

Involvement of MS in the HyWays process

1st member state workshop
Brussels, May 11 2005

Harm Jeeninga
ECN Policy Studies
jeeninga@ecn.nl

- HyWays is **not** about modelling but about building a fully validated and accepted roadmap
 - Models are valuable tools to help to achieve derive a coherent, accepted and validated H₂-roadmap
- HyWays has to build valid storylines, taking into account all kinds of barriers and opportunities
 - Models can address energy demand, penetration rates, emission impacts etc., but not country specific infrastructure built up or niche market development
 - Hybrid approach (including actor analysis) is needed

- The transition towards a hydrogen based society is the starting point
 - Simulation models show usually “no hydrogen” (short term benefits vs. long term profits)
 - Backcasting – forecasting approach is used
- HyWays has to show that the transition towards a future hydrogen society is preferable
 - Emission impacts, employment effects, impacts on GDP
 - Indicate the conditions (policy measures, energy prices, CO₂ constraints, etc.)

Major research questions

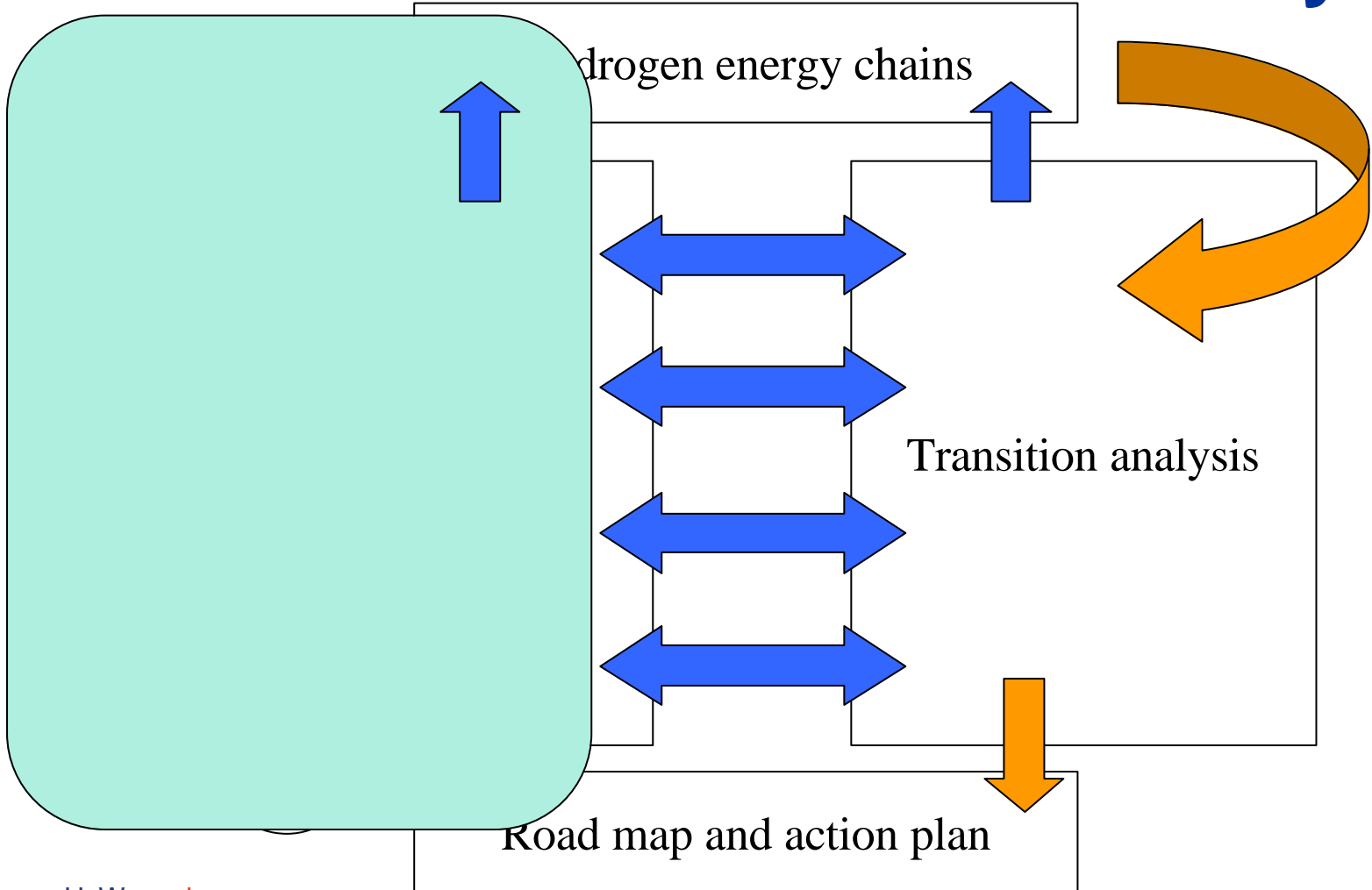
- Penetration of hydrogen as an energy vector for mobile and stationary applications;
 - Development of penetration rate and investment (additional) costs of hydrogen relevant technologies
 - Pathway analysis, including identification of critical actors and key changes and plausible hydrogen production routes matched to feasible timeliness
 - Changes in primary and final energy demand (security of supply)
 - Blueprint of a possible future hydrogen based society (stationary and mobile)
 - Emission analysis indicating achievable reductions in greenhouse gasses and pollutant emissions

- Demands on infrastructure
 - Estimated costs, capital investments and timescales for infrastructure built-up
- Identification of different (most promising) regional markets for a hydrogen economy in Europe and development of regional market strategies
- Development of industry R&D strategies for the creation of hydrogen economies; identification key technologies and needs for further research (R&D)

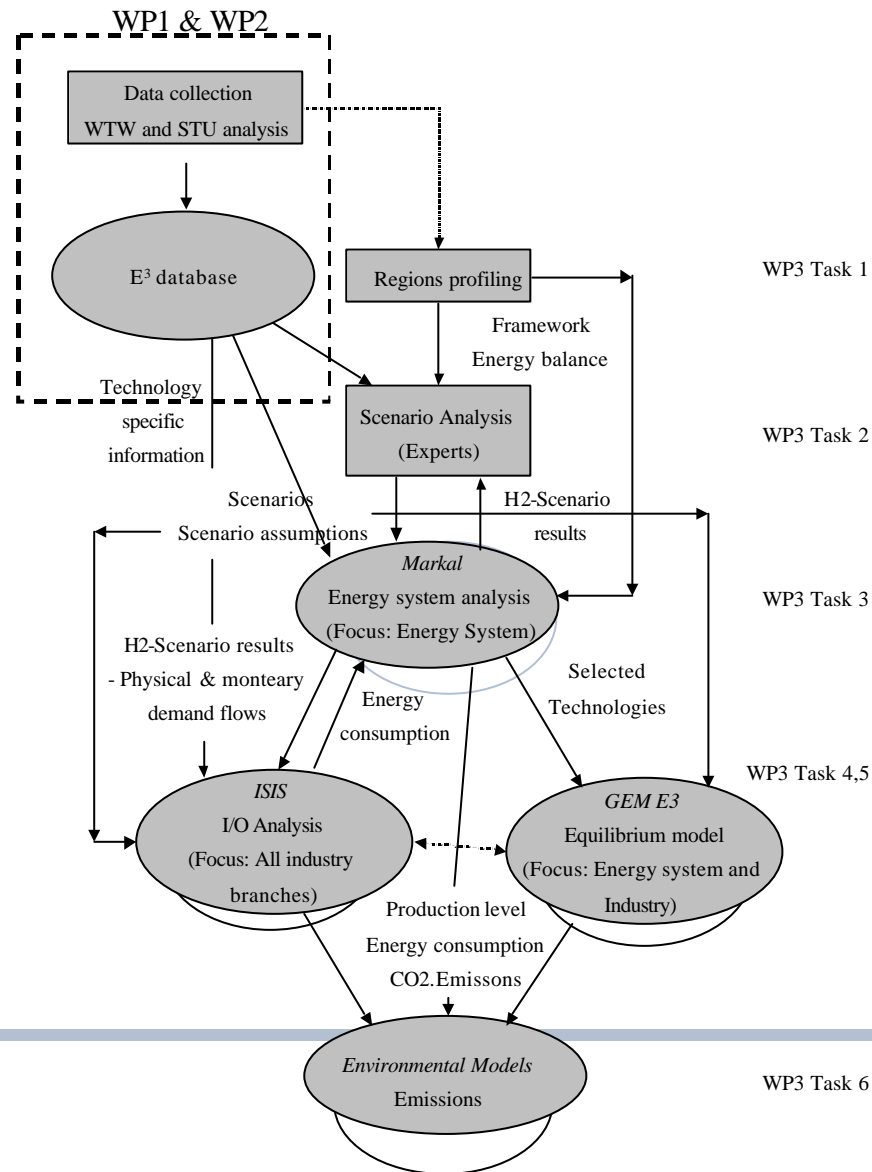
- Analysis of economical (i.e. subsidies, taxation) and legal conditions (i.e. regulatory policies) under which a hydrogen economy can become competitive in order to derive a European set of recommendations
 - Impacts on GDP, EU balance of trade, economic structure, employment effects, private vs. public investments, security of supply and social justice
 - Impacts of introducing general policy instruments such as a CO₂-tax, emission trading etc.

Hybrid approach

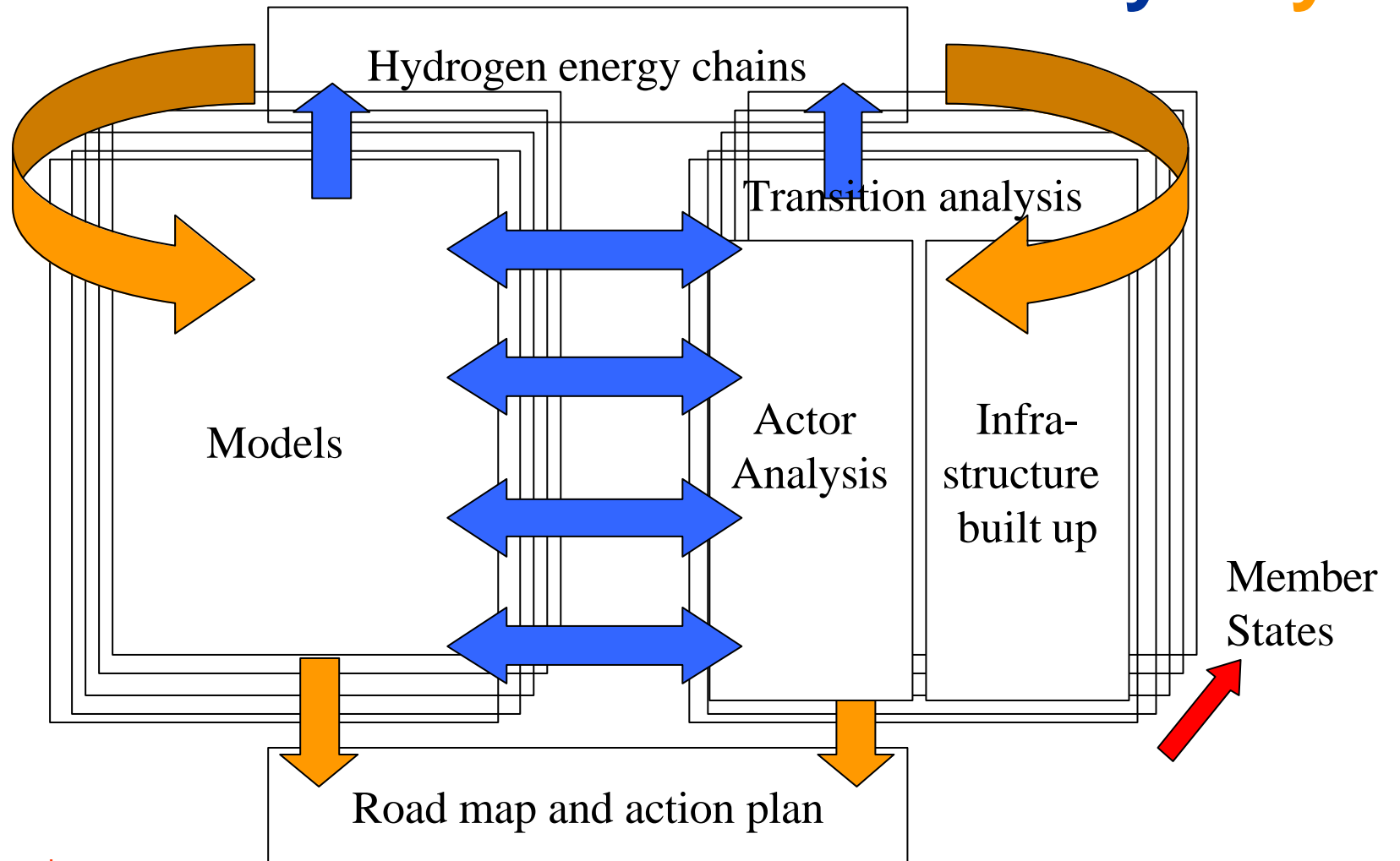
- Address impact on
 - micro level (technology) – E3-database and Markal
 - meso level (sectoral level) – ISIS I/O-model
 - macro level (national level) – GEM-E3
 - emission impacts – based on COPERT III
- Technical, social, economic, political/institutional aspects have to be taken into account
- Multi-level
 - Micro level – cost/benefit ratio (pay back time)
 - Macro/meso level – cost effectiveness (€/ tonne CO₂)

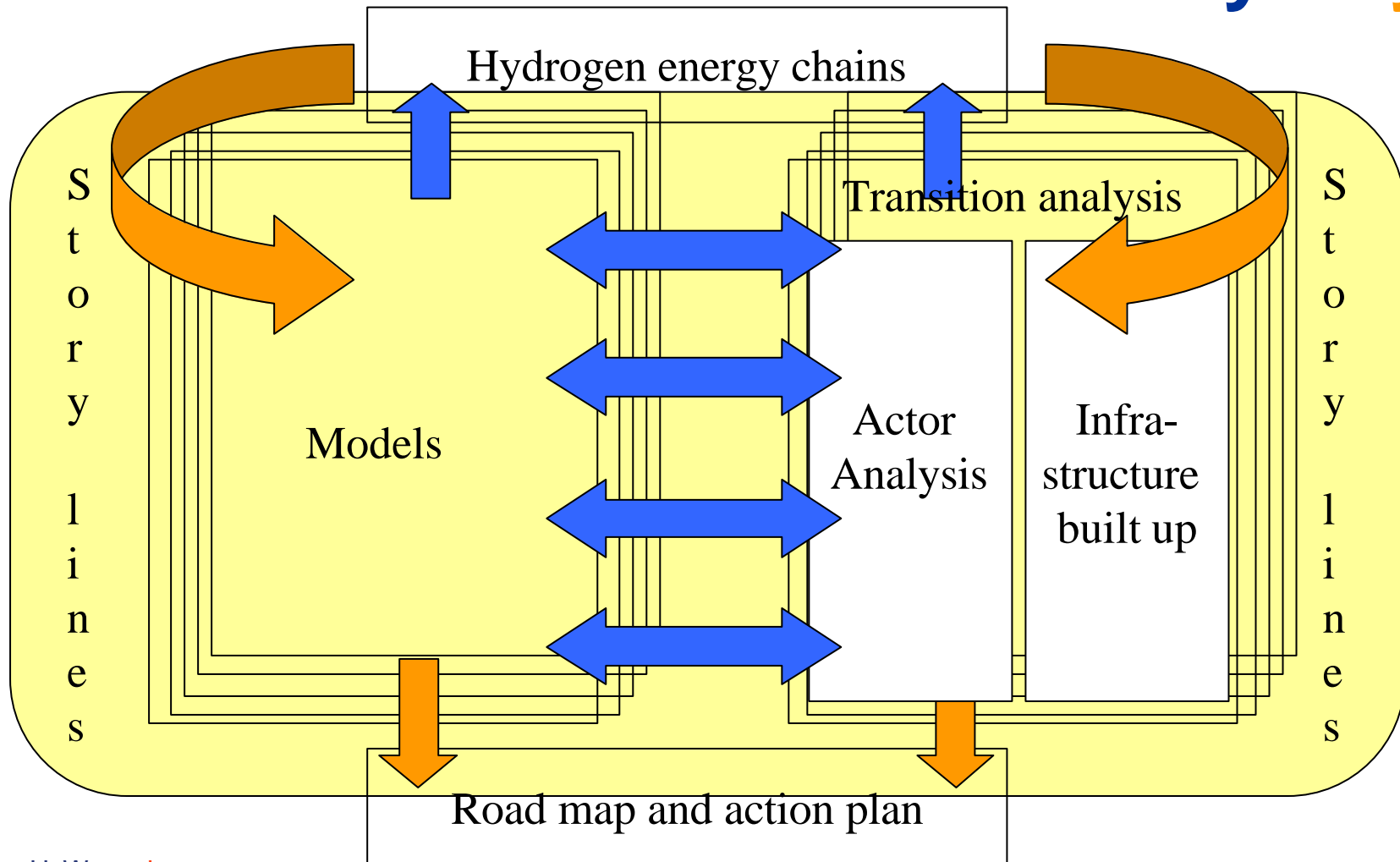


Modelling framework



- Critical actors
 - Identification of critical actors and their role in the transition process
 - Assess their attitude (supporting, neutral, opposing)
- Key changes - changes needed to accomplish the transition
 - Cost reductions and technological progress (technology learning)
 - Infrastructure and spatial planning
 - Codes and standards
 - Public acceptance (perception) and life style changes
 - Robustness (technological, economic, spirit of the times....)





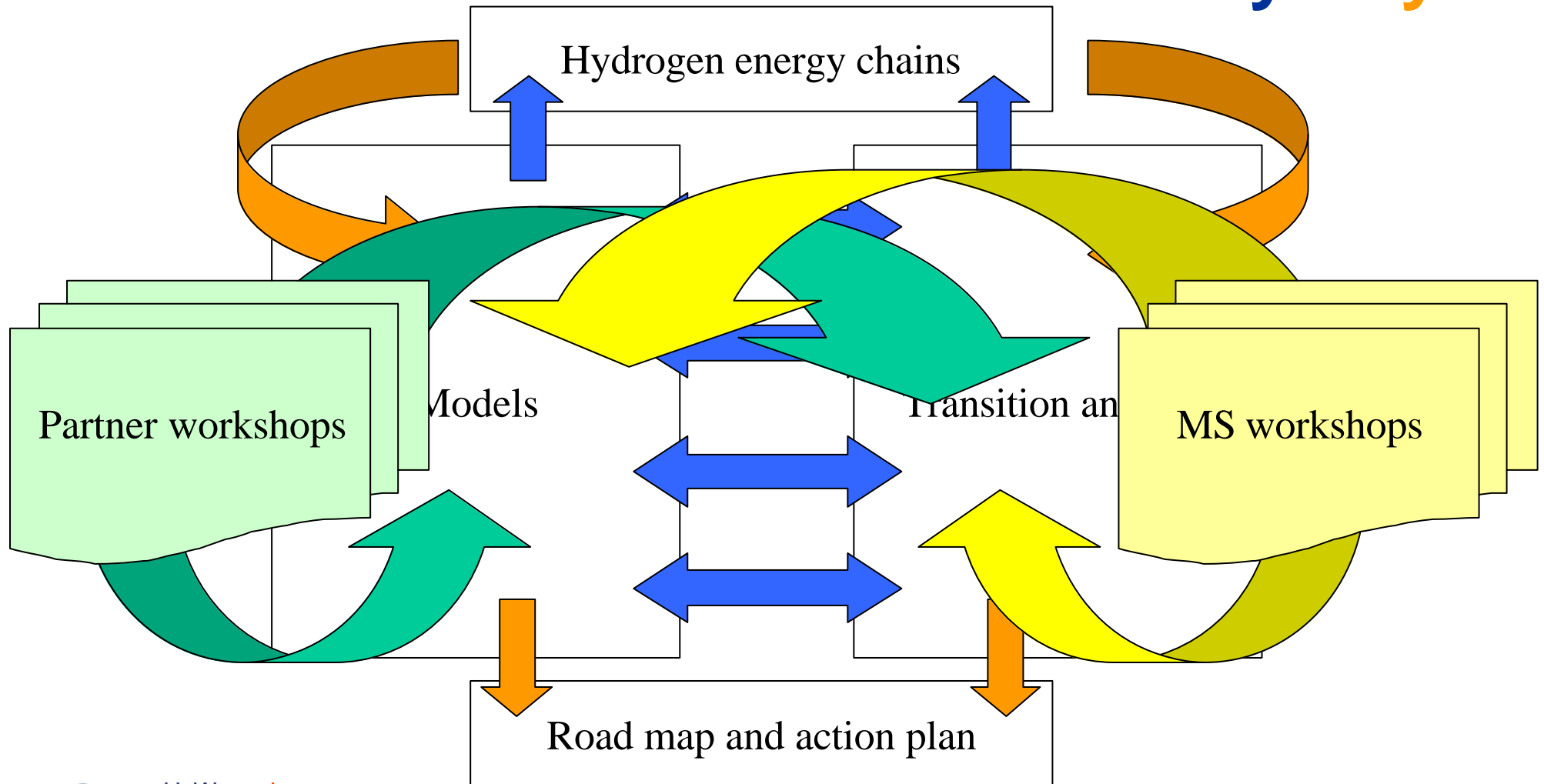
Optimisation of the energy system

- Cost minimisation: one option will be chosen from competing ones solely on cost/benefit ratios
- By applying bounds, the non-economic and country specific conditions can be taken into account
 - First results without applying many bounds (otherwise results are determined by modellers)
 - First results based on economics and not on interests
 - Feedback through MS-workshops

Crucial role for MS to turn the theoretical optimal pathways into well accepted and validated roadmap taking into account MS specific conditions !!

MS play crucial role:

- Validation and acceptance of results
- Stakeholder commitment
- Actor analysis
- Infrastructure built up
 - urban vs. country, highways, existing infrastructure and development of power sector
- Country specific conditions
 - Preferences (government, stakeholders....)



First Results „NL“ – Hydrogen Infrastructure Build-Up



Method:

- 1.) identify regional nodes



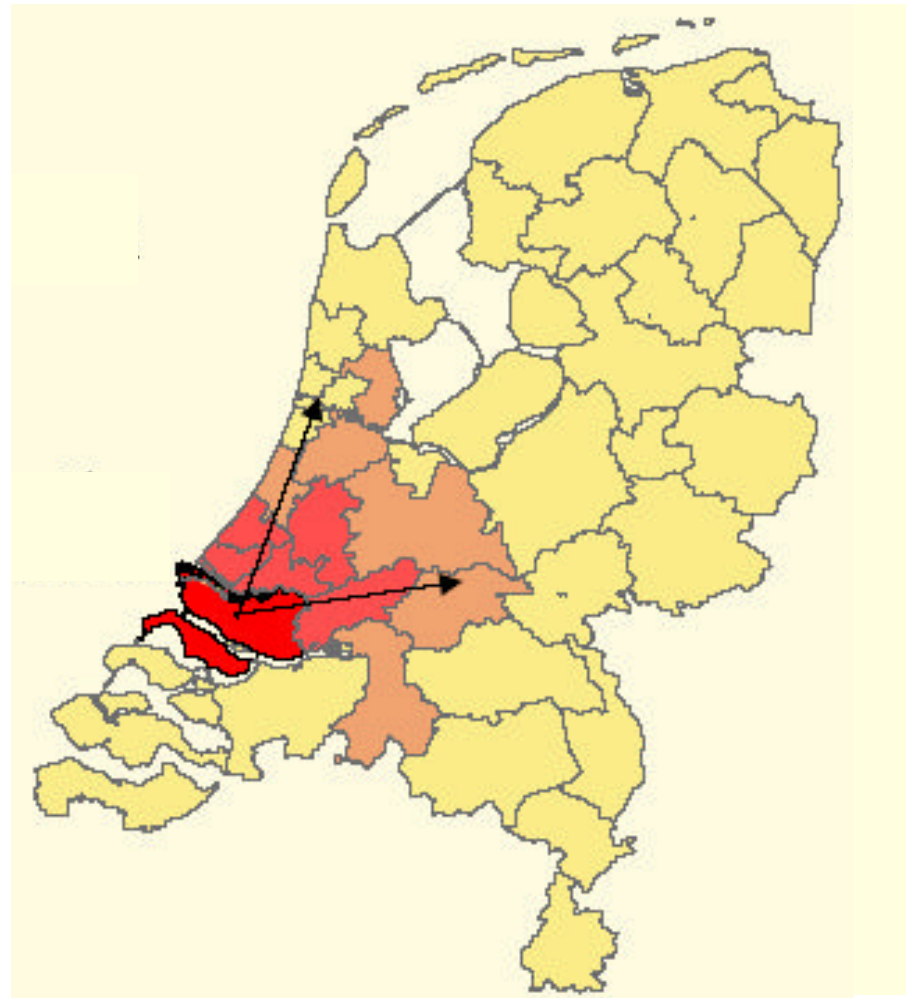
40 regions in NL (COROP grid): Starting nodes for a hydrogen fuelling station network

First Results „NL“ – Hydrogen Infrastructure Build-Up

HyWays

Method:

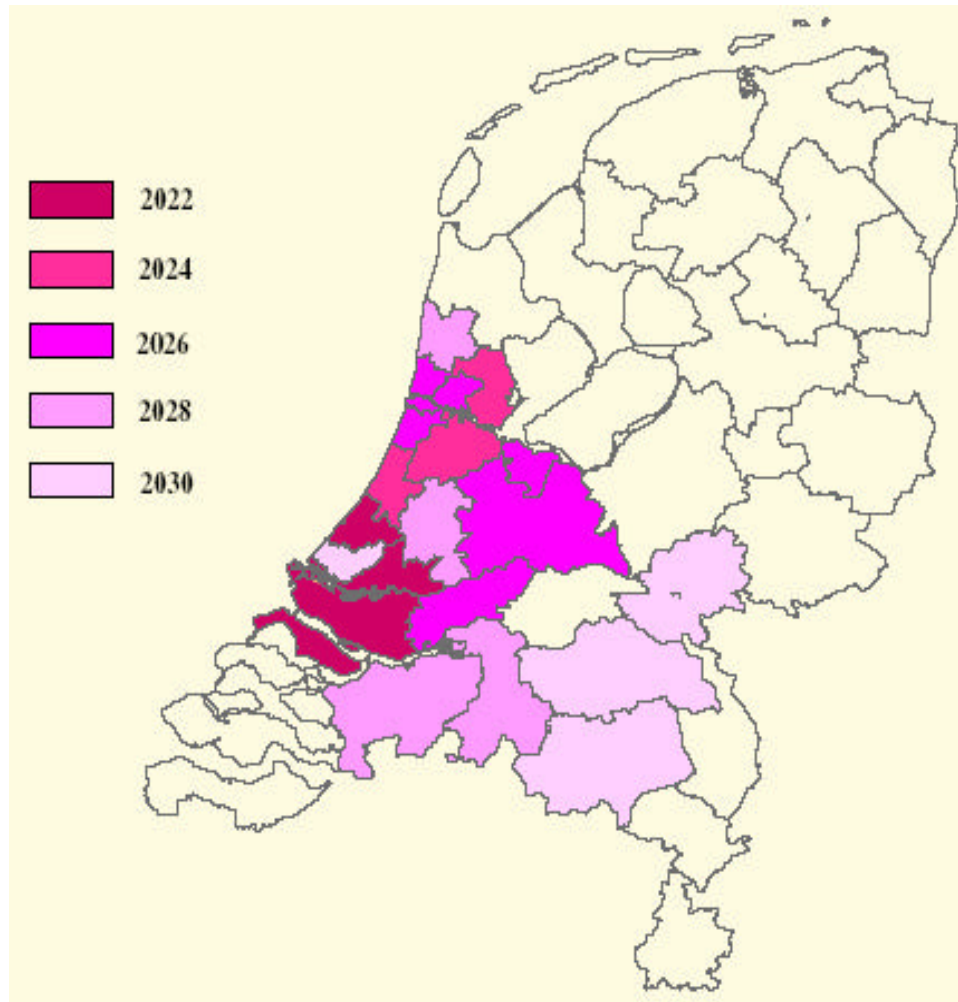
- 1.) identify regional nodes
- 2.) Rotterdam by-product hydrogen as starting point



Pipeline grid:
Central hydrogen production capacity located in Rijnmond area. Infrastructure can grow to neighbouring regions.

Method:

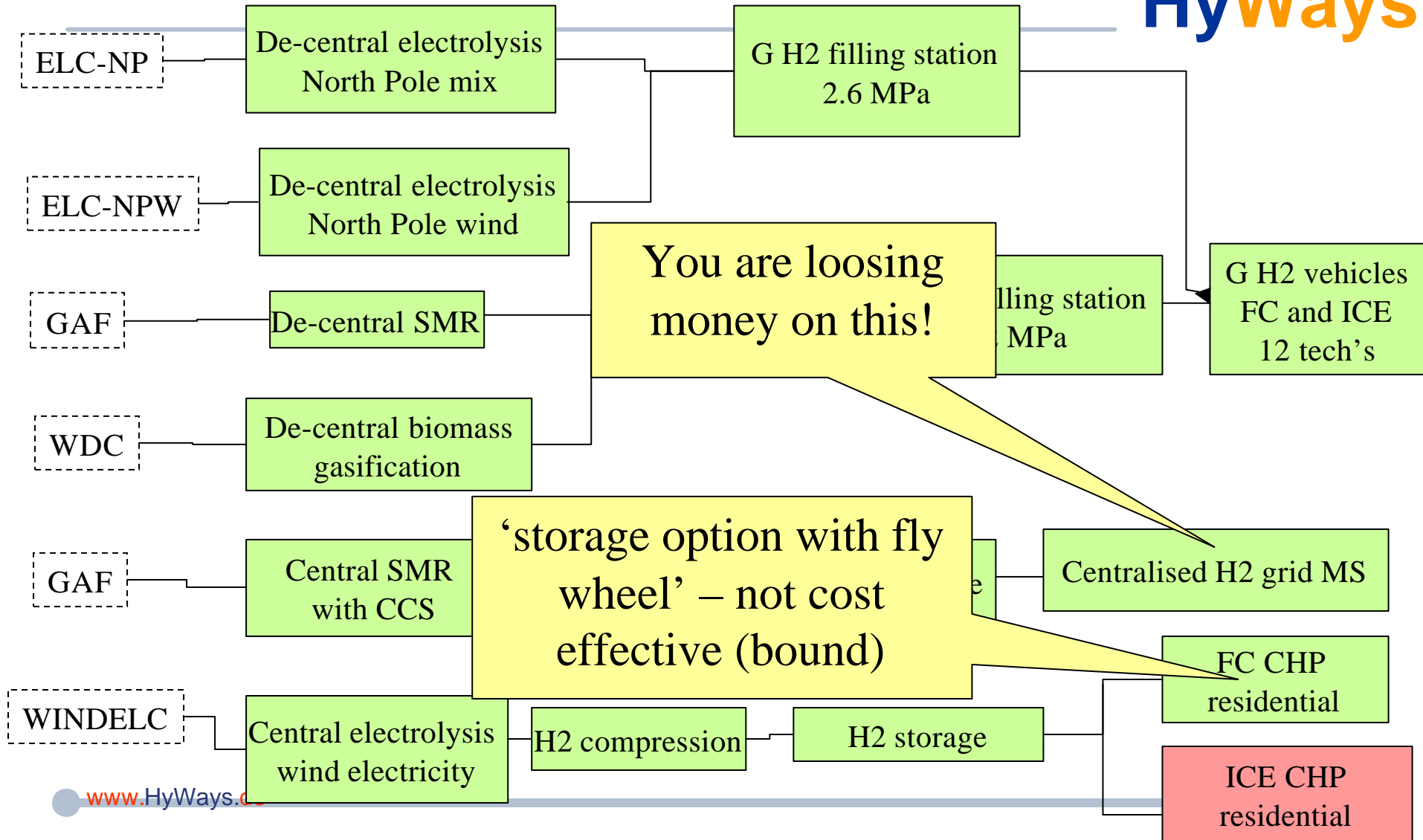
- 1.) identify regional nodes
- 2.) Rotterdam by-product hydrogen as starting point
- 3.) Use existing natural gas pipeline grid for transport and distribution



Scenario:

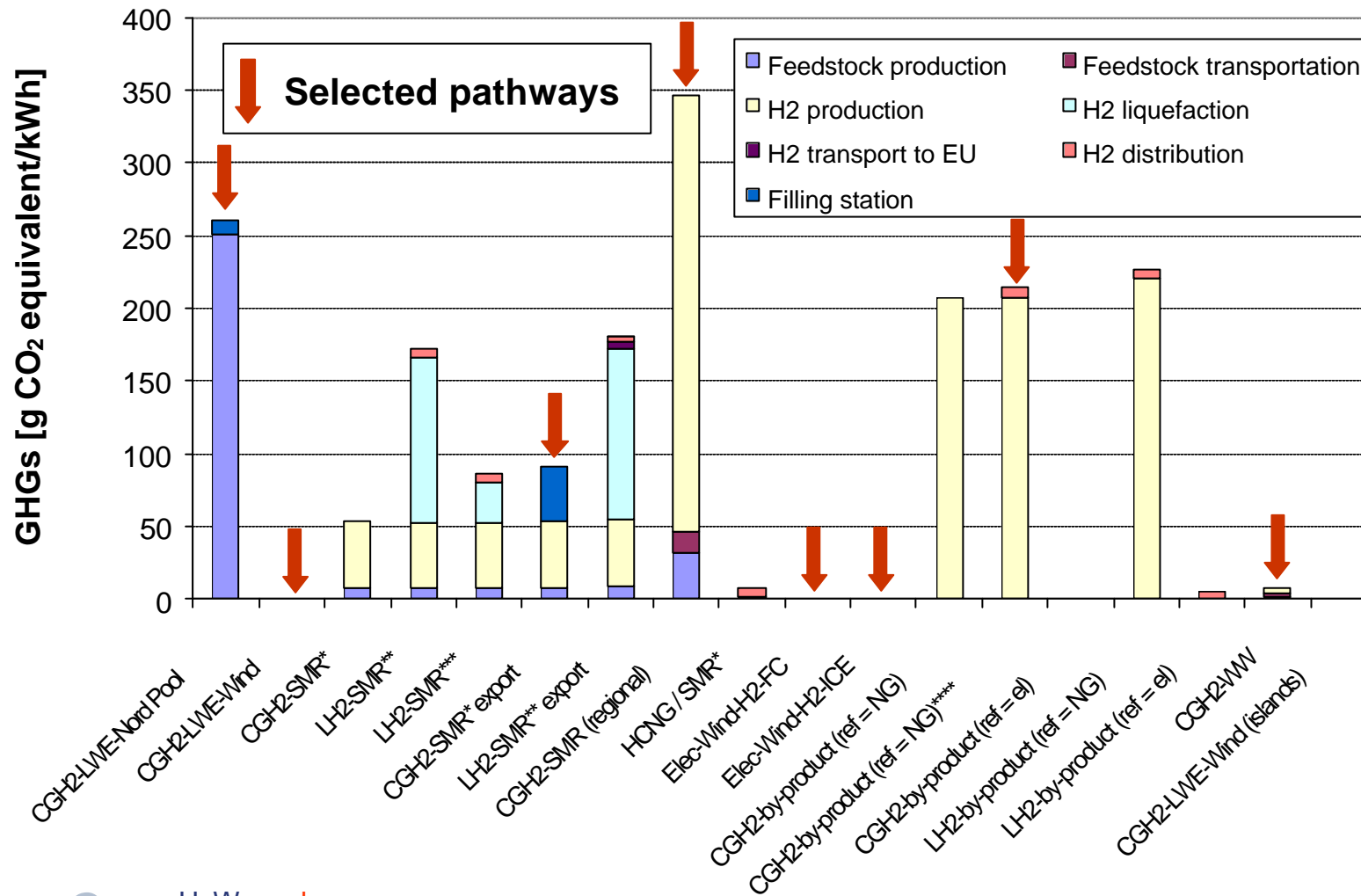
„High hydrogen penetration rates“

Example - Hydrogen Norwegian pathways



Results High Penetration case

GHG Emissions WtT and WtStU (selected pathways)



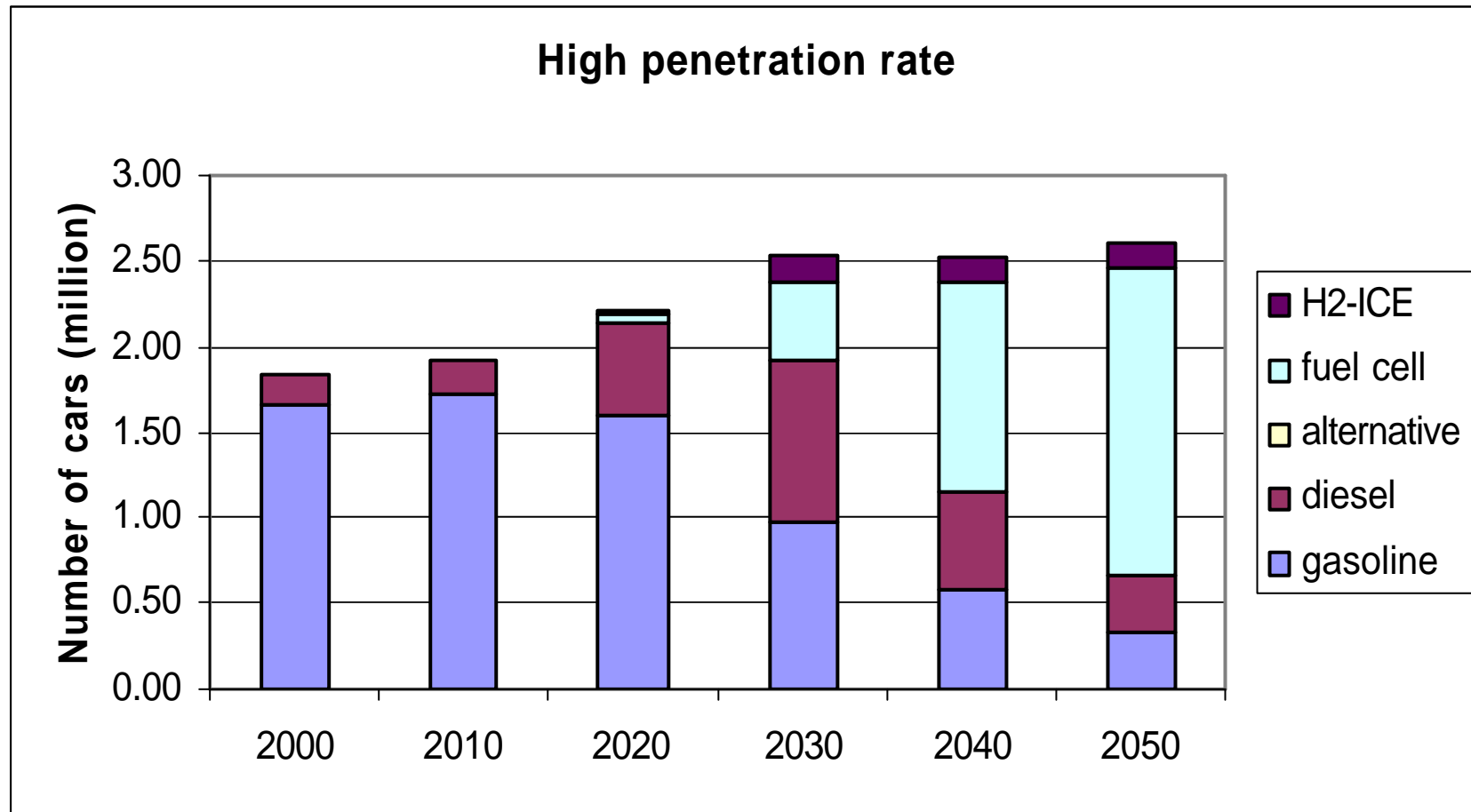
* with CO₂ capture and sequestration

** with CO₂ capture and sequestration, H₂ liquefaction with NG fueled CCGT

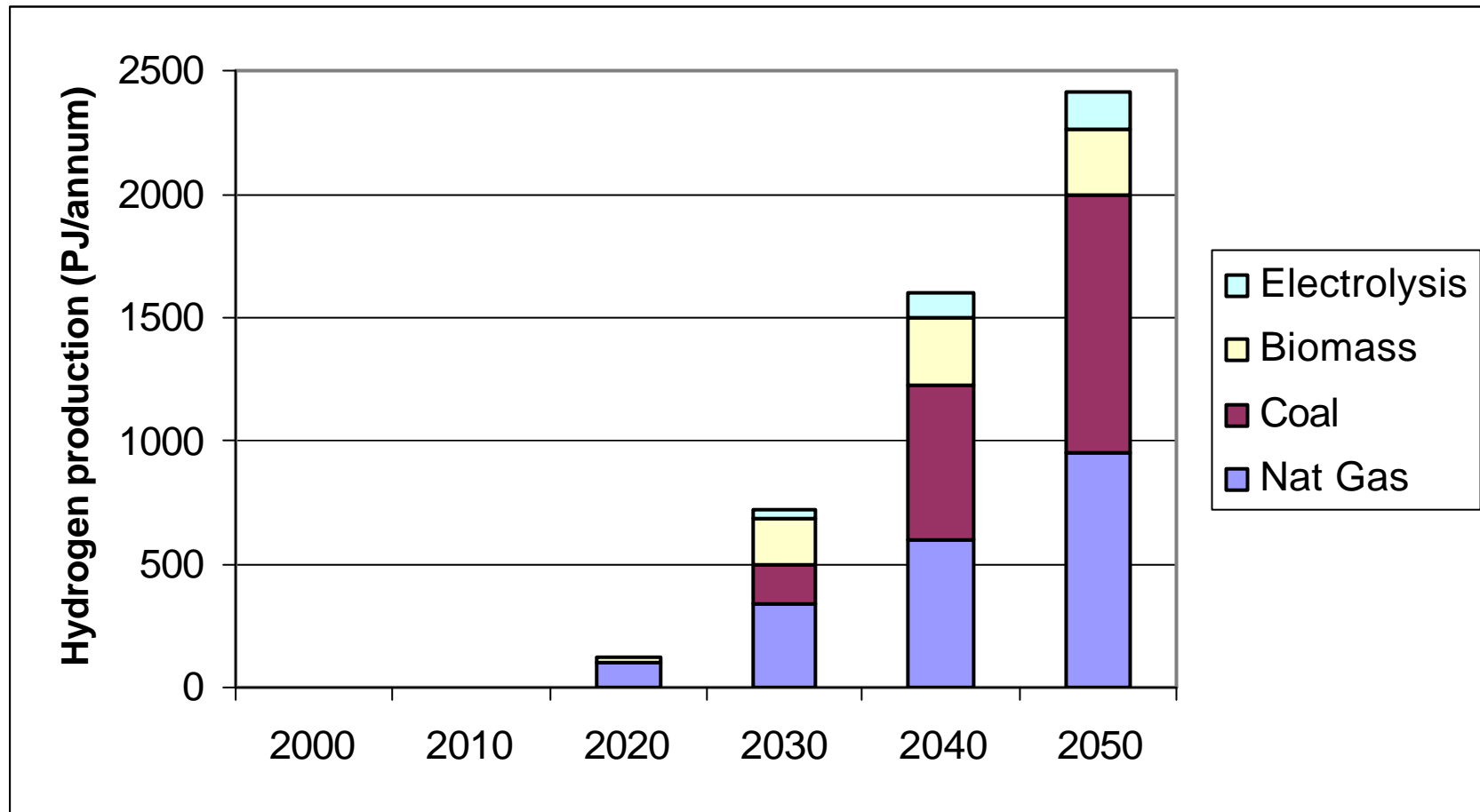
***with CO₂ capture and sequestration, H₂ liquefaction with H₂ fueled CCGT

**** trucked CGH₂

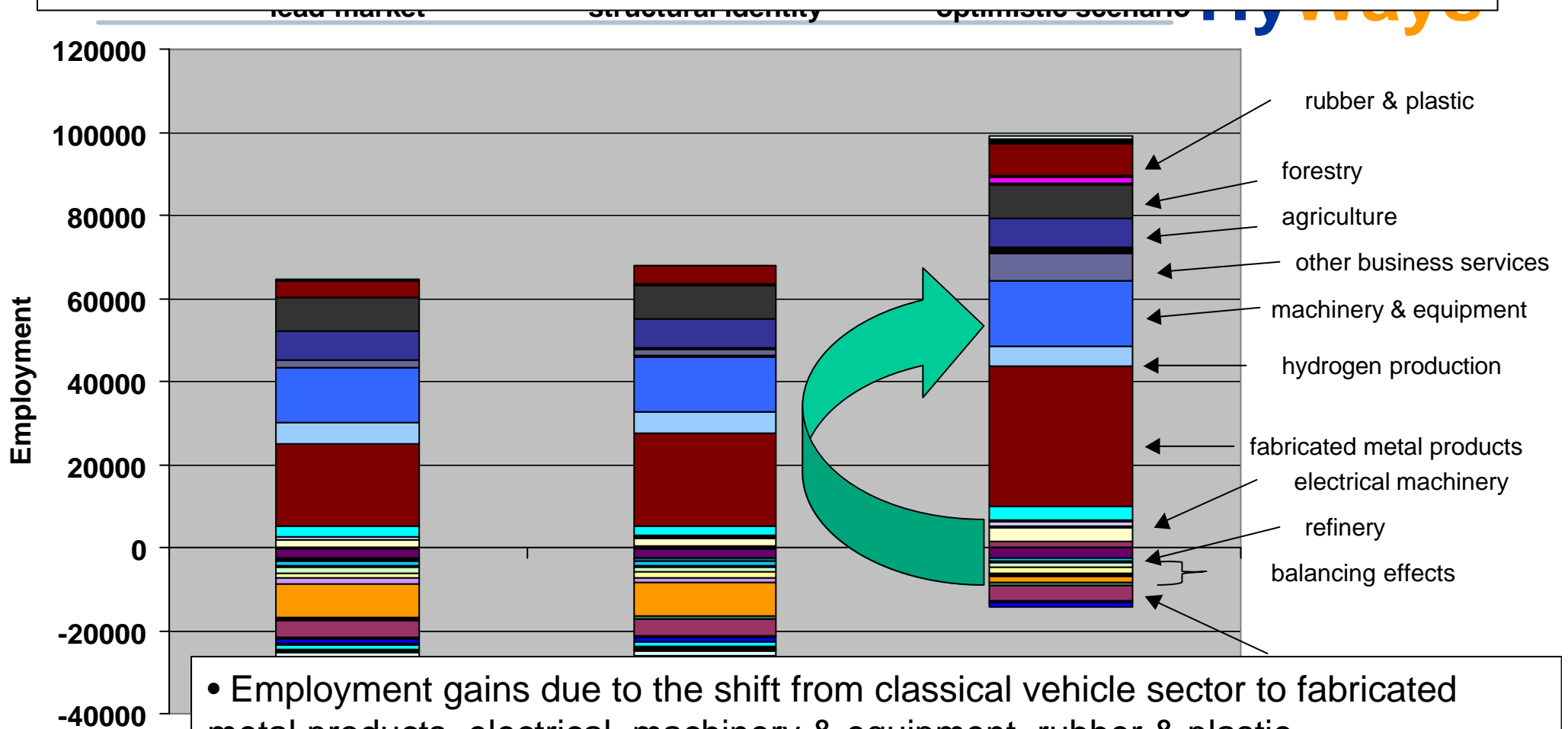
Example - Hydrogen cars in Norway



Example - Hydrogen production mix 6MS



Sectoral employment effects for France (2030)



- Employment gains due to the shift from classical vehicle sector to fabricated metal products, electrical, machinery & equipment, rubber & plastic
- Employment winnings in forestry and agriculture due to the use of biomass
- Hydrogen infrastructure technologies have only minor effects
- There will be employment losses due to balancing the higher hydrogen costs
- Differences in scenarios are mainly based on hydrogen vehicle exports

Simulation results – impact on GDP

lays

