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Greenhouse gas dynamics of different forest management and wood use scenarios

Participating:

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Commissioner: Federal Office for Environment

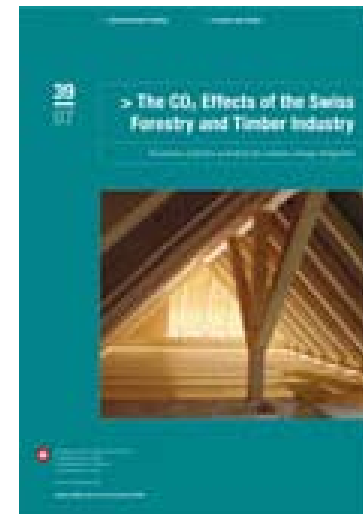
Key conclusions

The national greenhouse gas inventory is optimized if:

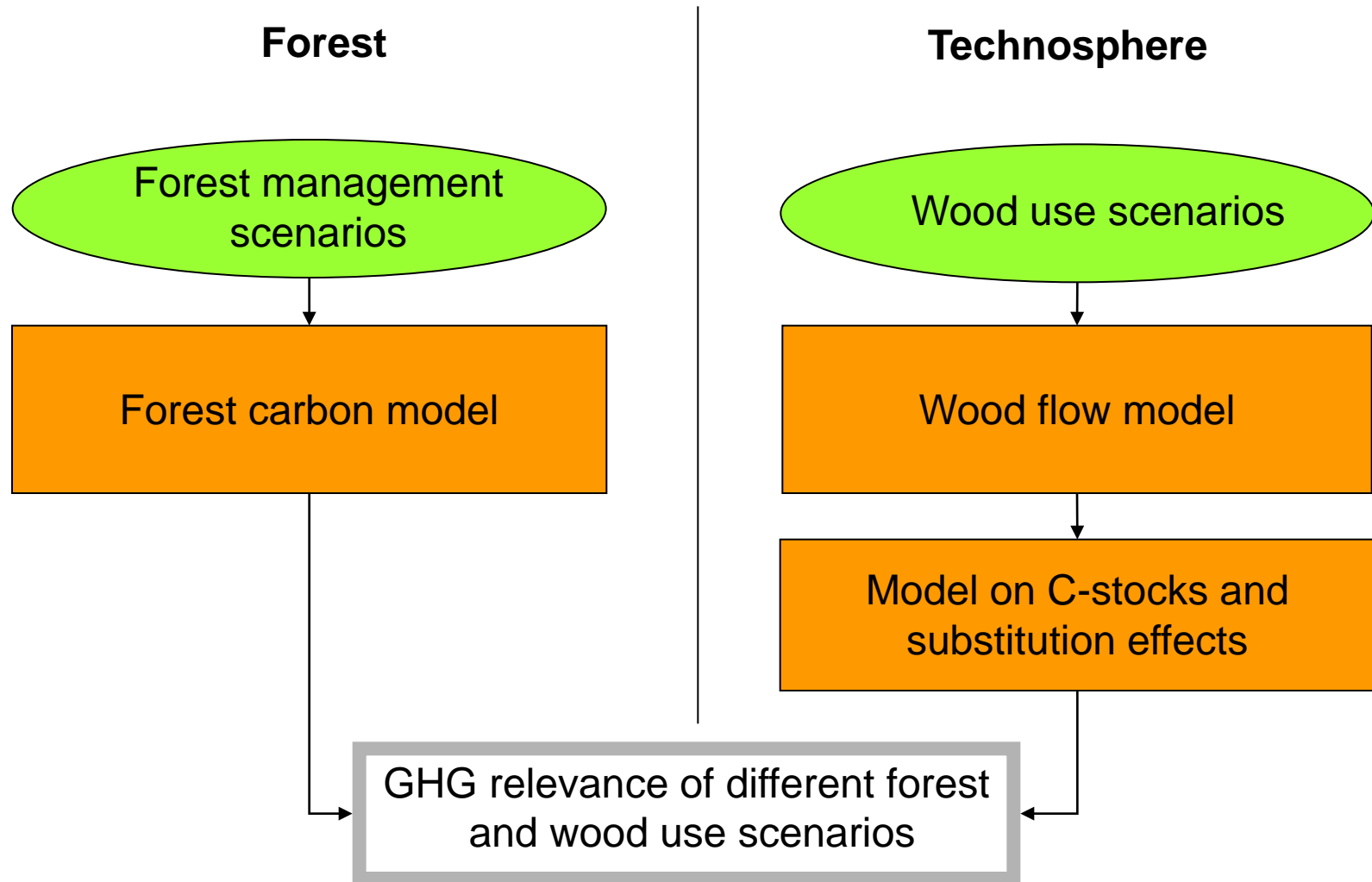
- 1) the **maximum increment** of wood is used continuously and completely.
- 2) wood is used best in a **cascade**, starting with wood products with long service life (as far as possible); wood should be recycled where reasonable and used energetically at the end of the cascade.

Outline

- Introduction
- Models
- Scenarios
- Results
- Conclusions



Approach: combination of various models



Forest model

Forest Management Model MASSIMO

Target parameters:

- Development of the forest structure
- Living and dead (above and below ground) tree biomass

Characteristics:

- Empirical: based on data of various Swiss Forest Inventories
- Stochastic: based on probability distribution of events
- Dynamic: Final state does not directly depend on initial state

Soil Carbon Model YASSO

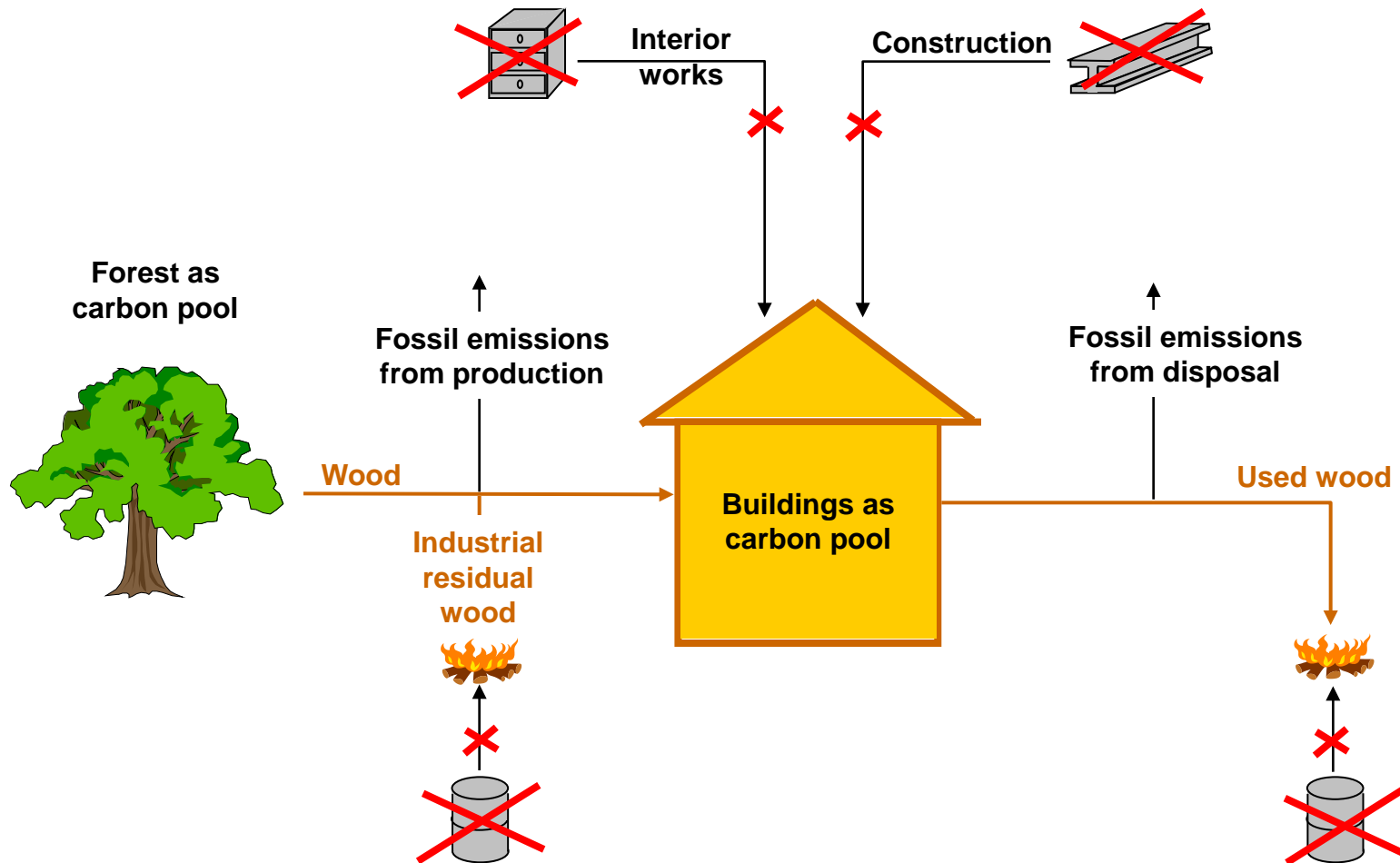
Target parameters:

- Soil carbon depending on organic input and decomposition rates

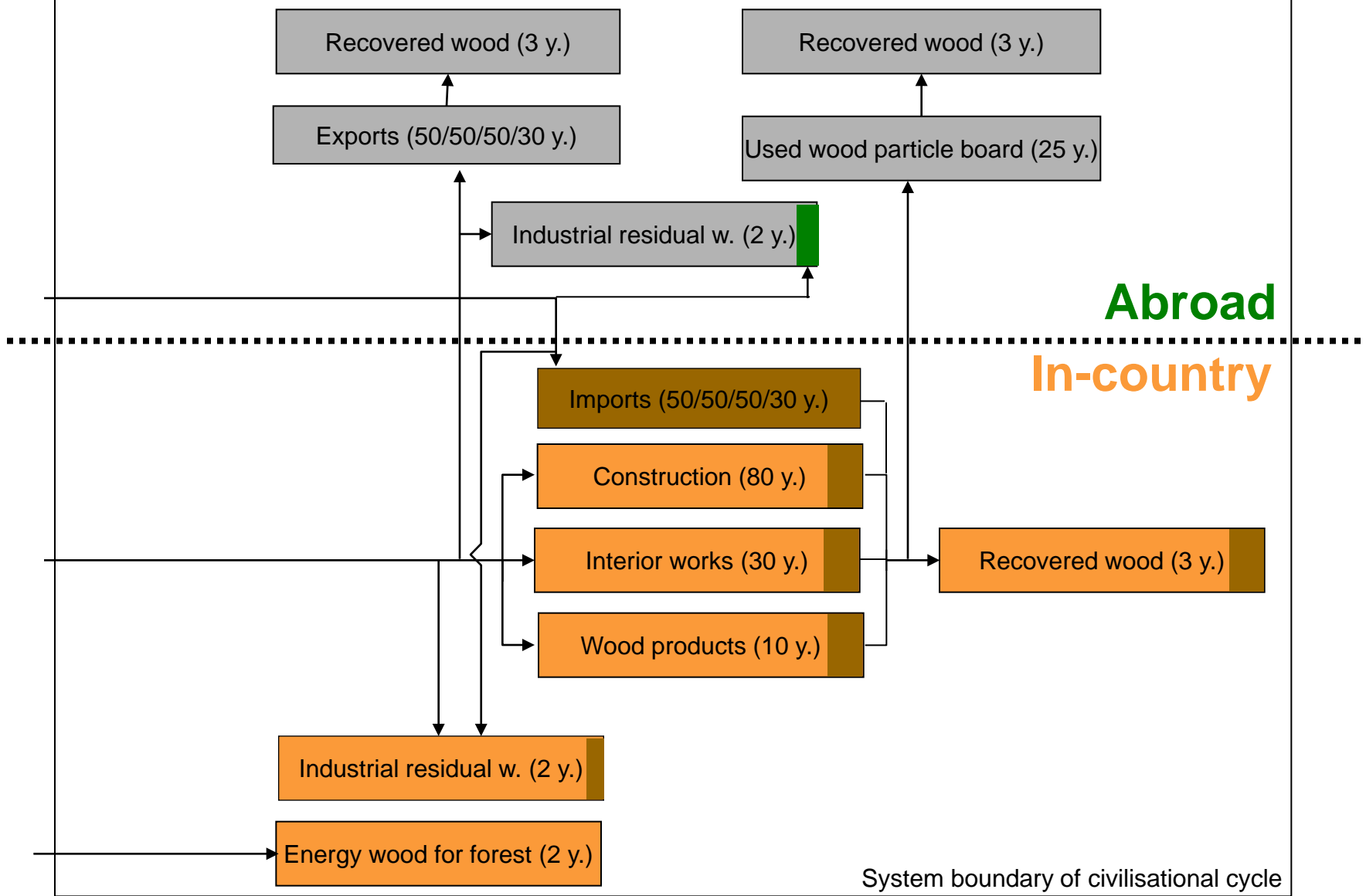
Characteristics:

- Deterministic

GHG-relevant processes of wood products



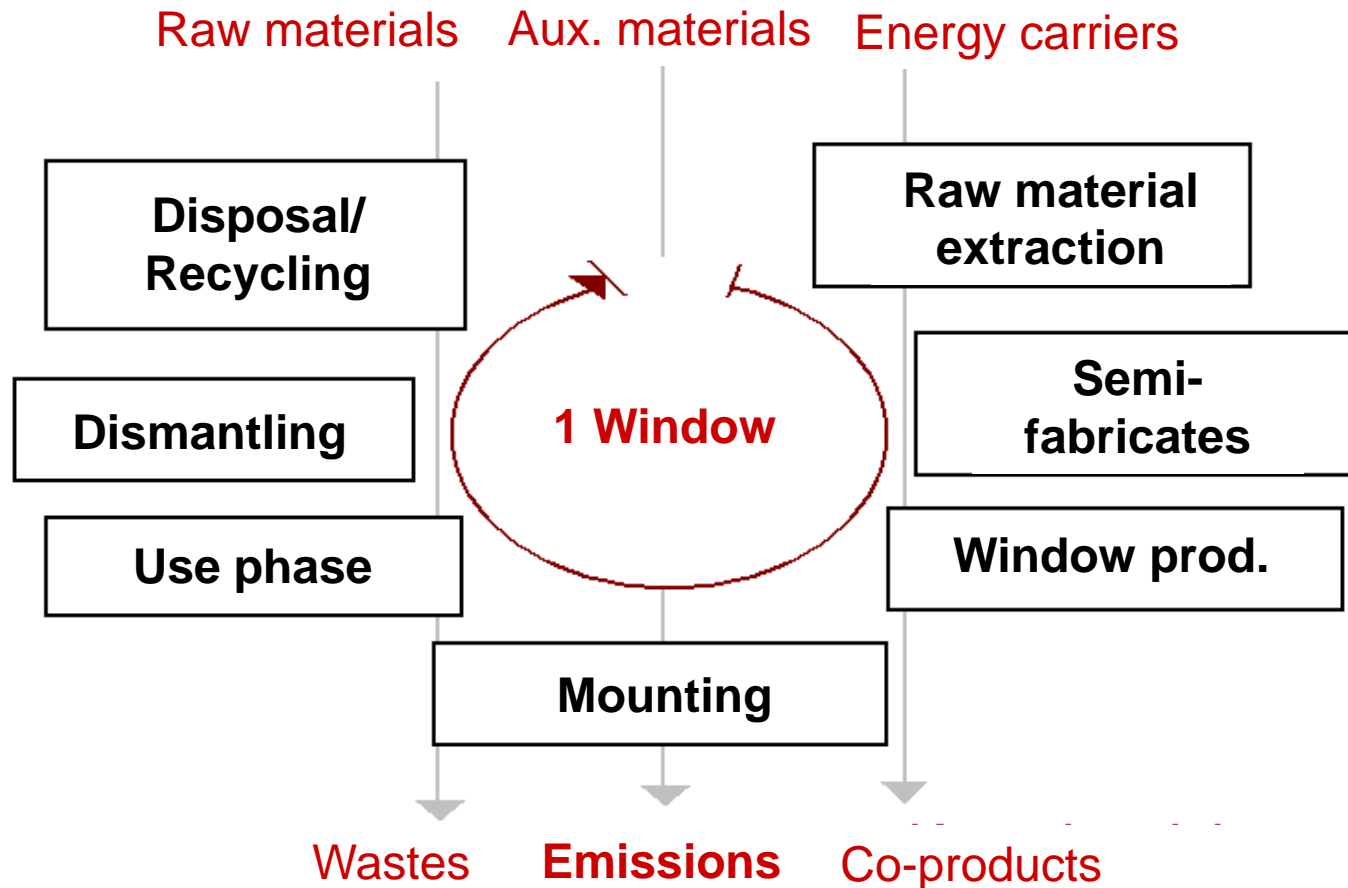
Wood pools in-country and abroad (without forest)



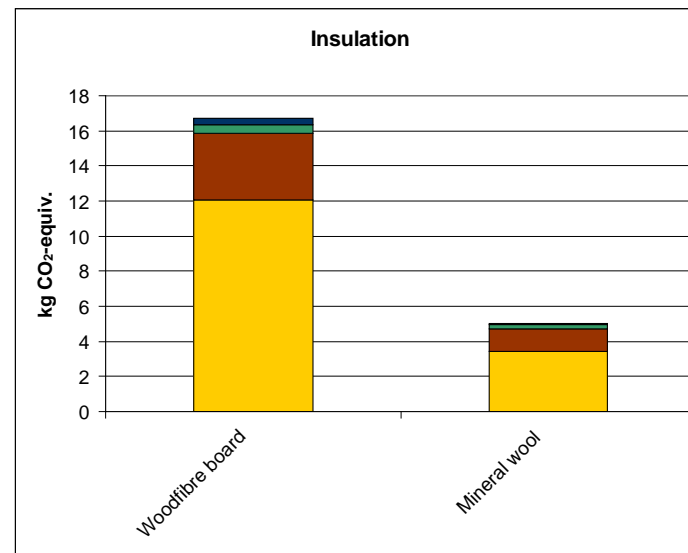
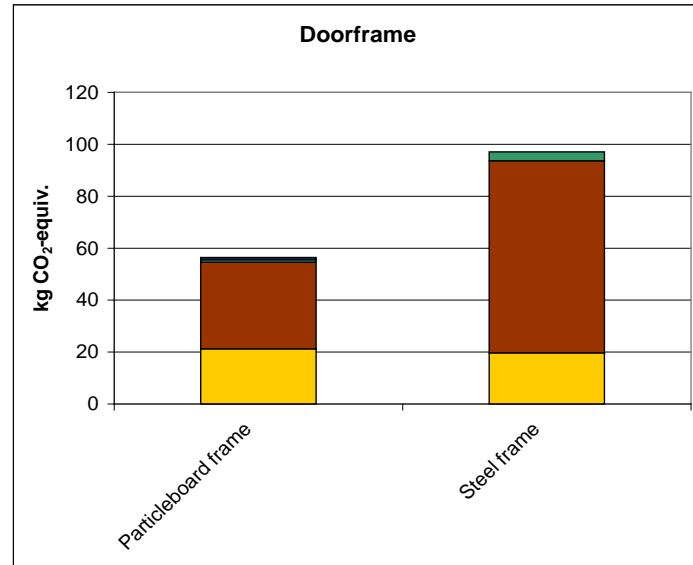
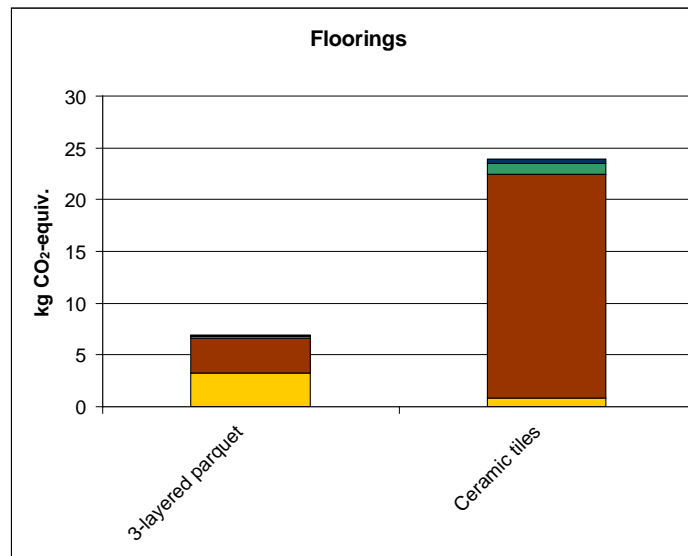
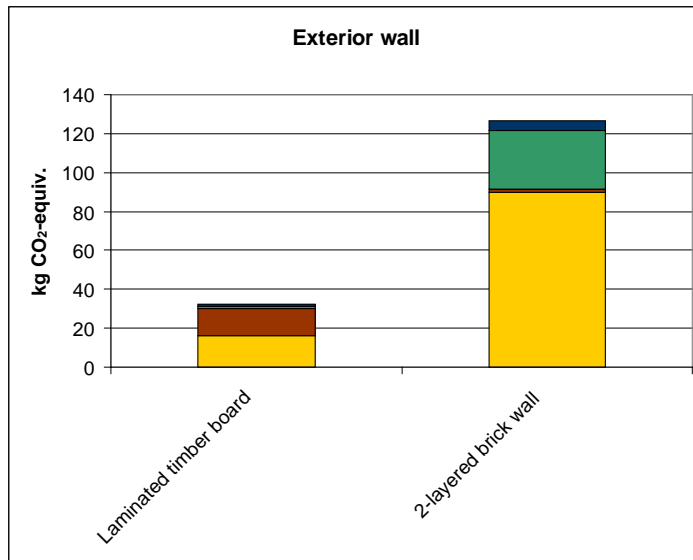
Substitution on a building element level

Building element <i>Construction</i>	Wood elements/products	Competing product/substitute
Exterior wall	Laminated timber board	2-layered brick wall
Pillar	Gluelam pillar	Steel pillar
Ceiling	Ceiling of wood beams	Ceiling of reinforc. concrete
Insulation	Wood fibre insulation panel	Mineral wool
Roofing	Unlined joist construction	Porous concrete pitched r.
Underground engineer.	Wood palisade	Concrete palisade
<i>Interior works</i>		
Coverings of wall	Profiled board, spruce	Interior plasterwork
Staircase	Wooden staircase, oak	Ready-made concrete staircase
Flooring	3-layered parquet flooring	Ceramic tiles, enamelled
Facade	Wood panels incl. supporting bars	Exterior plasterwork
Furnishing	Doorframe, particleboard	Doorframe, steel
Furniture	Wood furniture, particleboard	Steel furniture

Basis for substitution: Life Cycle Assessment (LCA)



GHG profiles of selected substitutes



- Disposal abroad
- Disposal CH
- Produktion abroad
- Production CH

Transboundary GHG effects

- Upstream GHG emissions from fossil fuel consumption = exploitation, refining, transport
- GHG emissions associated with imports of ancillary products for wood products
- Avoided (upstream) GHG emissions from the substitution of conventional products (produced in-country)
- Avoided GHG from avoided imports of conventional product
- (effects on forests abroad if imports/exports change)

Conclusions: substitution

kg CO₂/m³ Wood (920 kg CO₂)	Switzerland	Abroad	Total
Material substitution	-320	-410	-730
Energetic substitution	< -480	> -120	-600
Total	< -800	> -530	-1'330

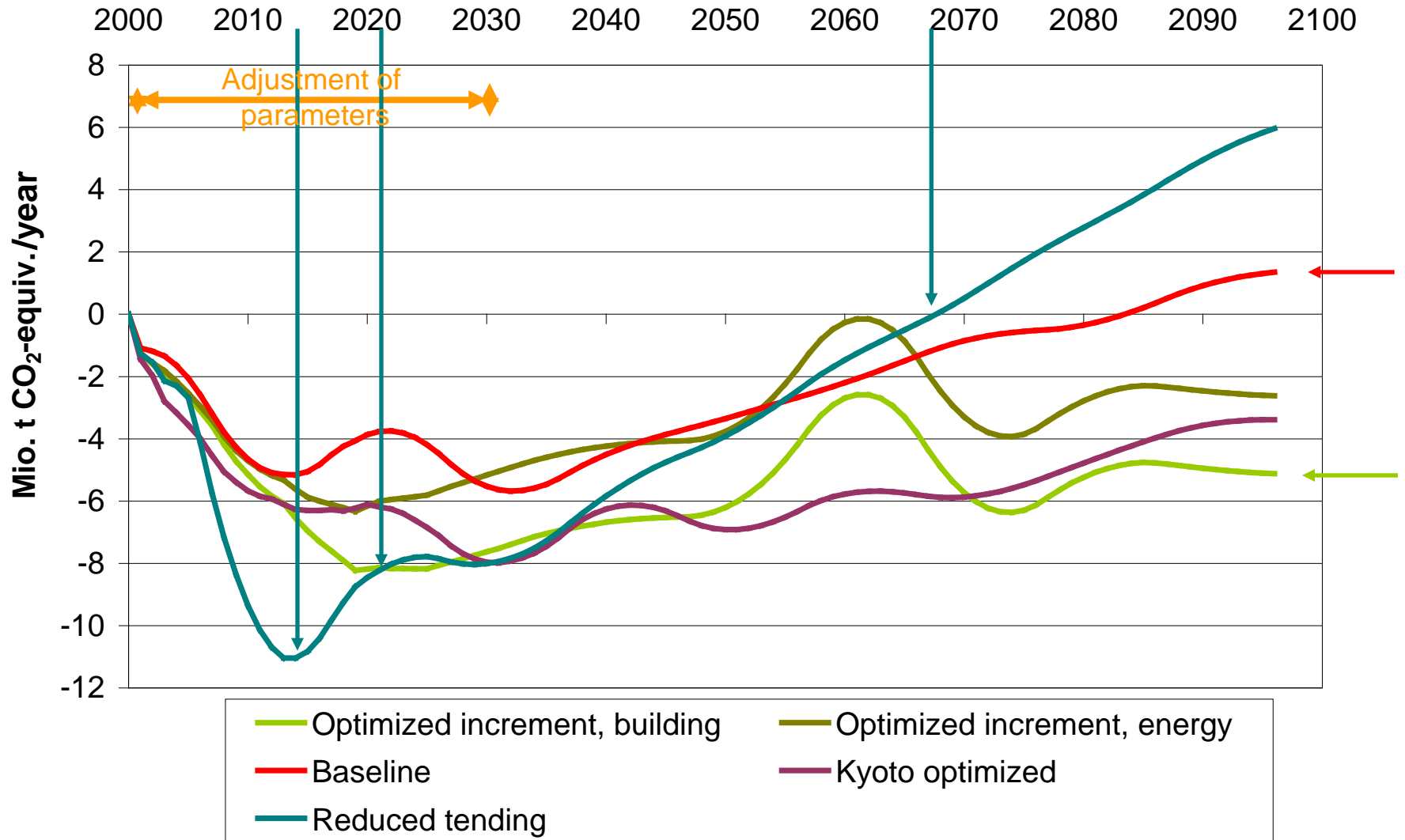
Scenarios

The scenarios reflect realistic policy options.

	Increment optimized		Kyoto optimized	Reduced forest m.	Baseline
Wood extraction					
Wood extraction Switzerland	+ 90%		+ 75%	- 40%	+ 20%
	Construc- tion	Energy	Construction		
Consumption					
Construction, interior works, wood products	+ 80%	+ 0%	+ 80%	- 24%	+ 20%
Forest energy wood	+ 122%	+ 344%	+ 67%	- 81%	+ 20%
Foreign trade balance					

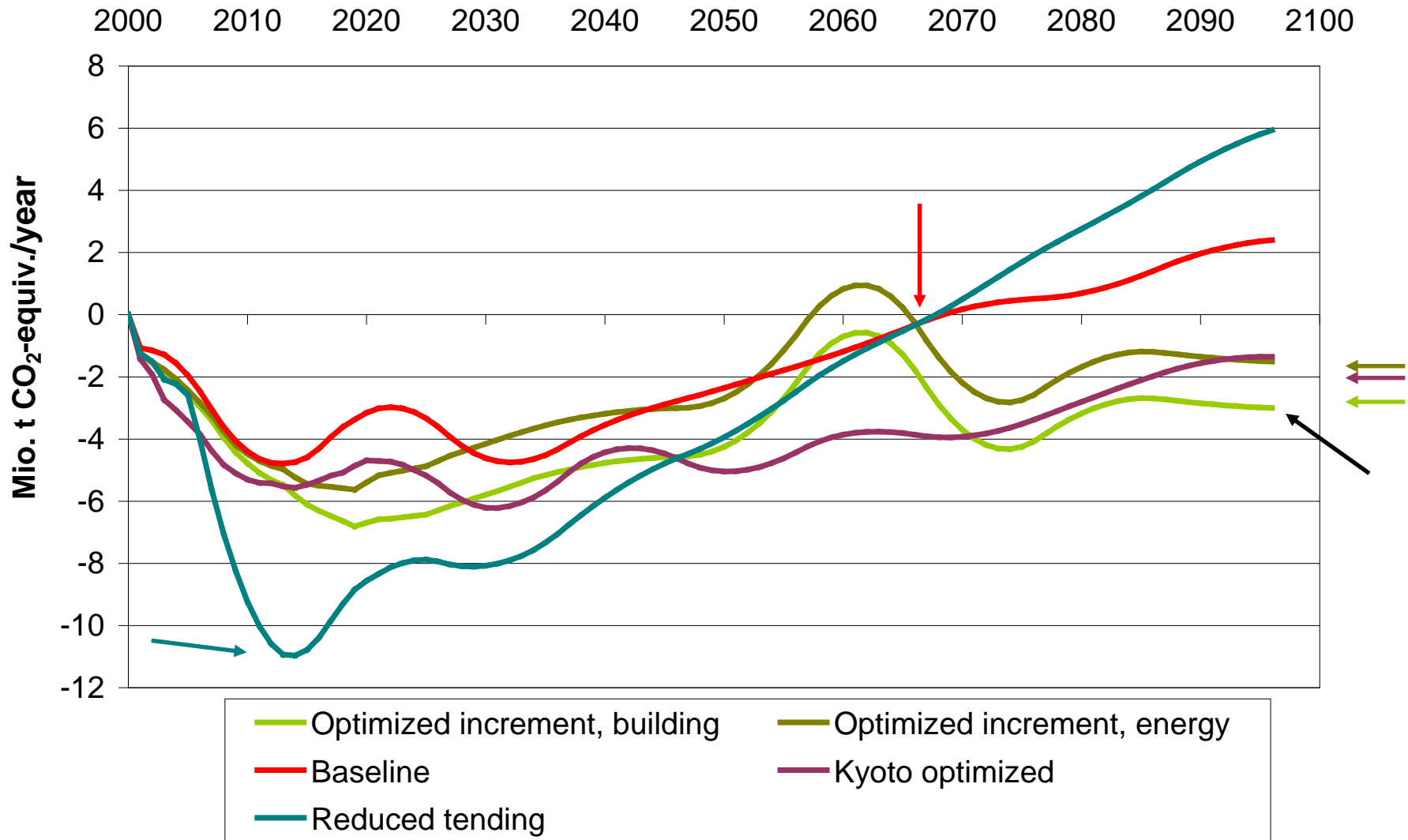
Comparison of scenario results

Annual global net-effects



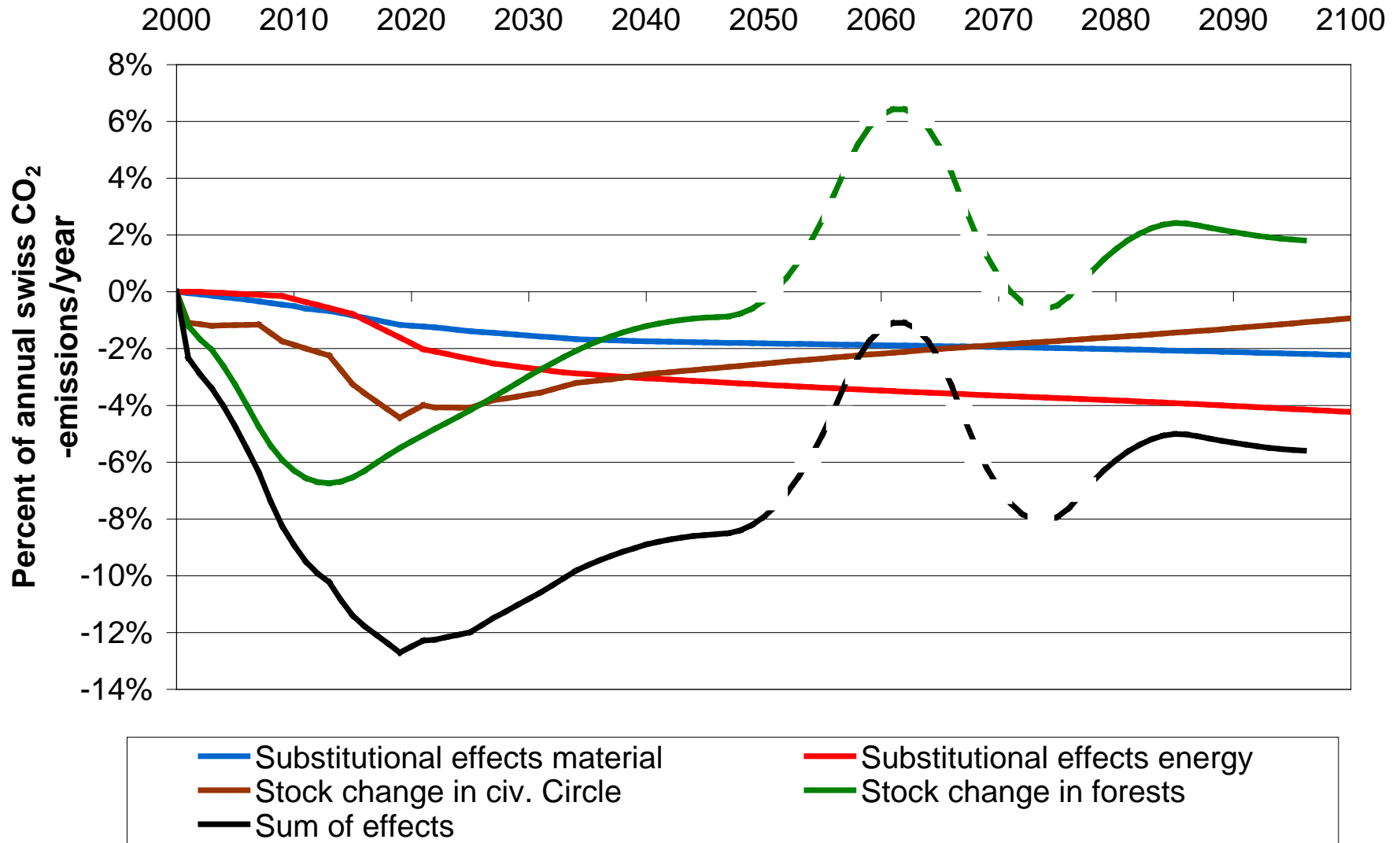
Comparison of scenario results

Annual net-effects in Switzerland



Scenario „optimized increment, building“

Annual detail effects in Switzerland



Conclusions

- **Manage forests to achieve maximum increment!**
- **Use wood to the maximum increment and in a cascade!**
- **Recover energy, also for post-consumer wood!**
- **Develop mitigation policies against climate change based on an integral assessment of forestry and the wood chain including transsectoral effects only! (=substitution effects!)**
- **Assess policy options based on clear geographical and temporal preferences!**



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

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References:

Werner, F., R. Taverna, P. Hofer, E. Thürig and E. Kaufmann (2010): National and global greenhouse gas dynamics of different forest management and wood use scenarios: a model-based assessment. *Environmental Science & Policy*, 13(2010): 72-85.

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