



Energy reduction potential of nanotechnological application in Germany until 2030

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23-25 SEPTEMBER 2008 COPENHAGEN, DENMARK**



Agenda

- ① **Introduction**
- ② **Methodology**
- ③ **Results**
- ④ **Conclusion**



Introduction

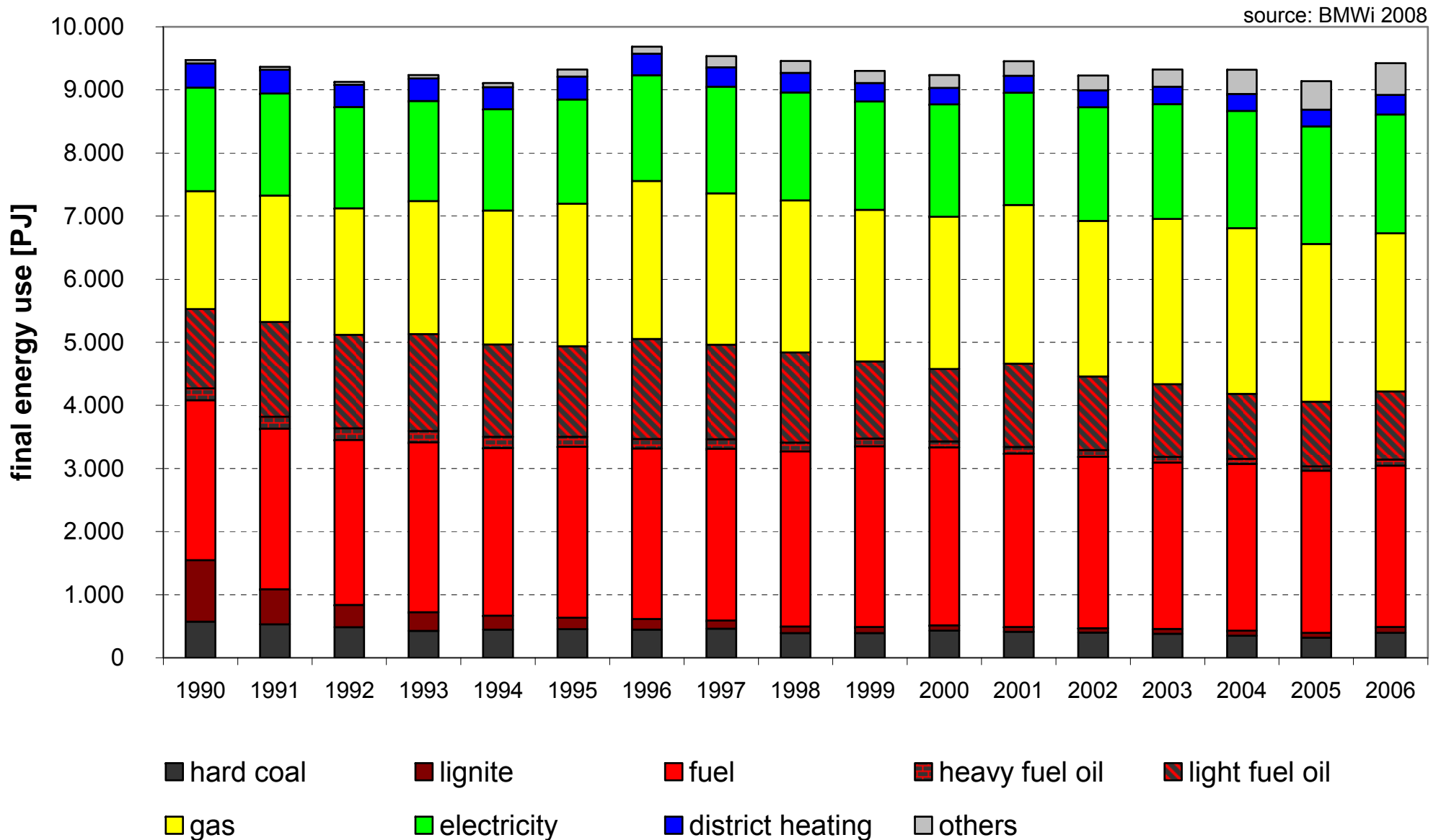
Problem:

- New innovations such as nanotechnology enable enhanced and new products and applications
- These products have certain impacts on the energy sector (e. g. shift in energy demand or energy sources)

Intention:

- To :
- identify
 - analyze
 - evaluate
- these impacts

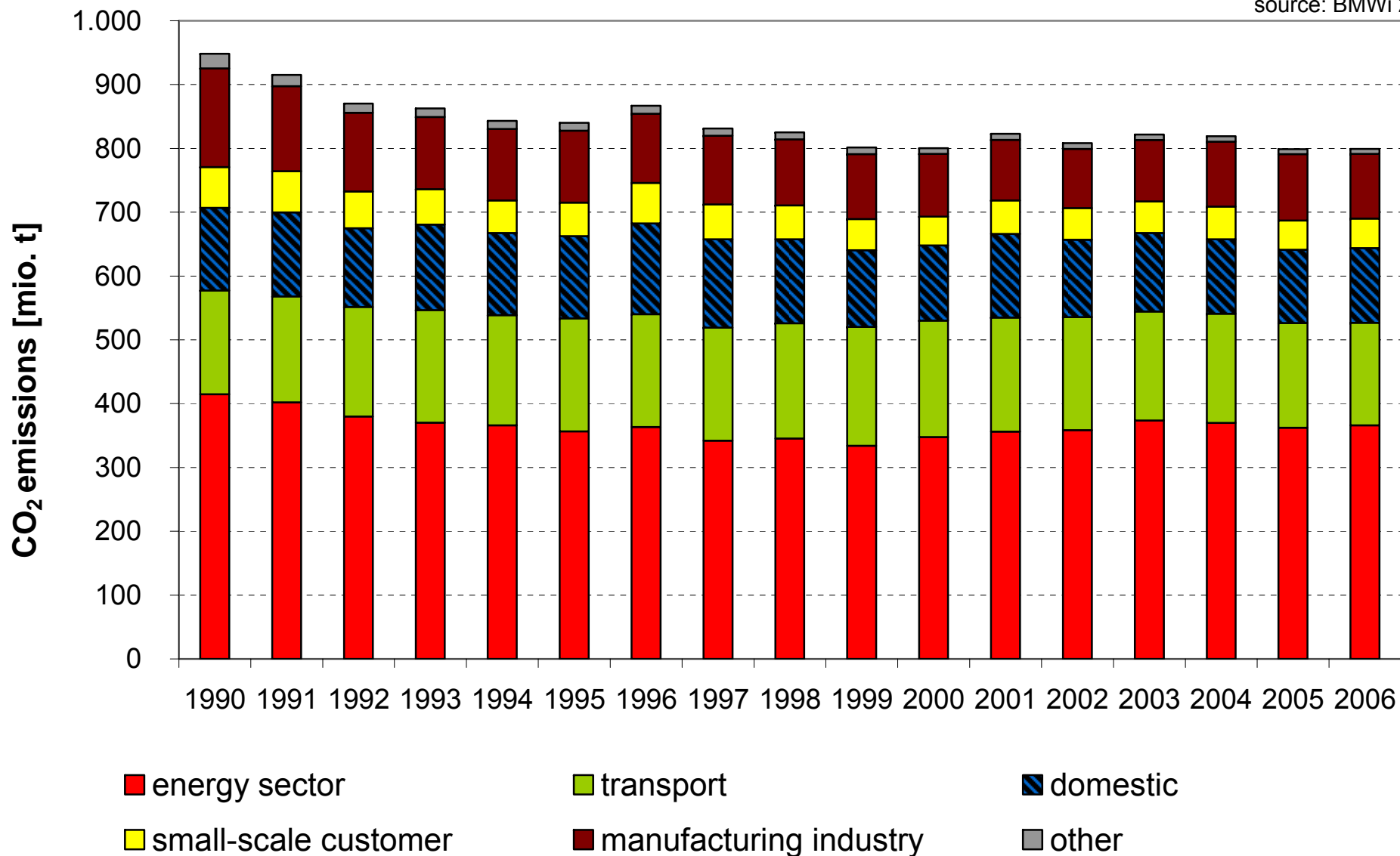
Development of the final energy consumption in Germany





Development of energy related CO₂ emissions in Germany

source: BMWi 2008





Agenda

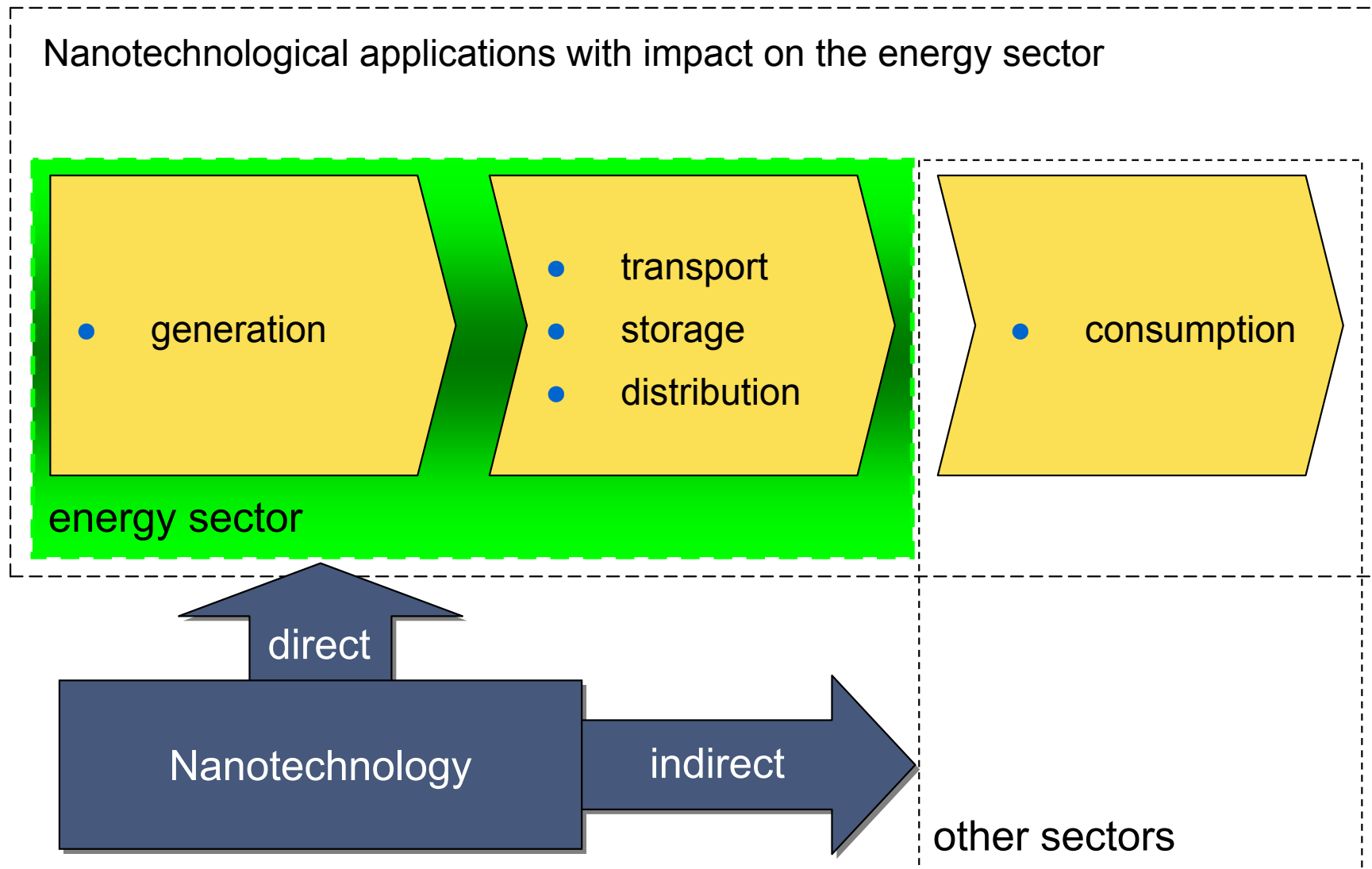
① Introduction

② **Methodology**

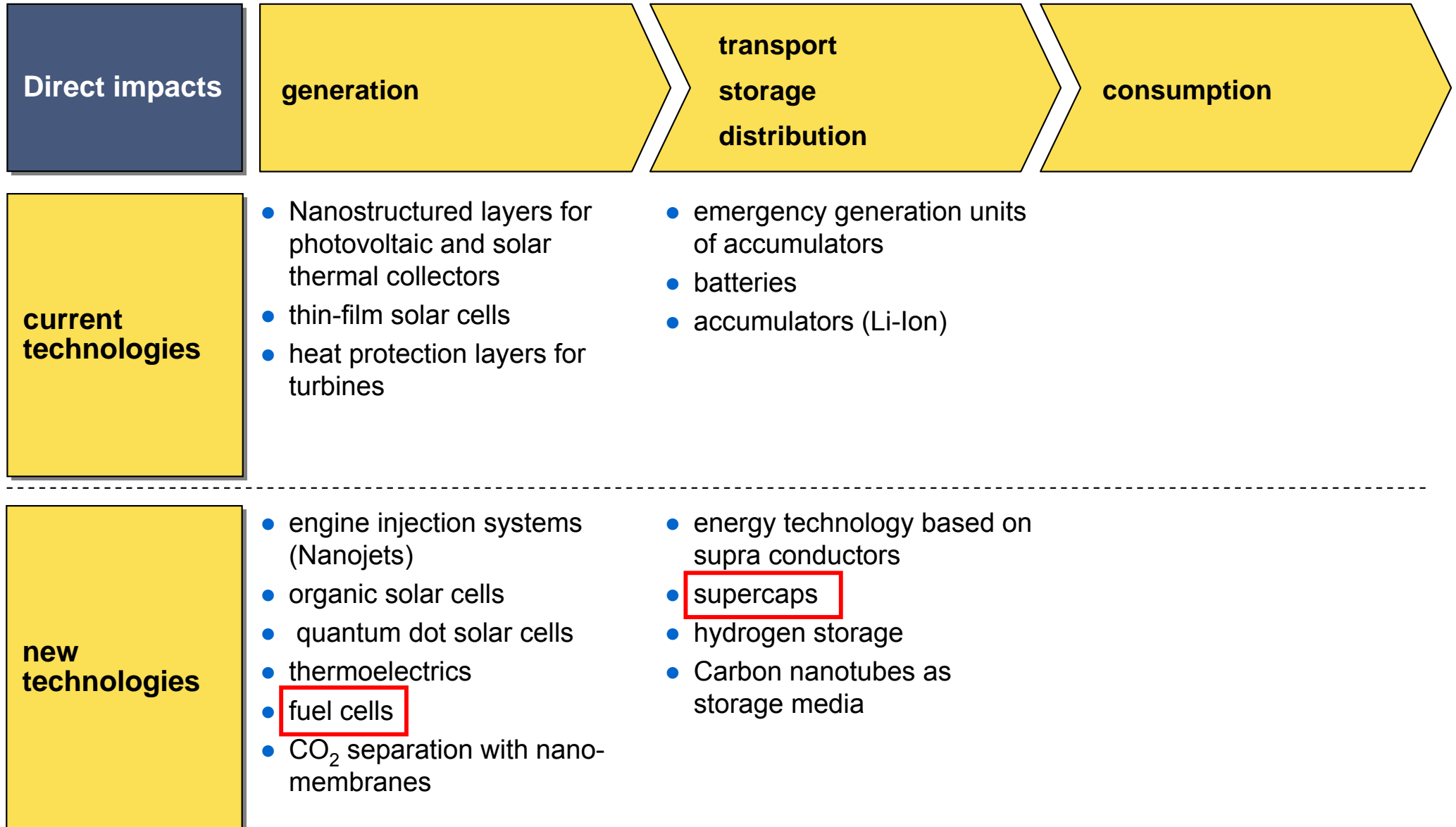
③ Results

④ Conclusion

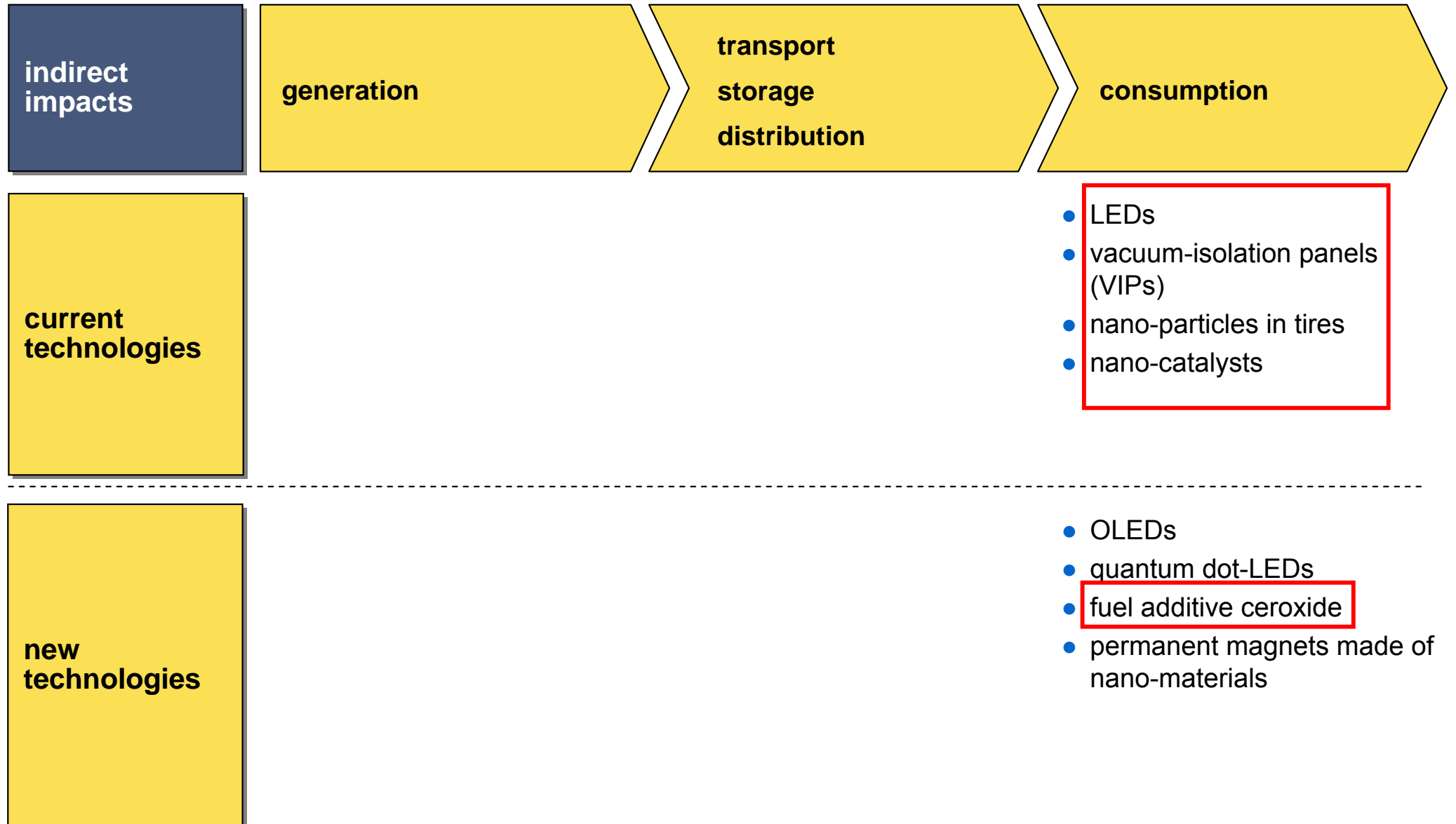
Nanotechnology and energy sector



Examples for direct impacts



Examples for indirect impacts





Scenario development

- **Development of future energy demand**
 - Sectors (industry, trade and services, domestic, transport) and applications
 - Energy sources
- **Period of analysis: 2005 – 2030**
 - Base year 2005
- **Design of three scenarios for a sensitivity analysis**
 - Base (expected development)
 - Plus / Minus (variation of main drivers of 25 %)
- **Main drivers of the scenarios**
 - Improvements in efficiency
 - Changes in energy demand
 - Prevalence rate of new applications

Analyzed applications

potential analysis

illumination:

- LED's for multiple coach lightning for all sectors

industry:

- ultra high performance concrete (UHPC)
- scratch-resistant lacquers (production)
- styrene production
- nanoparticles in synthetic production (PBT)

domestic:

- stationary fuel cells
- vacuum-isolation panels (VIP)

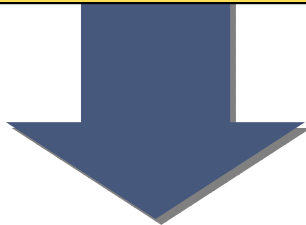
transport:

- fuel cell vehicles
- fuel additive cerioxide
- nanoparticles in tires
- supercaps in hybrid buses
- LED's for lightning
- scratch-resistant lacquers (use)
- polymers as car classes
- nanobased coatings to reduce friction in engines and powertrains
- piezo injectors

Application domestic: stationary fuel cells

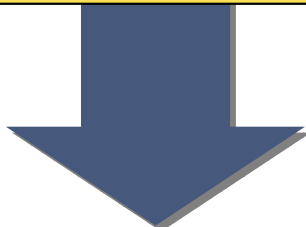
Field of application

- number of gas supplied residential buildings (in stock)
- number of residential buildings changing to gas supply (in stock)
- gas supplied new buildings



- lifetime existing heating system
- prevalence rate for stationary fuel cells

Annually number of new stationary fuel cells



- energy demand of buildings (heat and electricity)
- technical parameters of stationary fuel cells and comparative technologies

Modification in energy demand

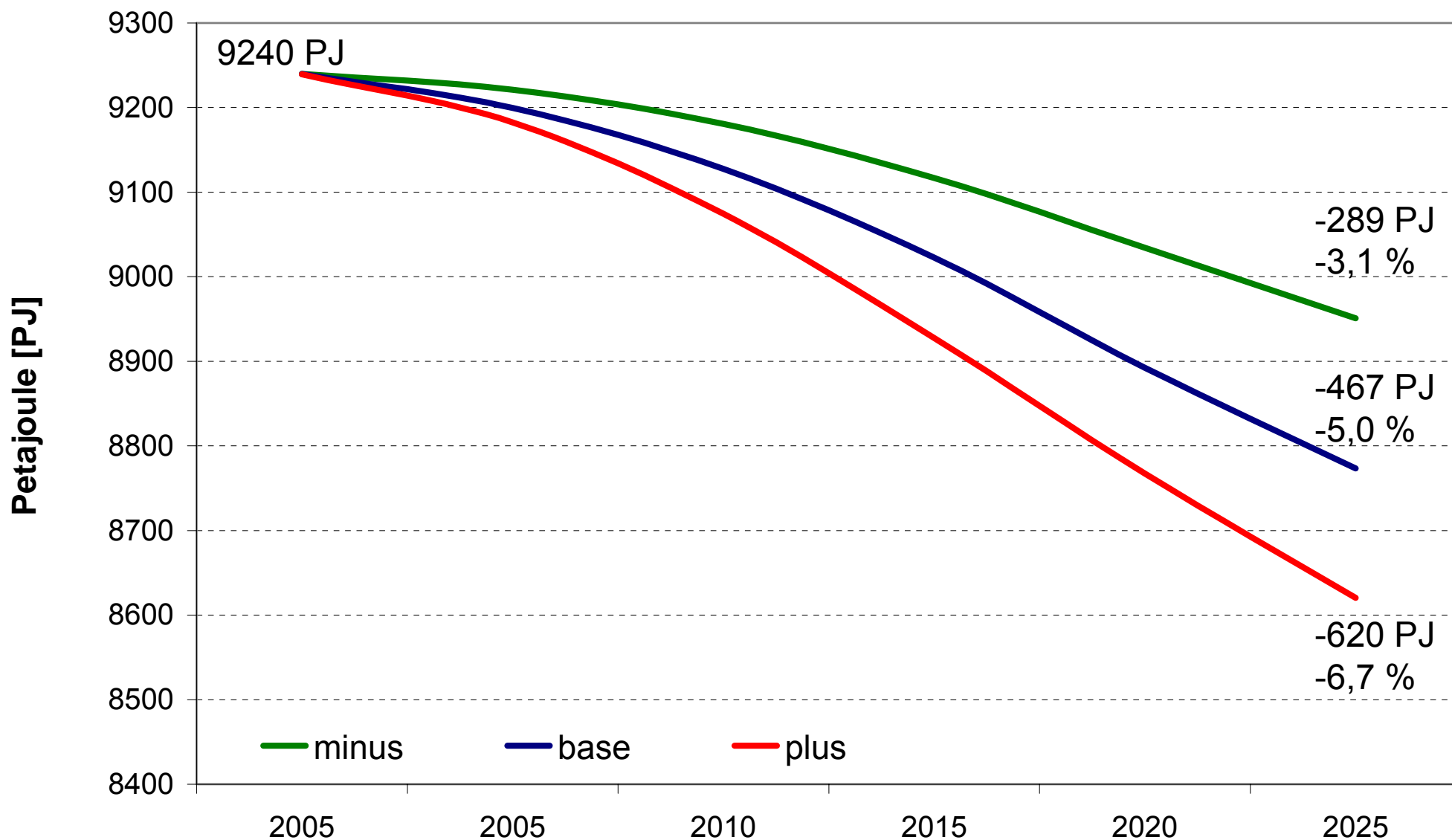


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Projected energy consumption 2005-2030





Change in energy demand from 2005 - 2030

Application and technologies	Reduction [PJ]	Reduction in relation to 2005 [%]
fuel cell vehicles	-10.48	-0.1
fuel additive cerioxide	-46.94	-0.5
nanoparticles as filler in tires	-52.24	-0.6
supercaps in hybrid buses	-0.83	-0.0
LEDs for automobile lightning	-4.43	-0.0
scratch-resistant lacquers (use)	-0.02	-0.0
polymers as car classes	-0.47	-0.0
friction reduction coatings	-19.25	-0.2
piezo injectors	-1.22	-0.0
application transport	-134.2	-1.5

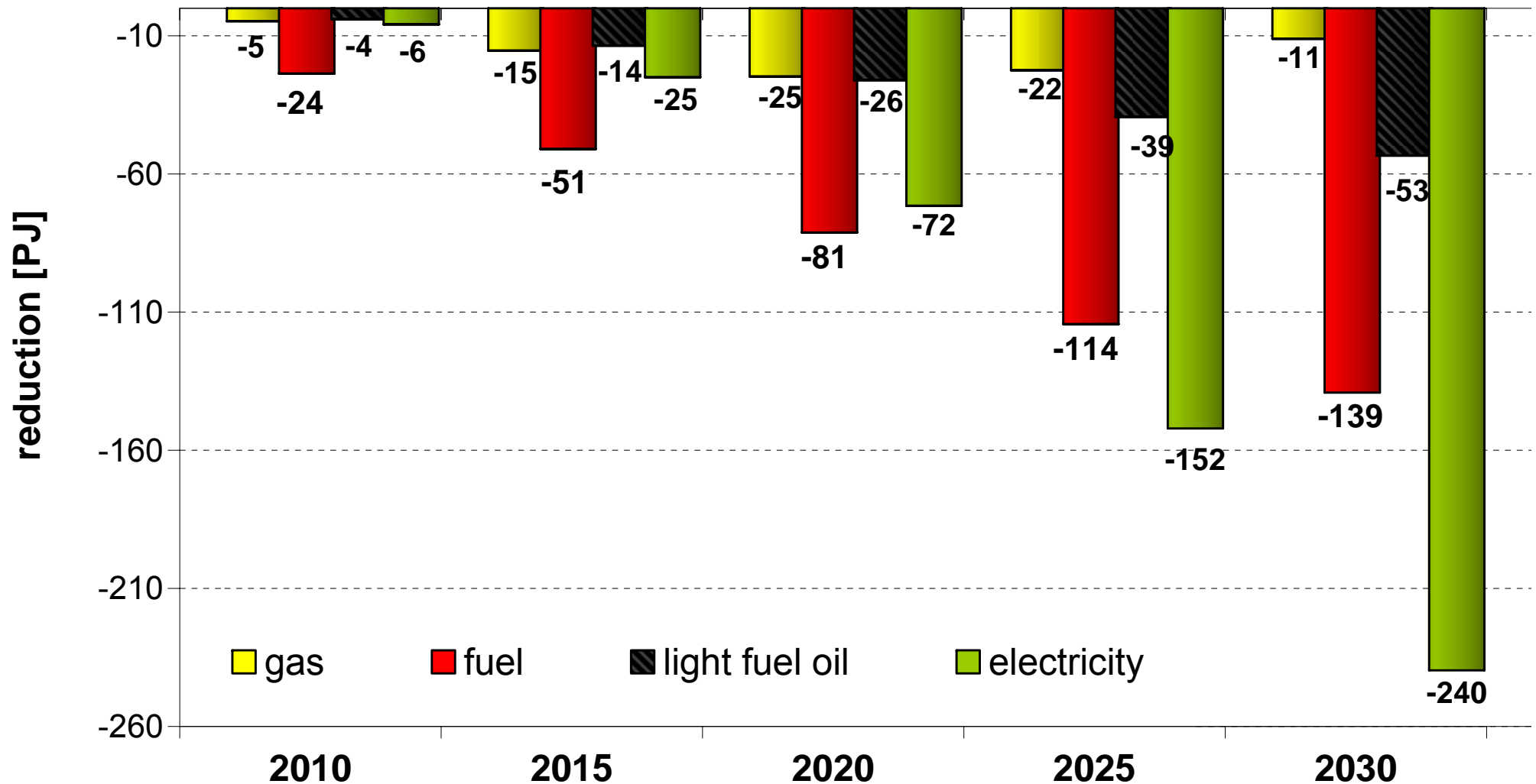


Change in energy demand from 2005 - 2030

Application and technologies	Reduction [PJ]	Reduction in relation to 2005 [%]
application lightning	-100.3	-1.1
fuel cells for heating and energy production in private housings (stationary fuel cells)	-70.3	-0.8
vacuum isolation panels (VIP)	-152.3	-1.6
application domestic	-222.9	-2.4
ultra high performance concrete (UHPC)	-0.5	-0.0
scratch-resistant lacquers (production)	-0.2	-0.0
styrene production	-7.9	-0.1
nanoparticles in synthetic production (PBT)	-0.5	-0.0
application industry	-9.1	-0.1
(application transport)	(-134.2)	(-1.5)
sum potential analysis	-466.5	-5.0

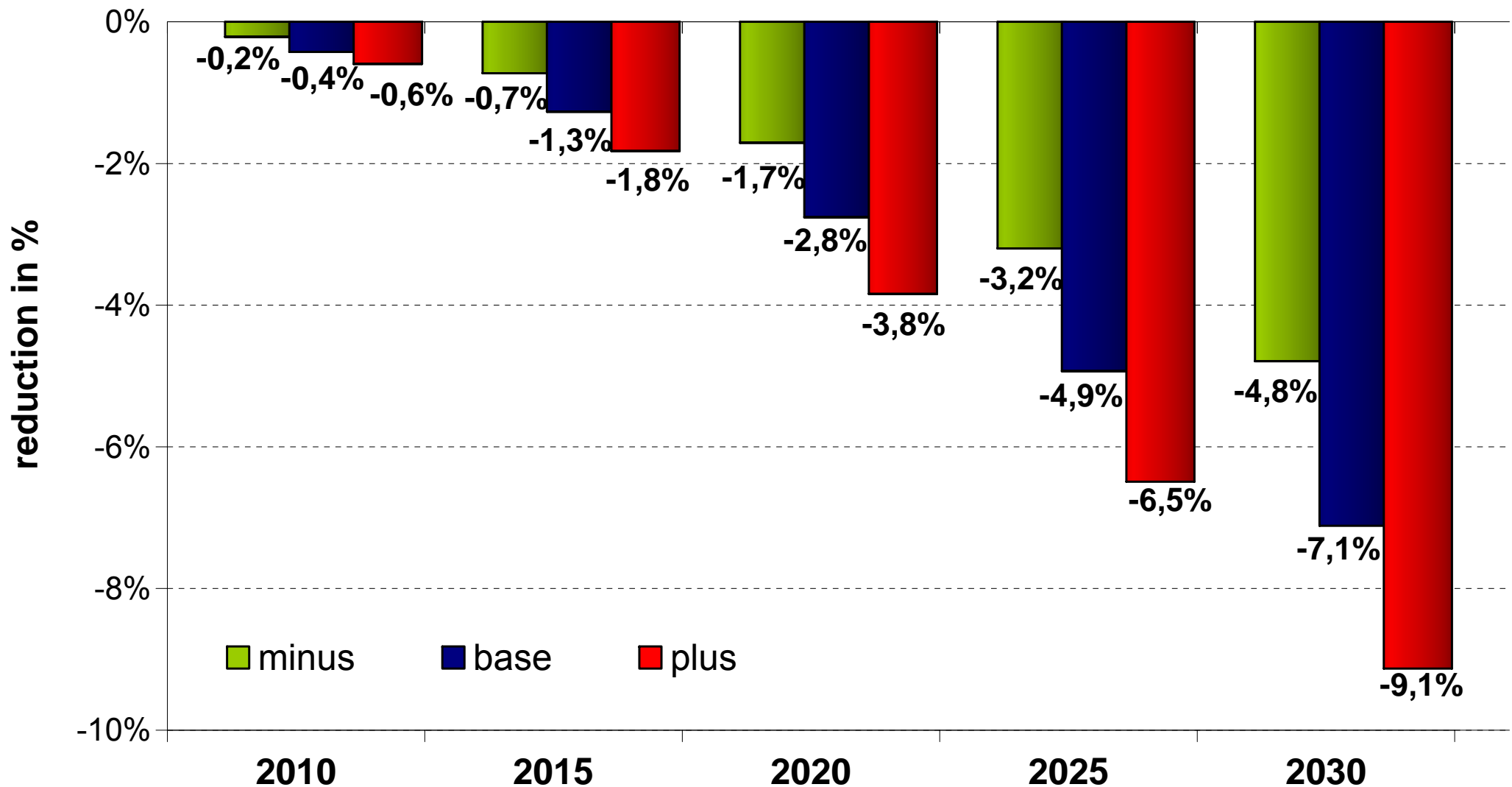


Development of selected energy sources 2010 - 2030 (base)





Possible reduction in CO₂ emissions





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Conclusion

- Nanotechnology is not going to change the energy sector radically but it is going to make an essential contribution to energy efficiency improvement and reduction of CO₂ emissions in Germany
- It takes a long time also for close to market application to result in significant energy savings
- In regard to the challenges concerning the use of energy it is necessary to work intensely and prompt on the development of innovative nanotechnology based technologies



**Thank you very much for
your attention!**

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