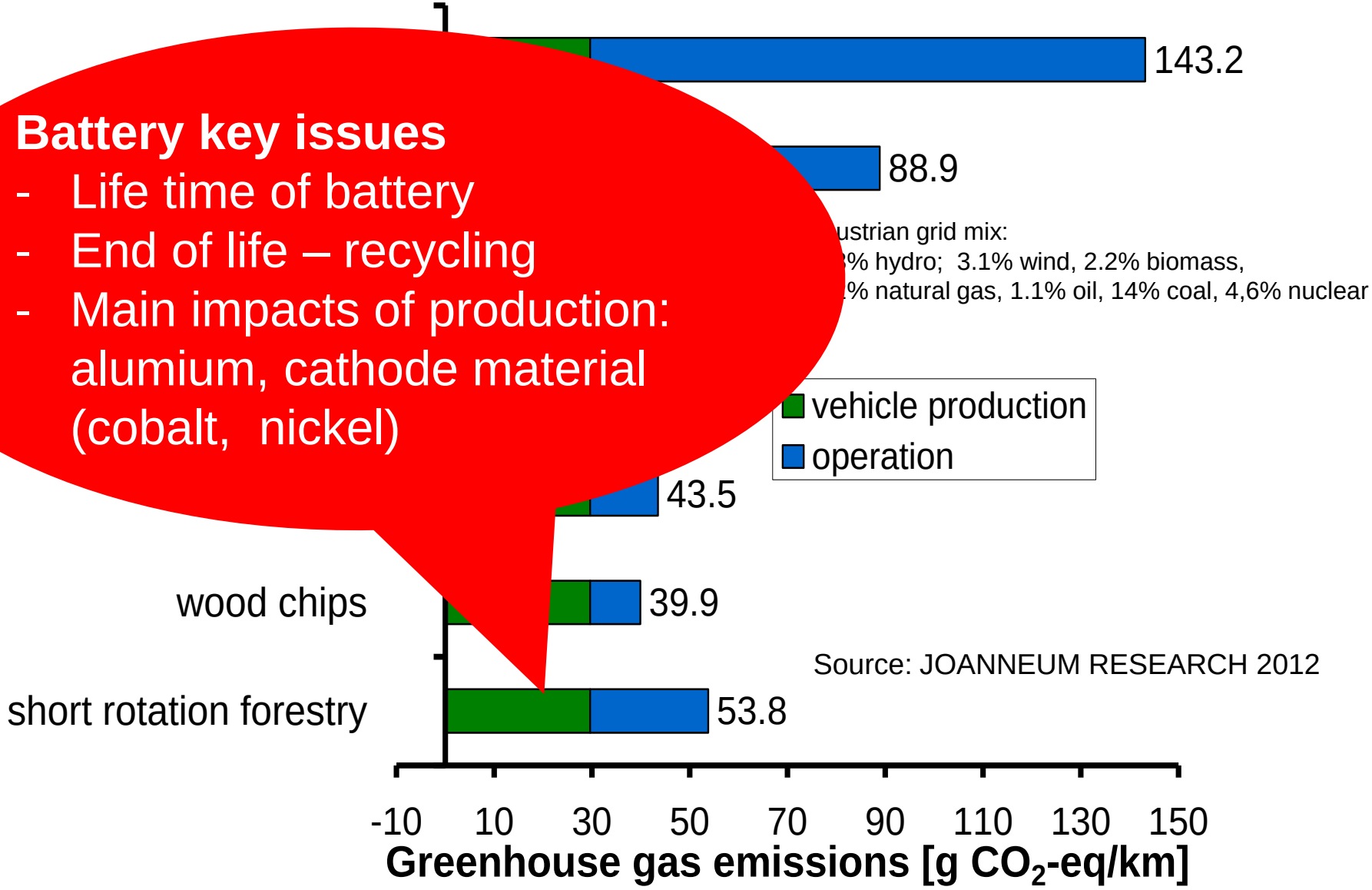
„End of life management“ Dismantling of vehicle

Transportation service

Greenhouse Gas Emissions of Electric Battery Vehicle

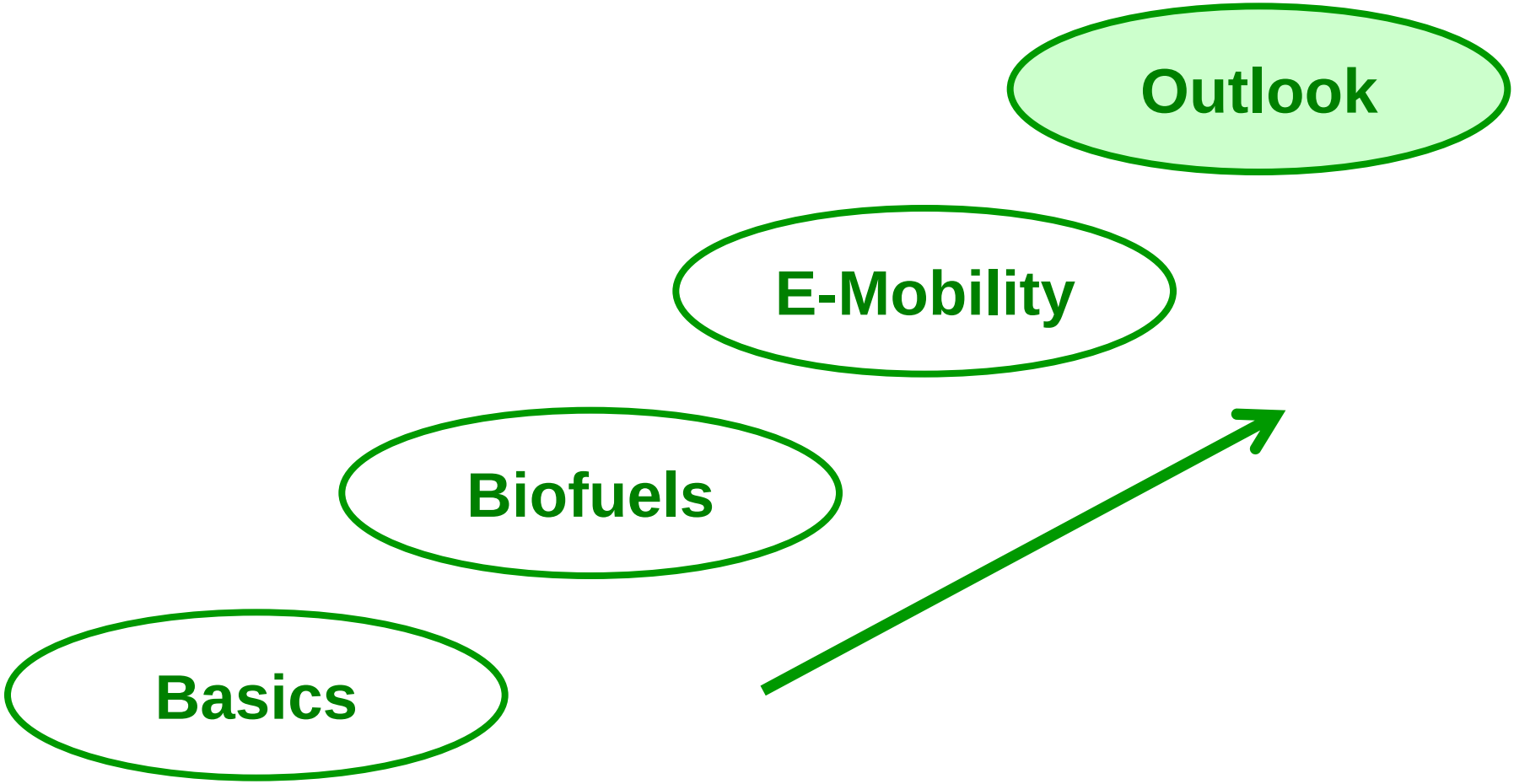
Battery key issues

- Life time of battery
- End of life – recycling
- Main impacts of production: alumium, cathode material (cobalt, nickel)

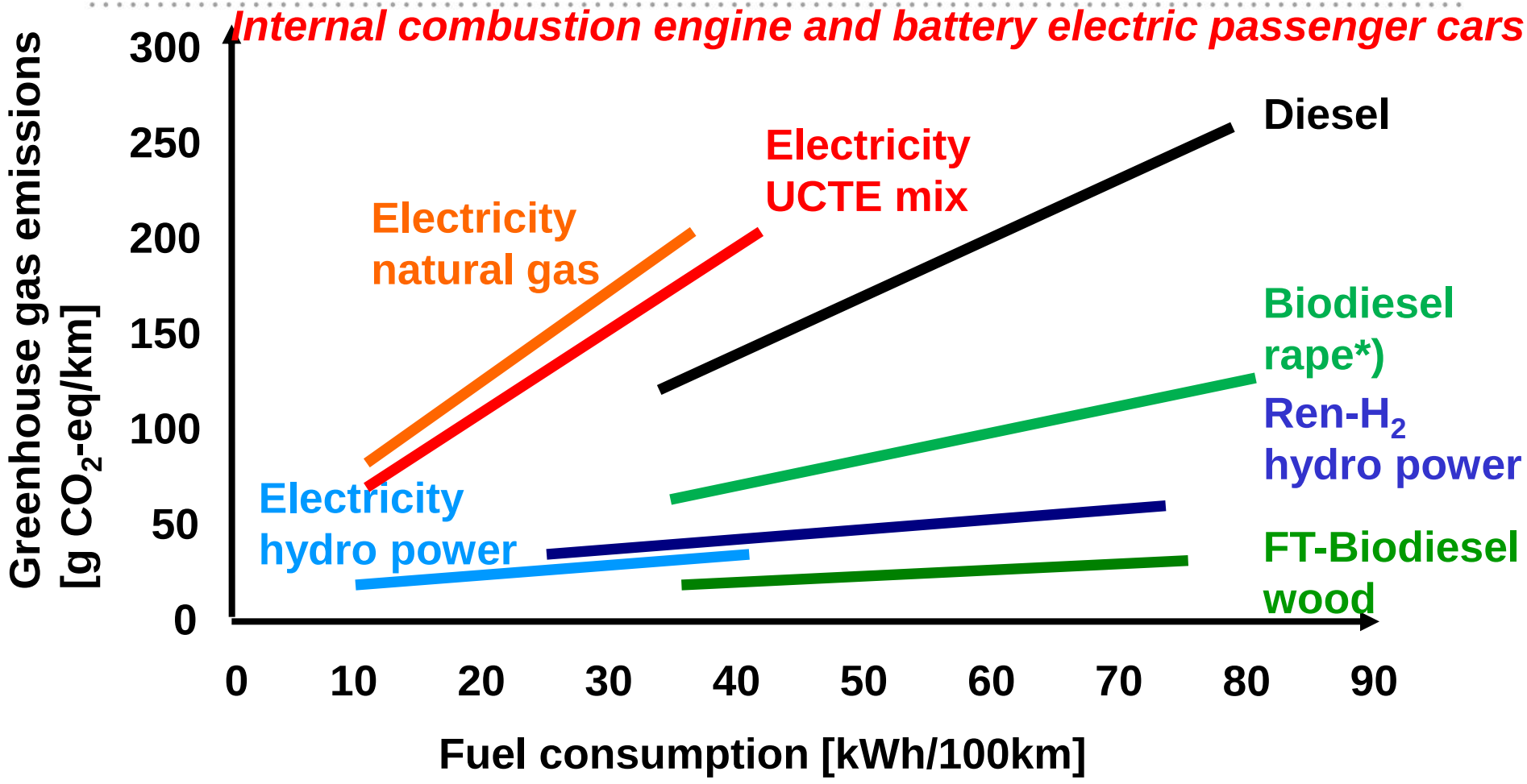


Source: JOANNEUM RESEARCH 2012

Overview



The Key Issue for Eco-Mobility: Energy Efficiency



*Source: LCA of passenger vehicles, Joanneum Research, *) without iLUC*

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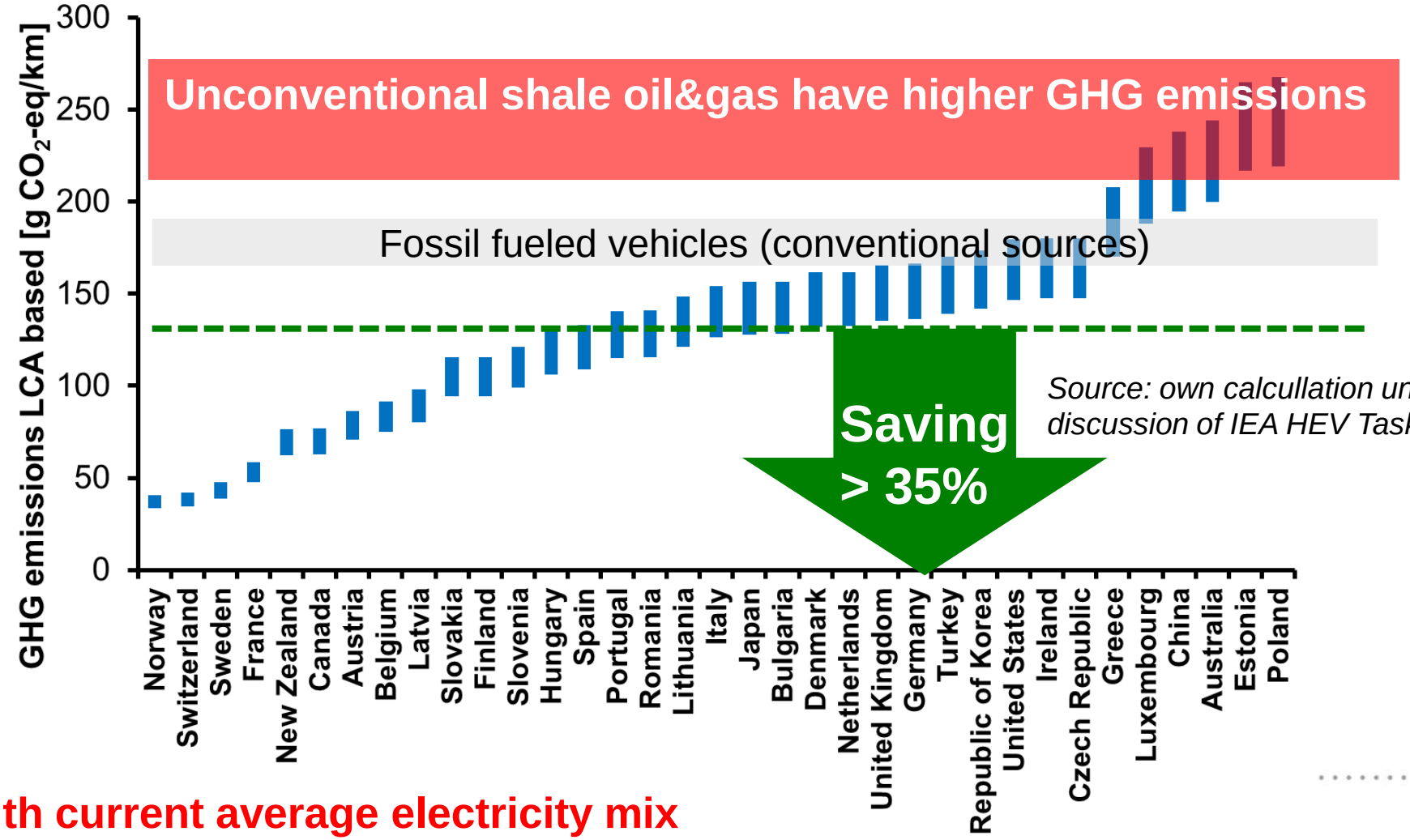
LCA Based GHG Emissions of Battery Electric Vehicle



Source: own calcullation under discussion of IEA HEV Task 19

With current average electricity mix

Comparative Assessment of Renewable Transportation Fuels for EcoMobility

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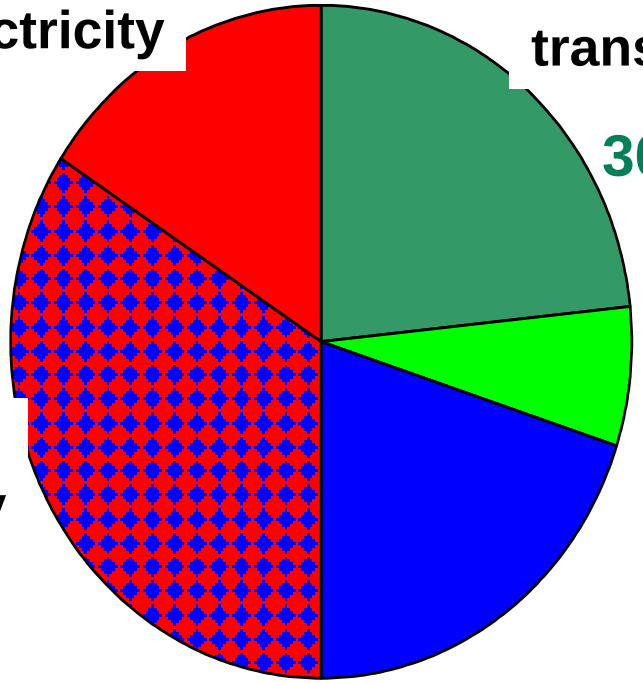
	"B-Mobility"	"E-Mobility"	"H_2-Mobility"
Primary energy	many options	many options	many options
Fuel production technology	1st generation existing 2nd generation under development	existing	fossil existing renewable under development
Sustainability	food/feed/fibre/fuel	renewable	renewable
Local emission	yes	no	very low
Infrastructure	existing	partly existing	not existing
Vehicle technology	existing	first vehicles on market	under development
Customer needs (Range/Refuel time)	common	uncommon	less common

Final Energy Carrier in a Sustainable Austrian Transport Sector 2050

"Sustainable" Transport sector Austria 117 PJ/a (currently (2011) 340 PJ/a) with same Amount of Transportation Services as in 2010



16% renewable electricity

23% liquid transportation biofuels

30% Transportation biofuels

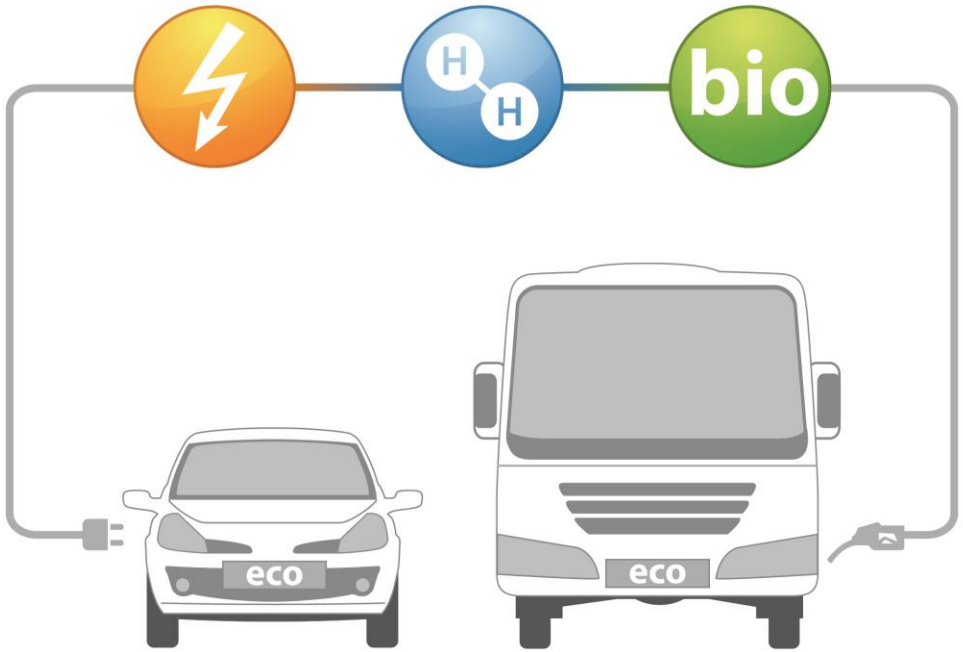
7% gaseous transportation biofuels

34% renewable electricity and/or hydrogen

20% renewable hydrogen

Source: Joanneum Research, 100% renewable domestic energy

Your Contact



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