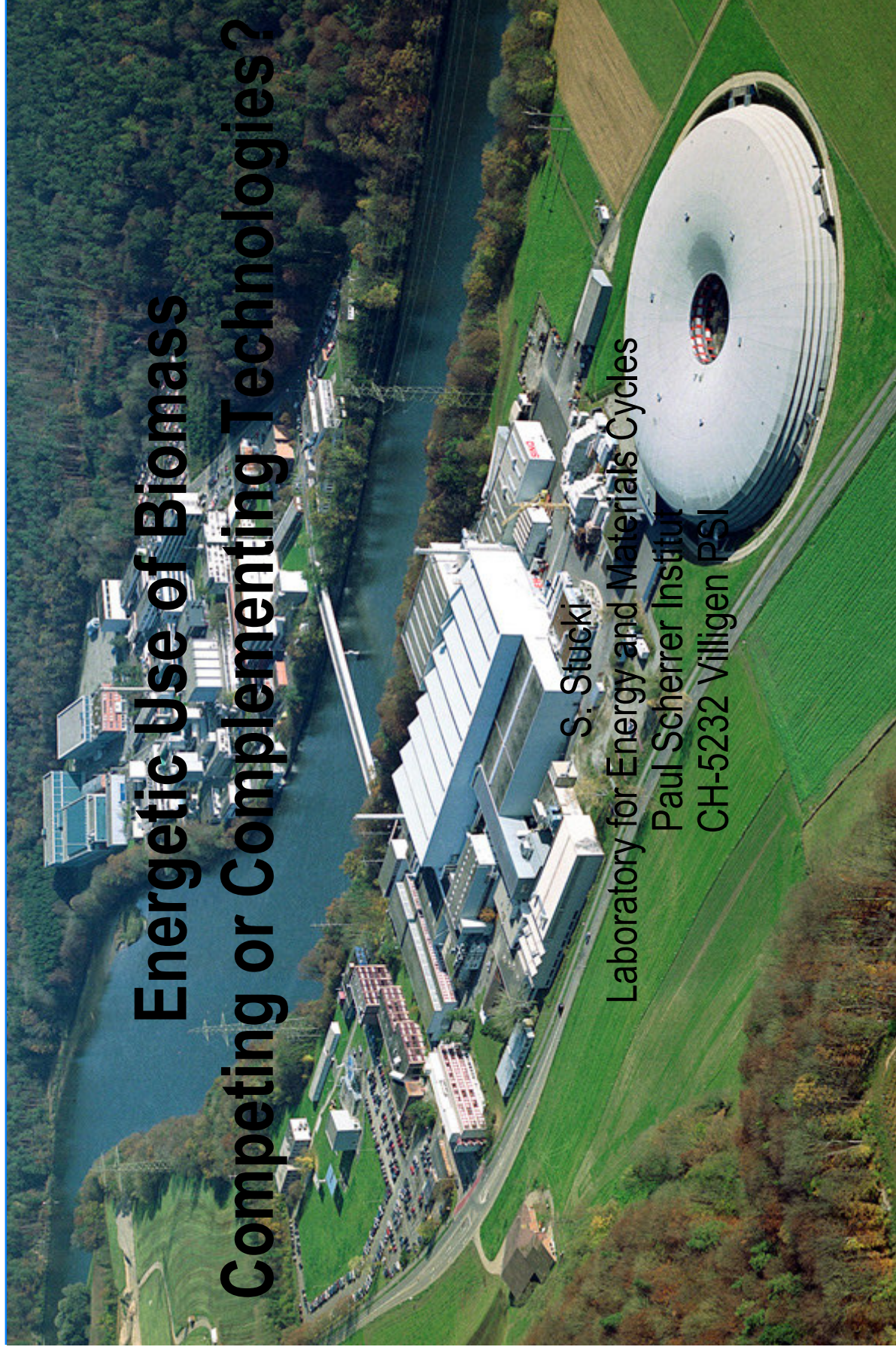
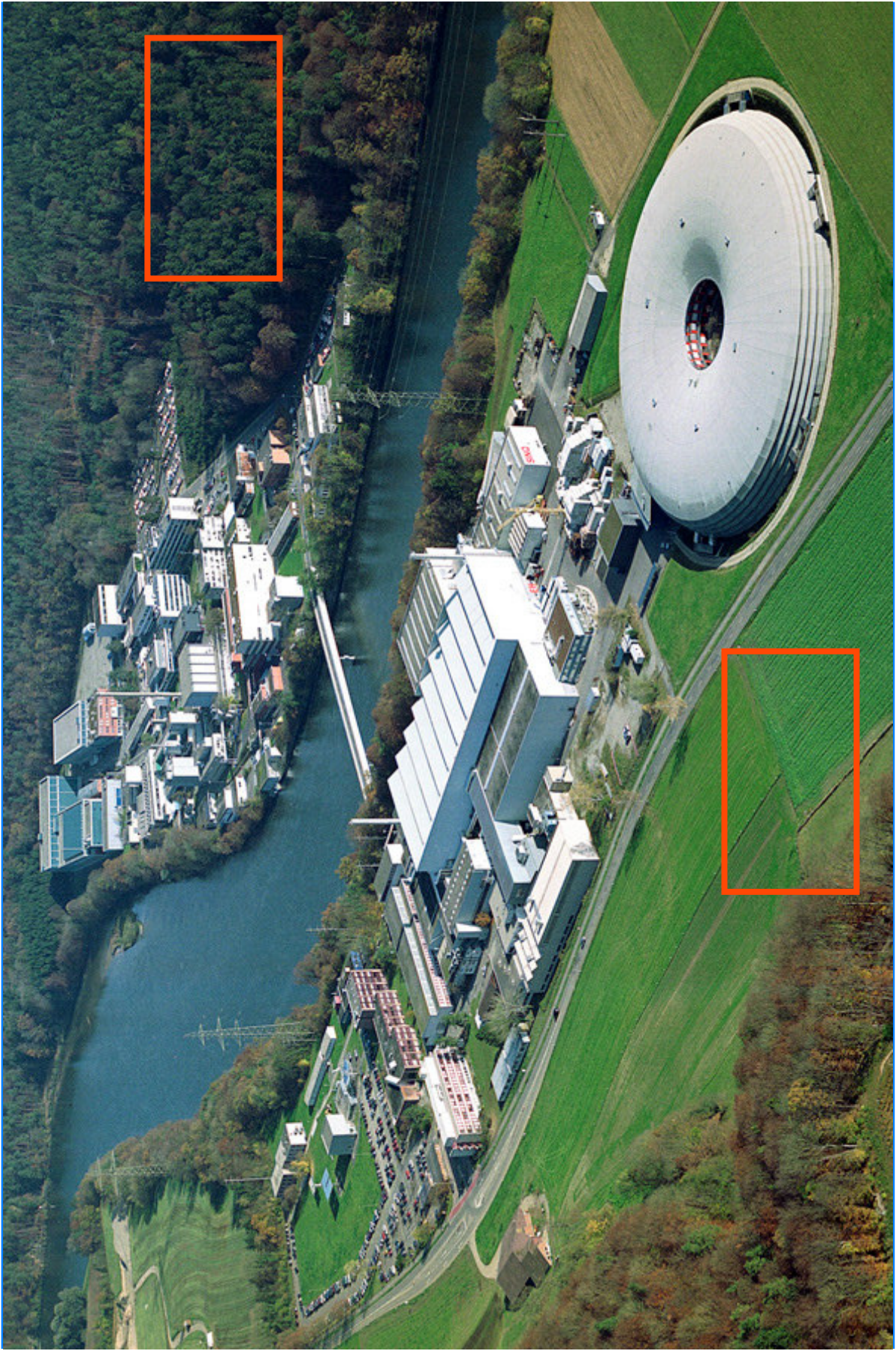


Energetic Use of Biomass Competing or Complementing Technologies?



S. Stucki
Laboratory for Energy and Materials Cycles
Paul Scherrer Institut
CH-5232 Villigen PSI



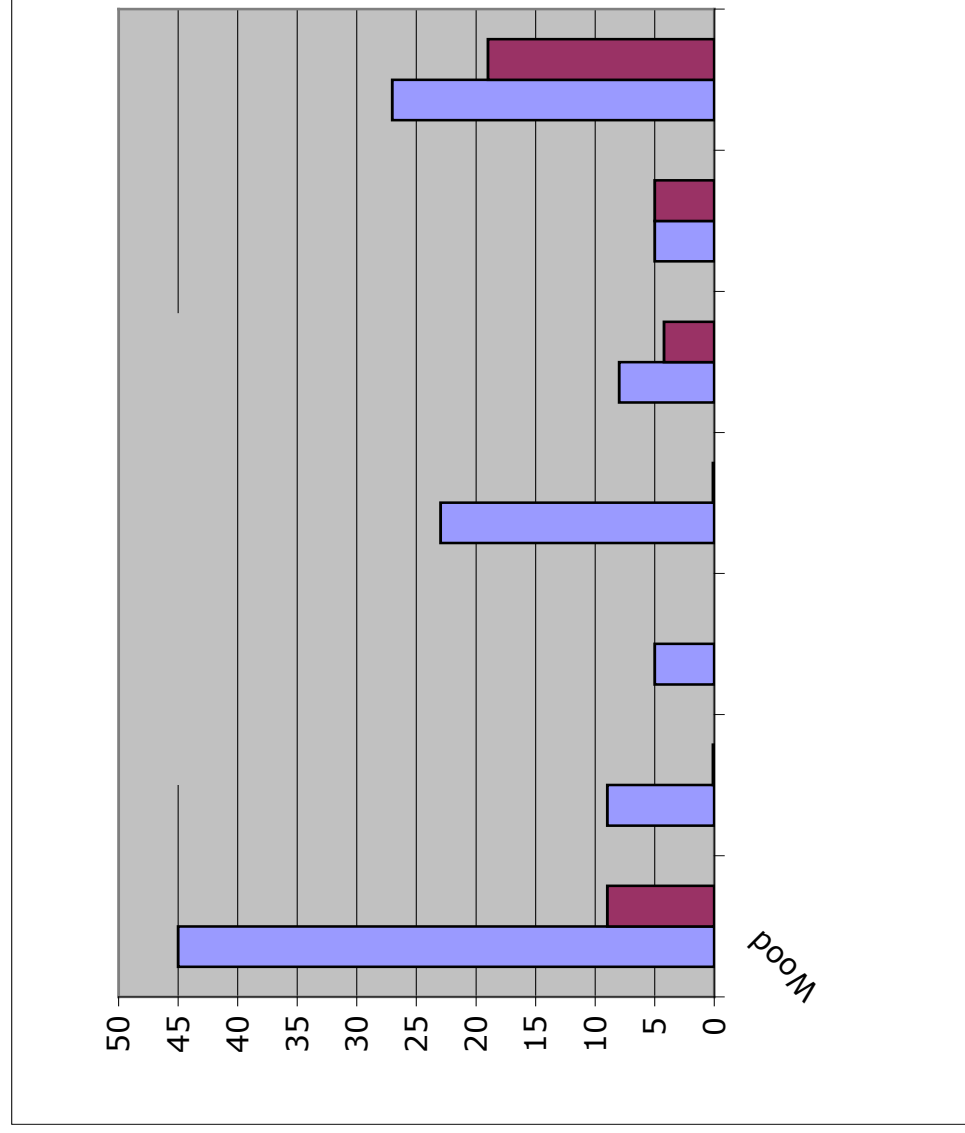
Switzerland and Kyoto

Electricity production is CO₂-free

Transportation sector keeps growing. CO₂ targets will be missed.

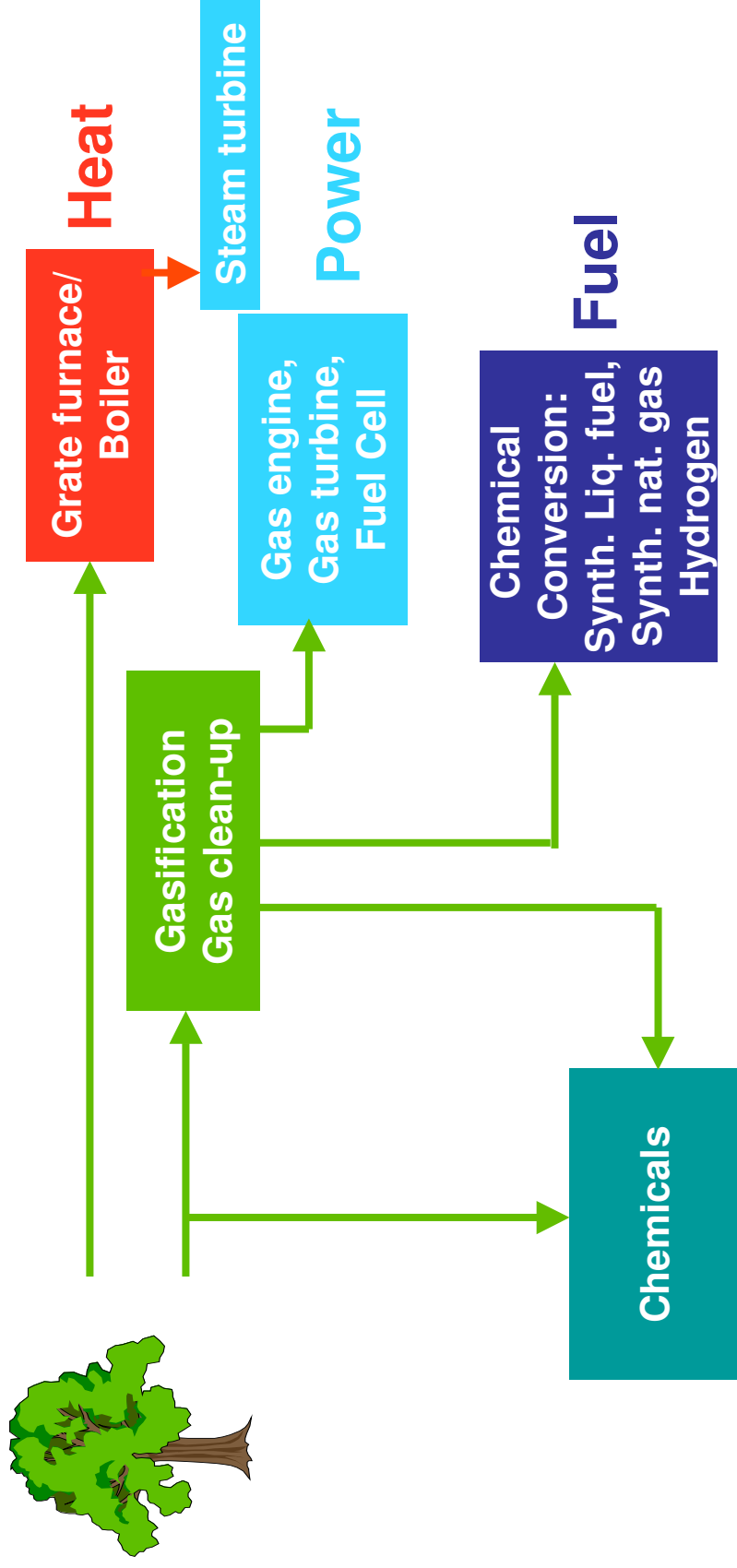
What happens, when nuclear capacity needs to be replaced?

Biomass Potentials in Switzerland

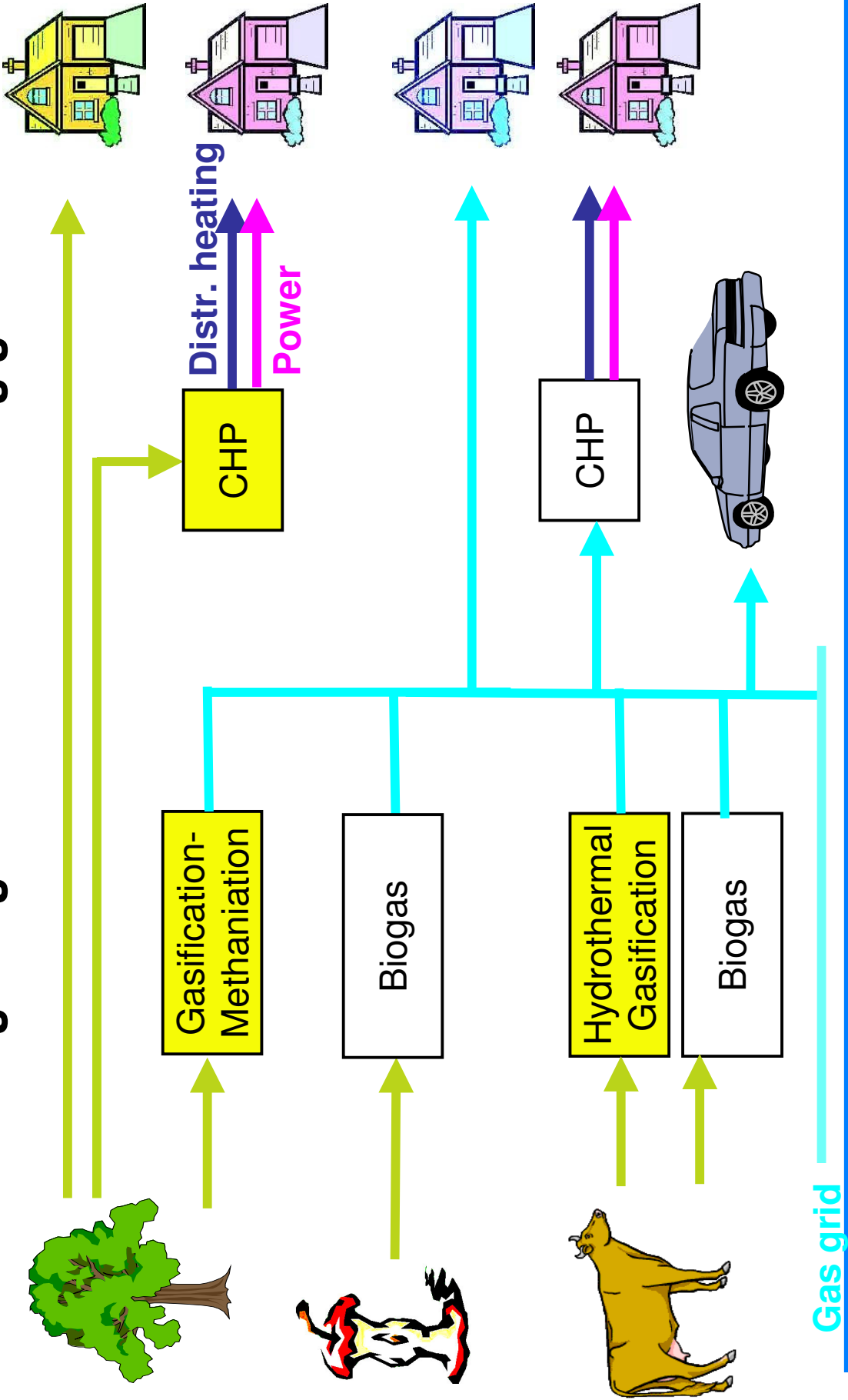


Referenc: Bundesamt für Energie 2004: Potentiale zur energetischen Nutzung von Biomasse in der Schweiz

Wood: Which technology for which product

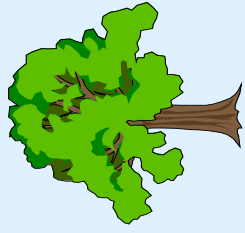


ECOGAS: Integrating Biomass into existing grids

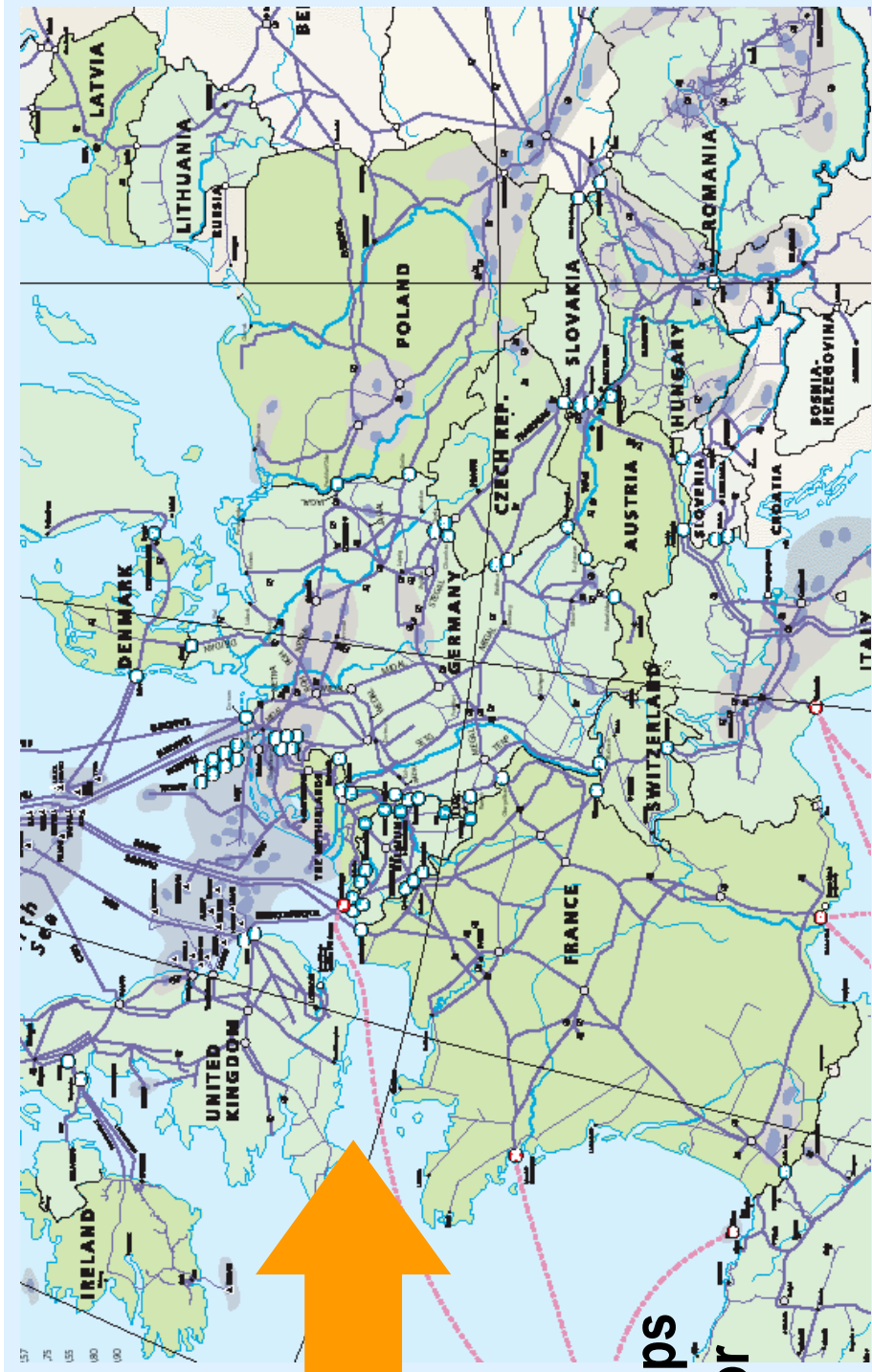


Linking biomass energy & the European Natural Gas Network

Variety of biomasses for a dense distribution network (NG grid at 25 ... 70 bar)



- Wood
- Straw
- Energy crops
- Black liquor
- ...



Güssing CHP Plant

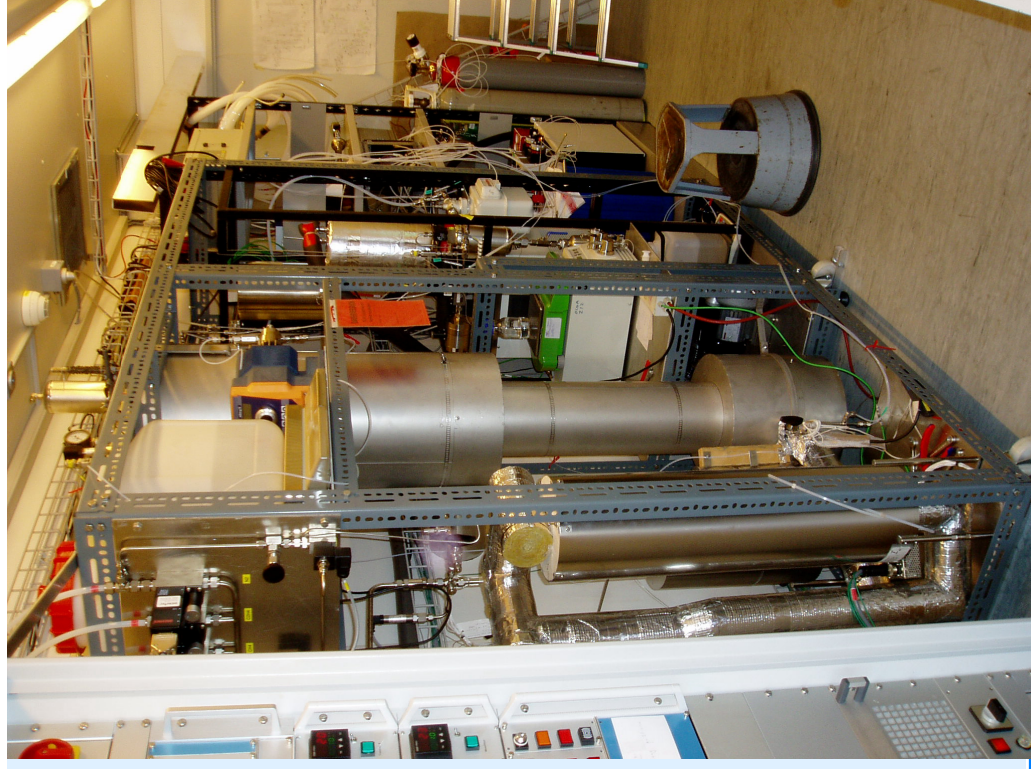


PSI's Methanation Reactor at Güssing

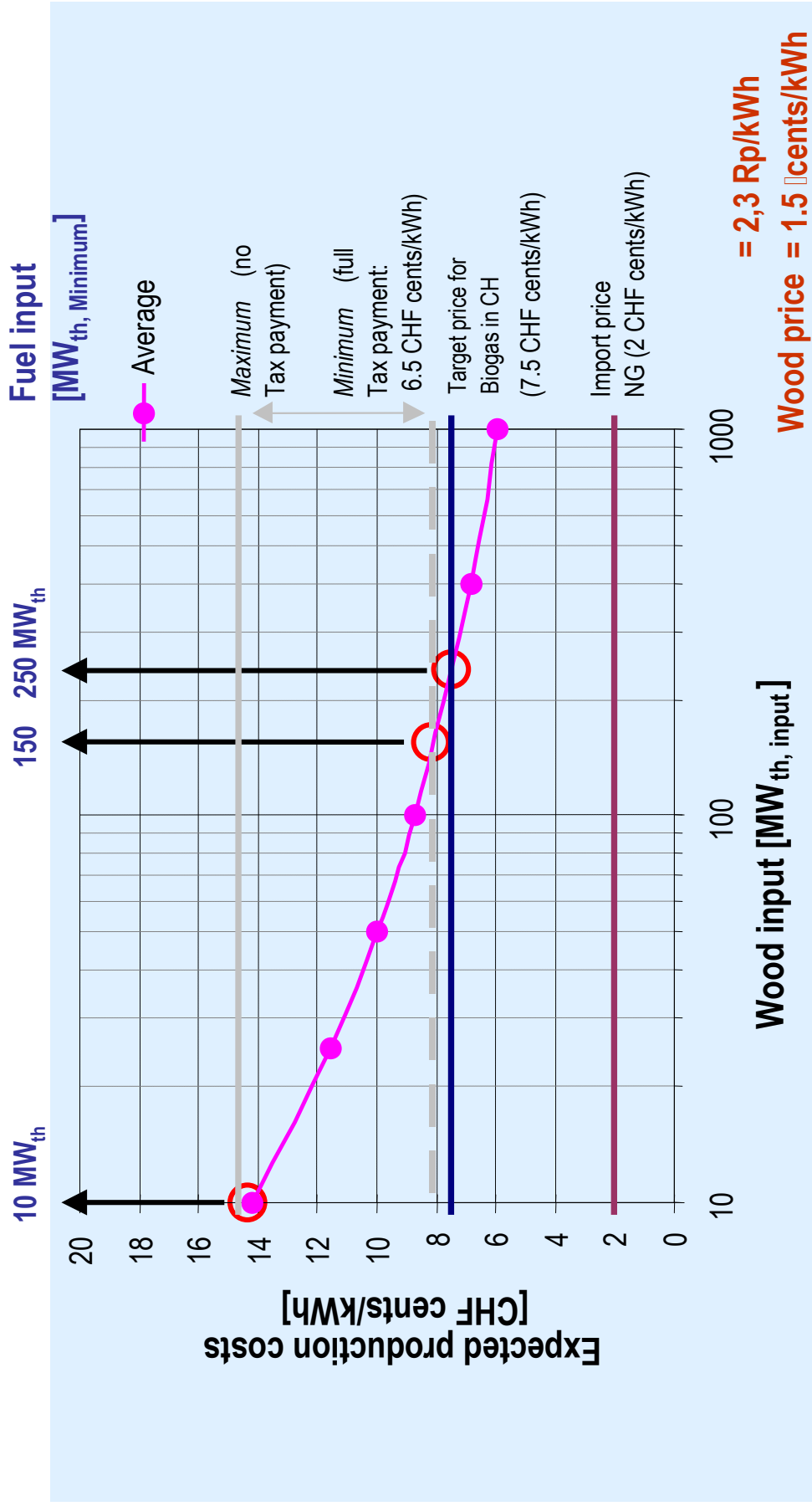
Catalytic conversion of producer gas (including tars, alkenes with 85% efficiency

Wood to methane: 60% efficiency

Technology ready for scale-up to 1 MW (2006)



Cost analysis for SNG production from wood



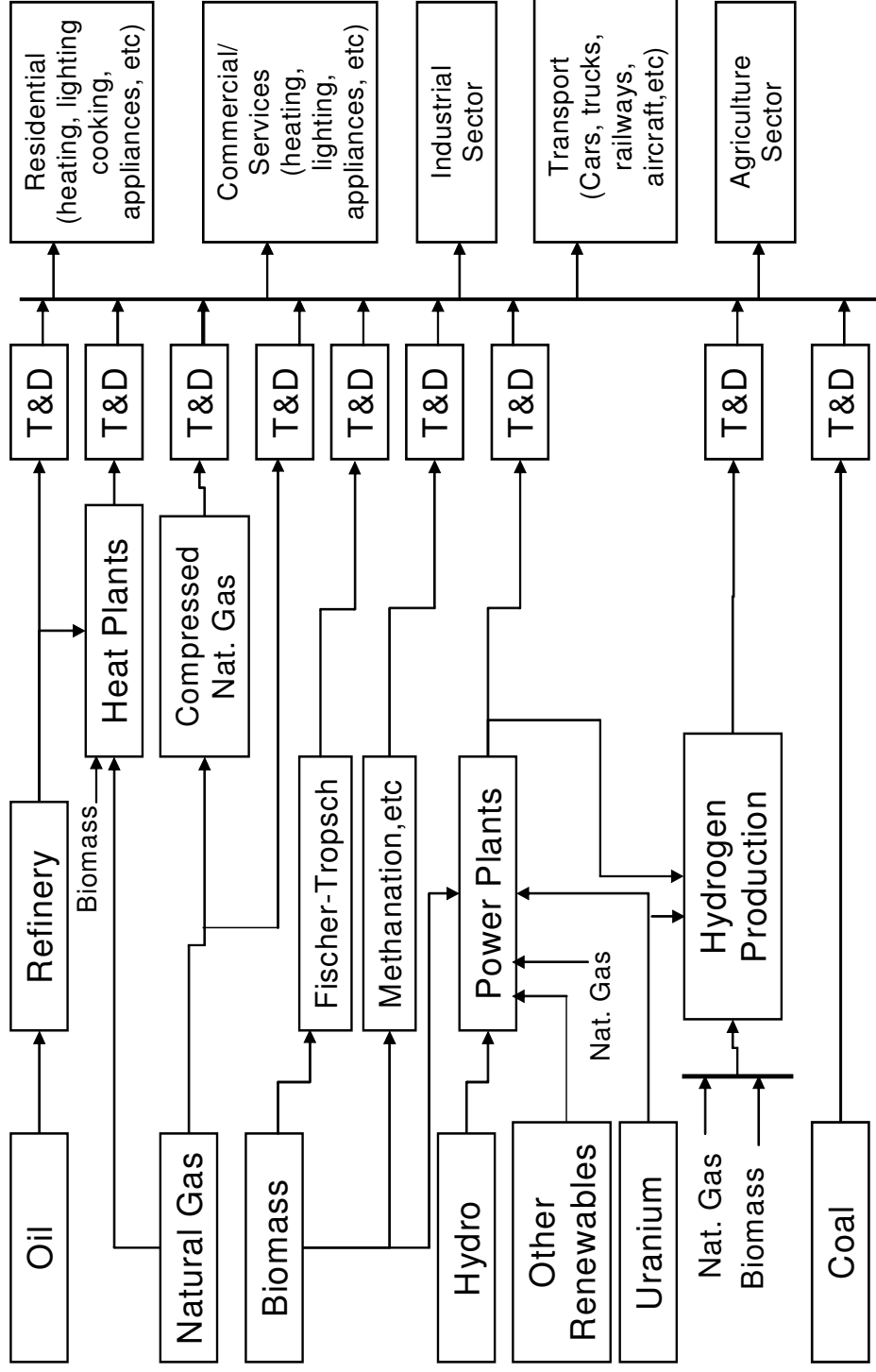
Economic Modelling (Markal Model)

Economic model of Swiss Energy System

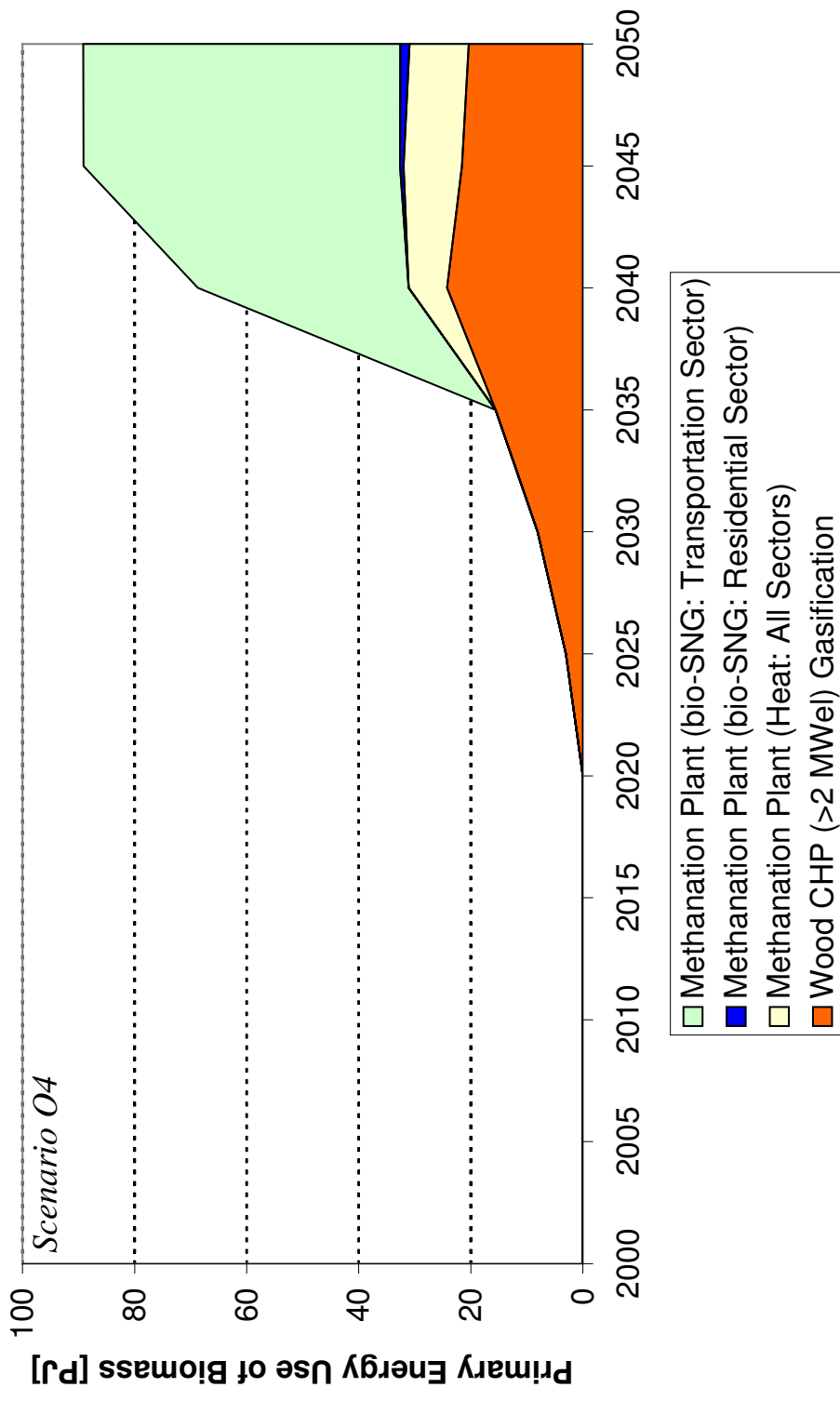
Introducing new technologies into the system; varying exogenous parameters, such as oil price development, etc.

Model optimizes energy system economically, taking into account time constants for market introduction of investment goods.

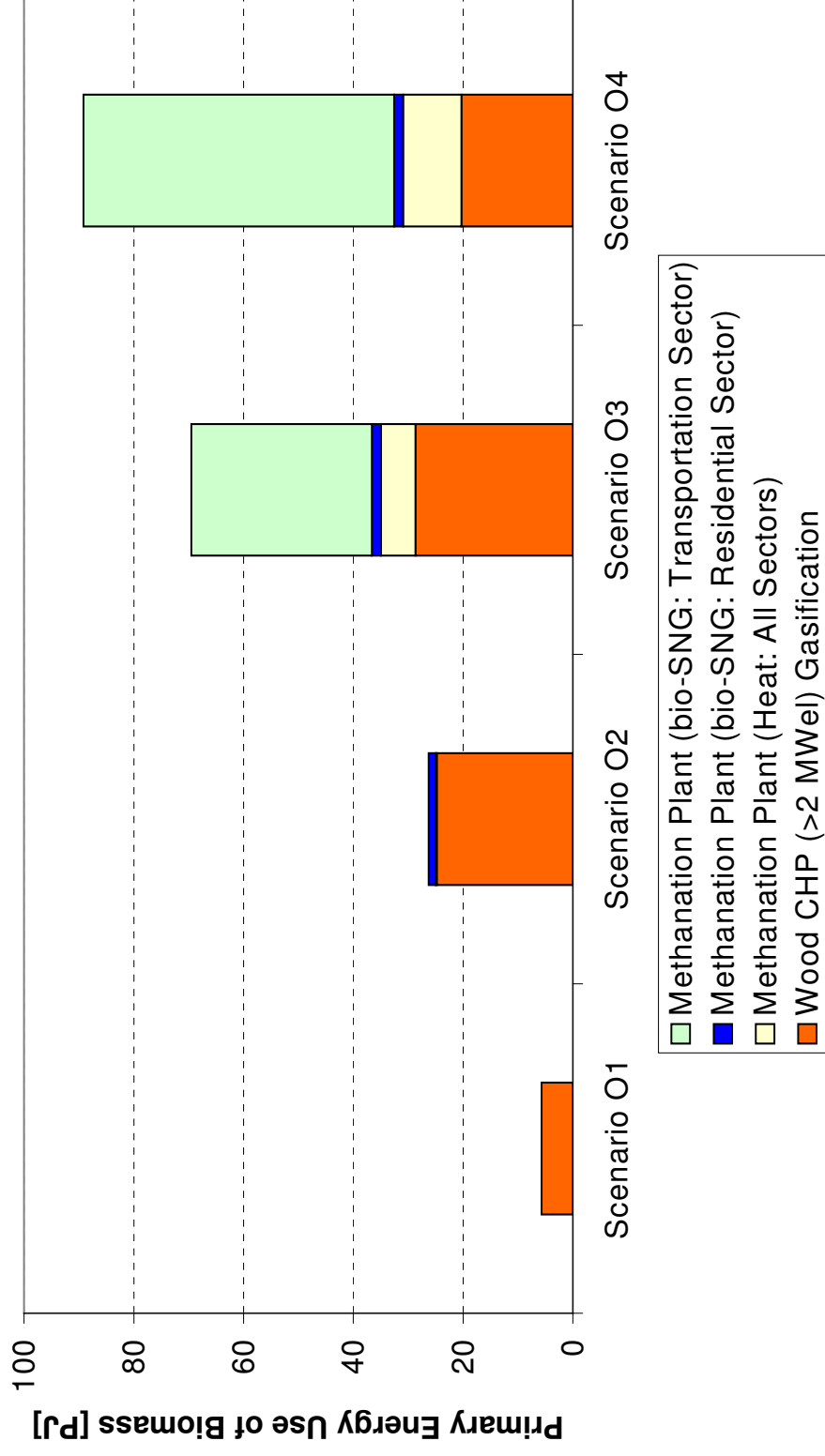
Reference system



Oil price 2050: 130 US\$/bbl



Oil price 2050: 100-130 US\$/bbl



Dry Biomass to Energy - some Qualitative Statements

	E n v i r o n m e n t a l	E c o n o m i c	F u t u r e t r e n d s
D i s t r i b u t i o n (t r a n s p o r t)	CO ₂ P e t r o l u m	D e p e n d e n c e o n p e r f o r m a n c e a n d c o n v e r s i o n e f f i c i e n c y S e a s o n a l d e m a n d	P e l l e t s D e m a n d f o r h e a t i n g e n e r g y d i m i n i s h e s
L a r g e s c a l e h e a t R e s i d e n t i a l	CO ₂ F l e a s c o n r b l	E x p e n s i v e h e a t d i s t r i b u t i o n l i m i t s e c o n o m y s c a l e S e a s o n a l d e m a n d	F u r t h e r " d i u t i o n " o f h e a t d e m a n d
L a r g e s c a l e h e a t P r o c e s s e s	CO ₂ F l e a s c o n r b l	H i g h l o a d f a c t o r s L i m i t e d n u m b e r o f s i t e s	
C o m m e r c i a l a n d p o w e r	CO ₂ F l e a s c o n r b l	H e a t d i s t r i b u t i o n l i m i t s e c o n o m y s c a l e L o a d f a c t o r	H i g h e l e c t r i c e f f i c i e n c y
P o w e r g e n e r a t i o n	CO ₂ i n p o w e r s e c t o r d e p e n d e n c e o n e l e c t r i c e f f i c i e n c y F l e a s c o n r b l	E x p l o r a t i o n o f n e w s c a l e	C o m m e r c i a l c y c l e s
T r a n s p o r t a t i o n o f f u e l s	CO ₂ i n t r a n s p o r t a t i o n d e p e n d e n c e o n e l e c t r i c e f f i c i e n c y	E x p l o r a t i o n o f n e w s c a l e	C h e m i c a l s, b i o r e f i n e r i e s

Vision: Linked Networks

