



Understanding the Modeling Framework for Designing the Strategic Scenarios and Analysis of Scenario Field: The Tools, the Concept and the Class of Problems

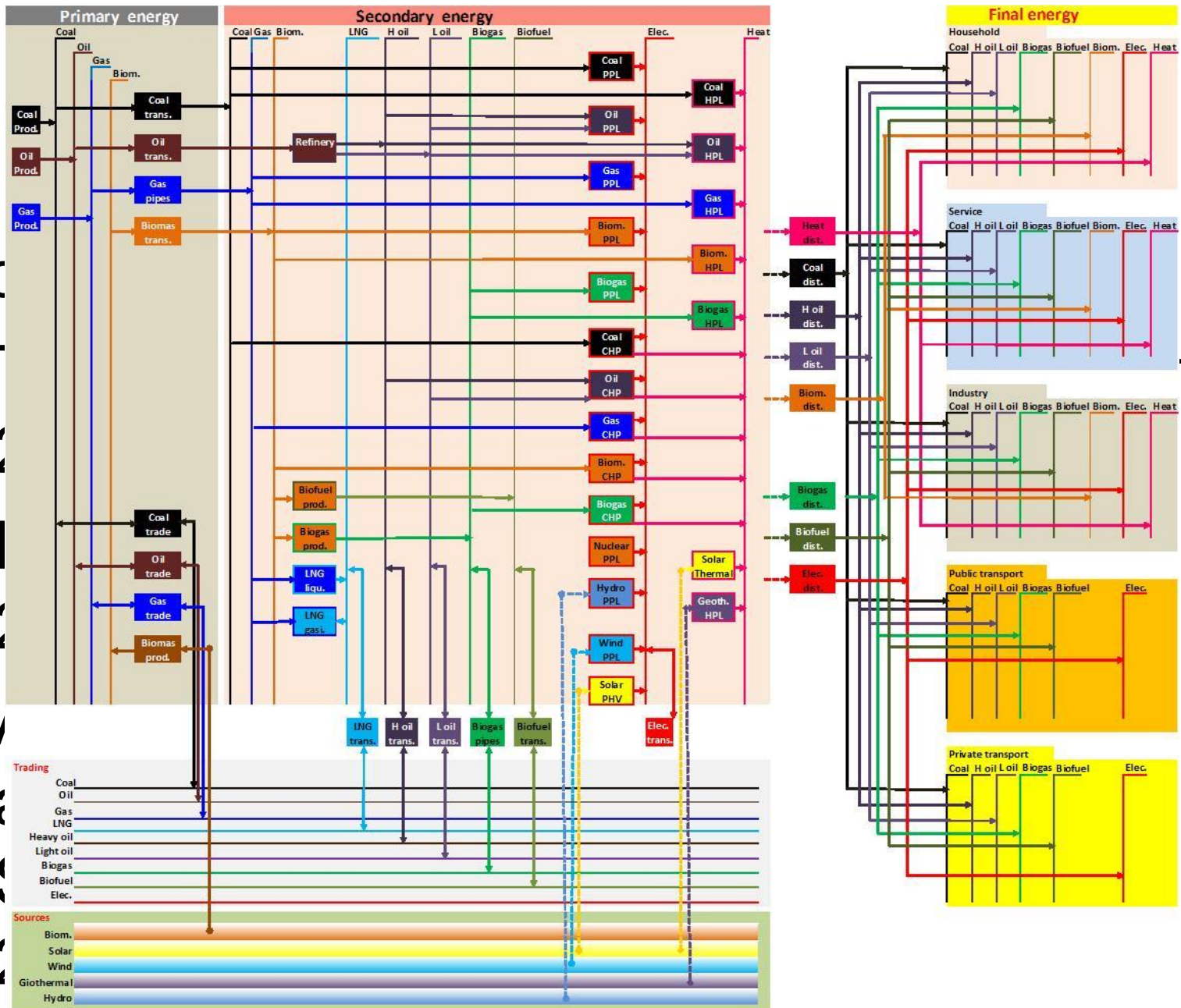
Yaroslav Minullin

21 October 2013 Vienna, Austria

Agenda

- Overview of the Mission of the Technical Group and of the Applied Methodology
- Overview of the Achievements and Typical Results
- History and Track Record of Modeling Tools
- Supply Model MESSAGE
- Demand Model FEDA/ECHO
- Discussion

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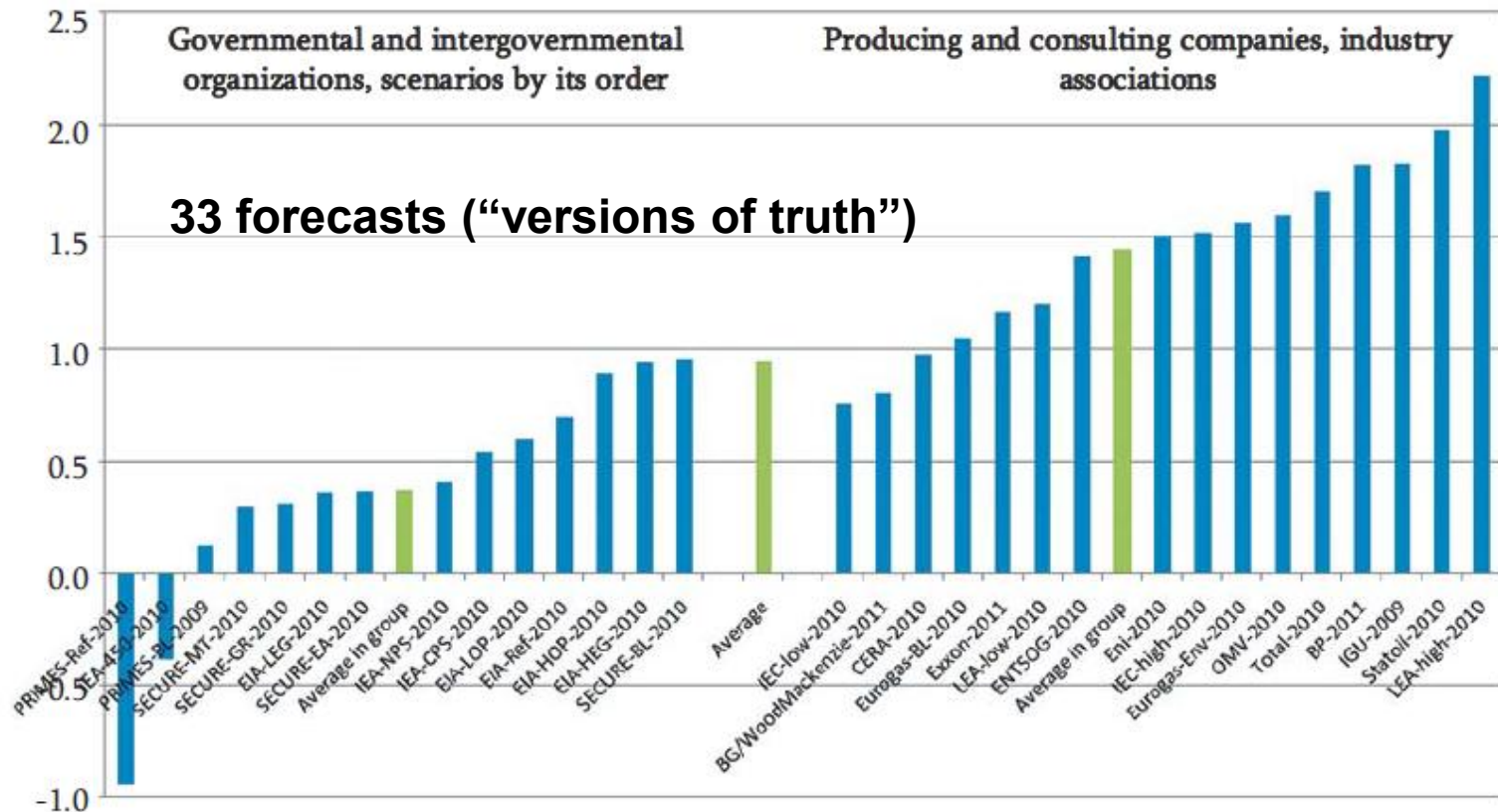


Motivation

- After the “Screening Exercise” there was a need for a modeling tool
- Aggregate numerous factors of influence into a countable number of groups.
- Create a transparent and flexible framework to provide the grounds for generating messages
- Institutionalize the knowledge in different areas: supply, transformation, demand, competition, regulation

Strategic Scenarios

- Strategic Scenario – is not a forecast and not another “version of truth”. The field of

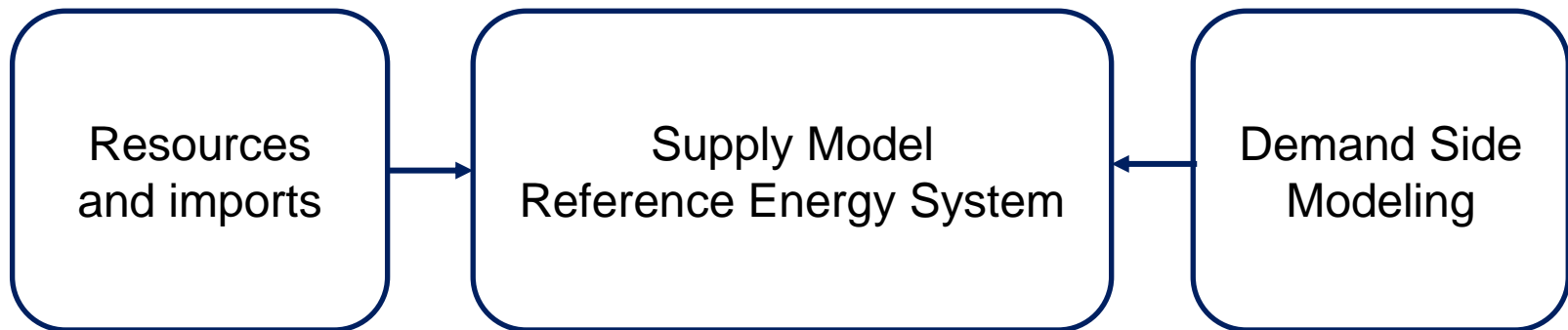


Strategic Scenarios

- Ultimate goal is to sense the locality of the scenario field and to objectively evaluate different pathways

Scenario Analysis: Set-up Of Experiments

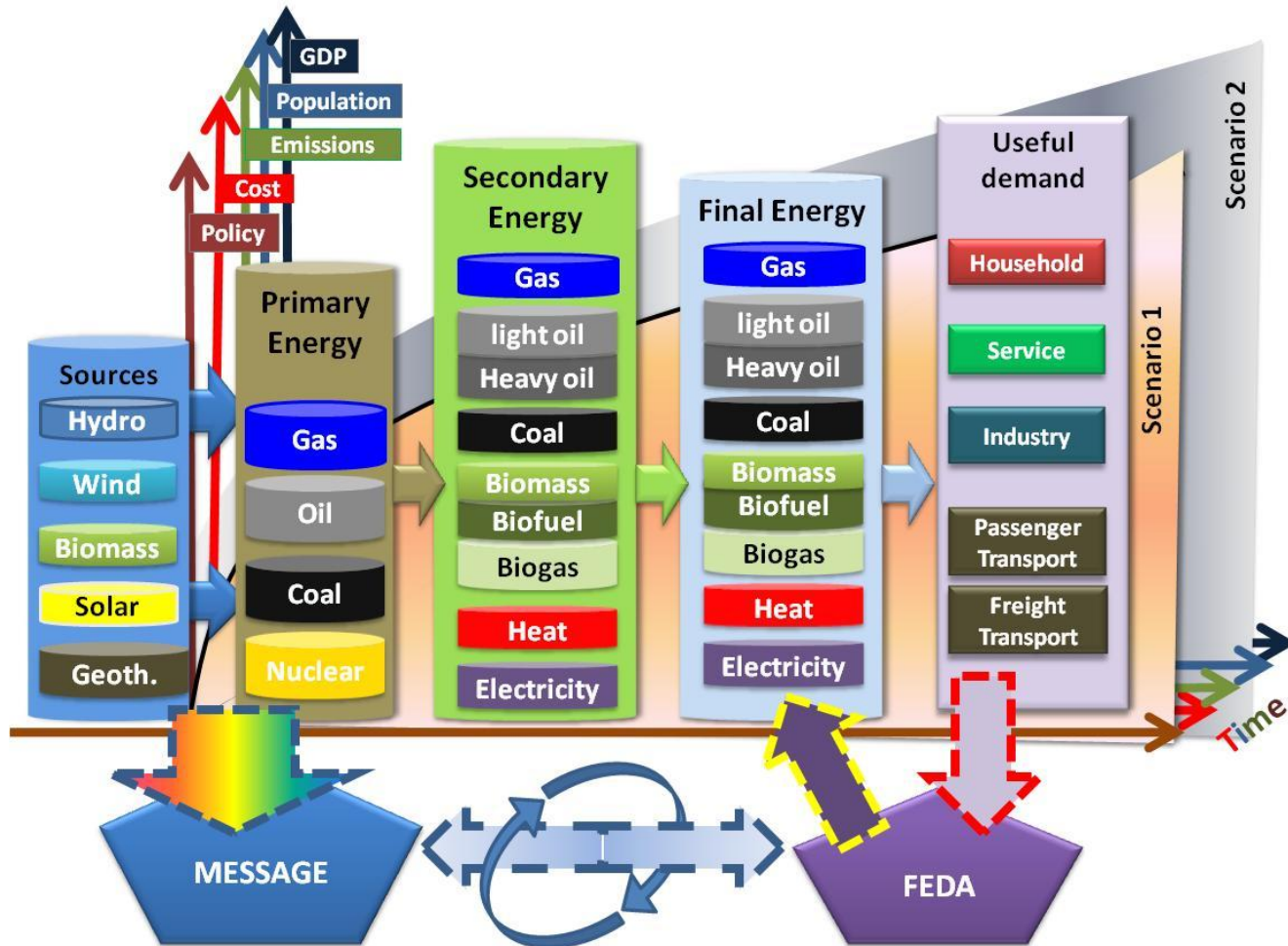
- Basis: proven modeling framework (supply model MESSAGE, demand model FEDA)
- Assumptions: accepted energy policies (e.g. “20-20-20”)
- Driving factors: dynamic indicators and events



Methodological Progress

- A Concept of the Modeling Framework was developed and tested
- The supply model for EU-28 was significantly extended (resource to final use, horizontal links)
- A demand model FEDDA was introduced
- Synergetic effect and reverse engineering

Modeling Framework: a Look Inside

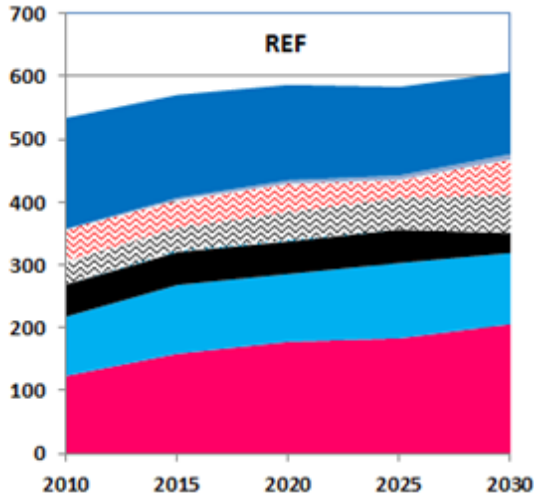


Results of Test Application: Set-up

- Case studies for analysis: trajectories of Russian gas import to EU (stable, growing, falling)
- Analytical Basis: MESSAGE, FEDA, expert estimations, sensitivity analysis
- Reference scenario: 4-regional model of aggregated EU-28 regions

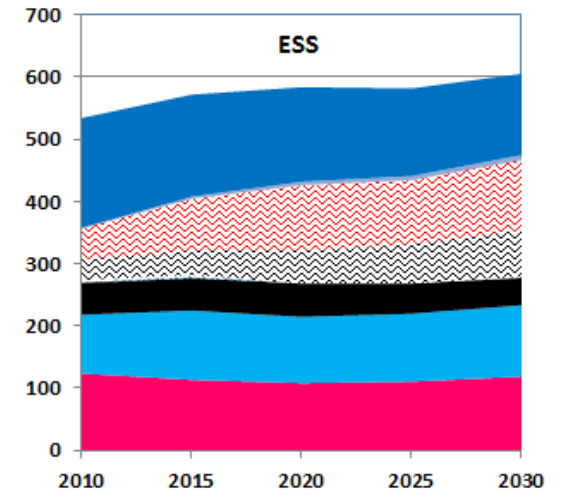
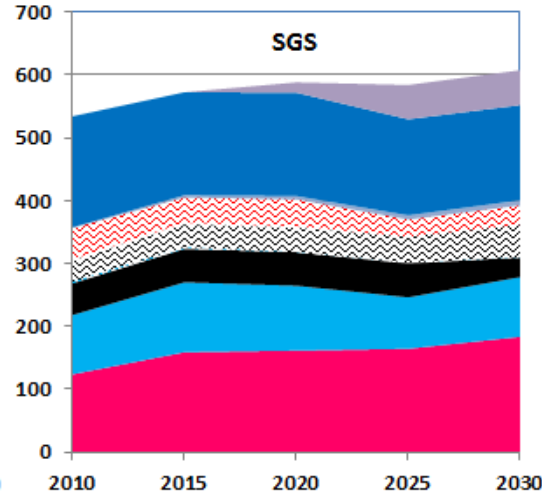
Results of Test Application: Case Studies

Growing

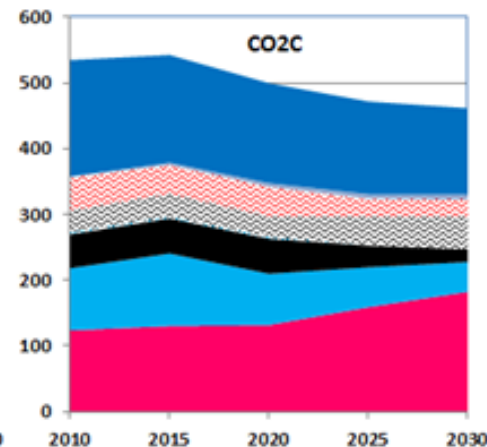
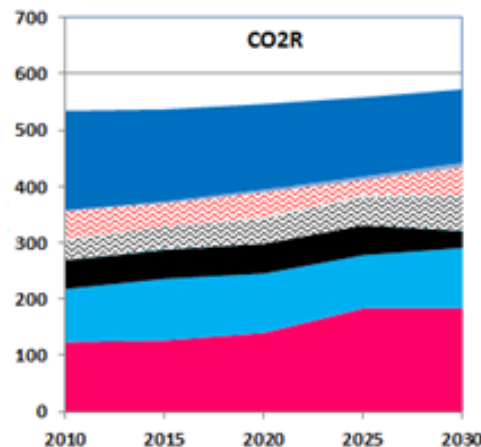
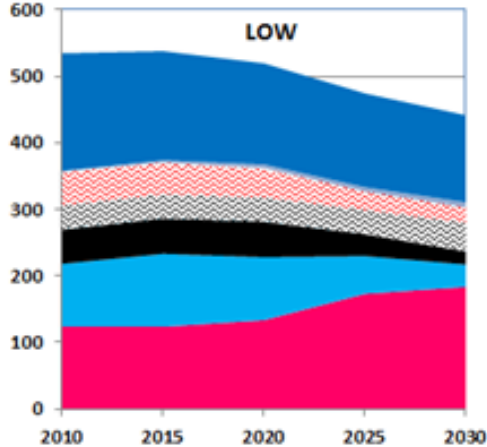


Case Studies

Declining



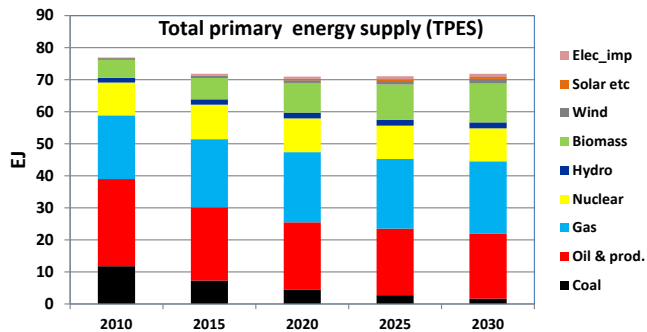
Stable



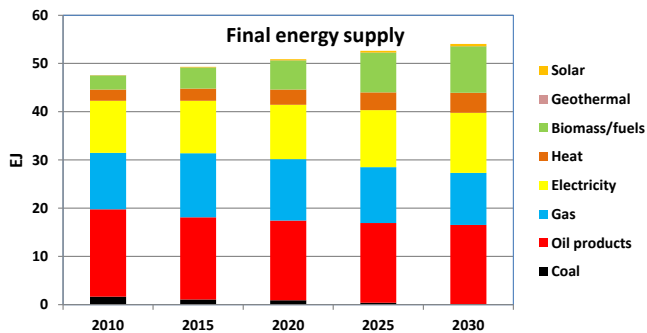
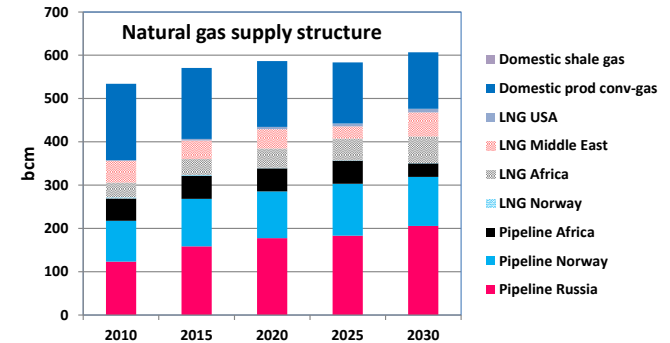
- Domestic shale gas
- Domestic prod conv-gas
- LNG USA
- ⋈ LNG Middle East
- ⋈ LNG Africa
- ⋈ LNG Norway
- Pipeline Africa
- Pipeline Norway
- Pipeline Russia

Results of Test Application: Qualitative Analysis

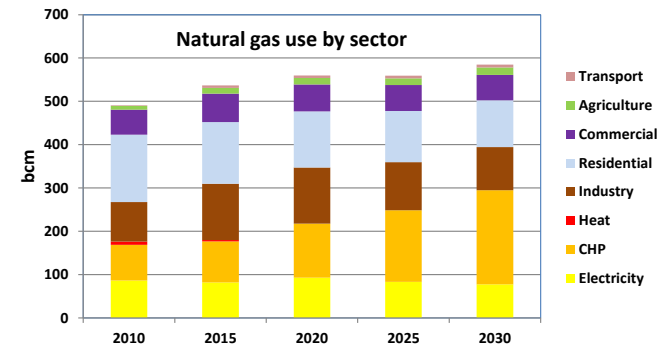
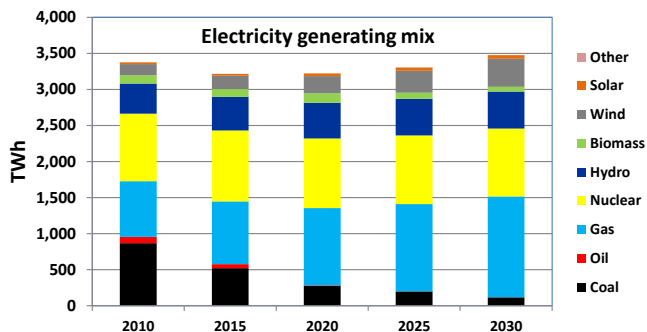
Reference scenario (REF)



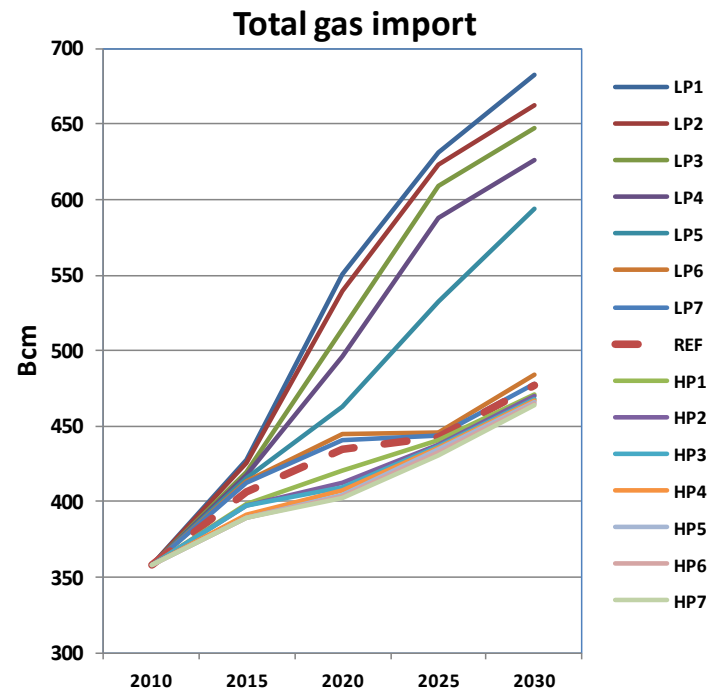
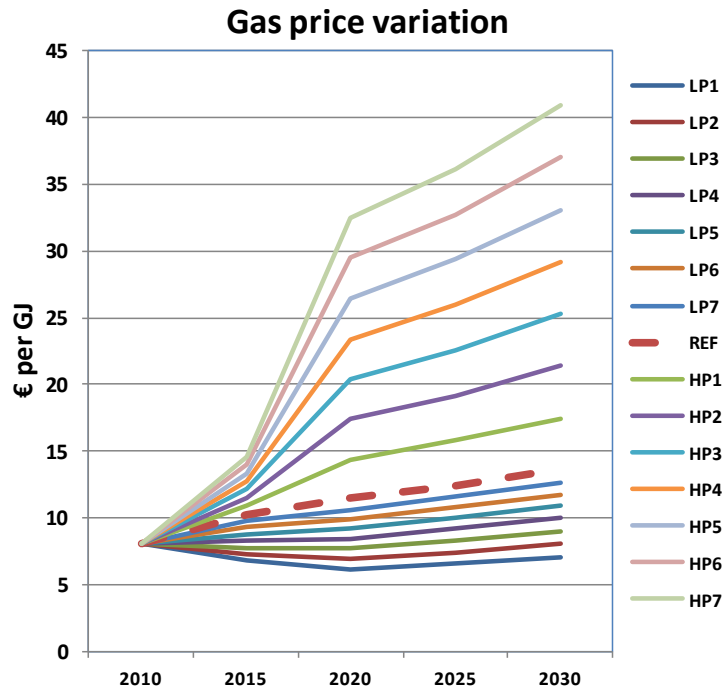
Reference scenario (REF)



	2010	2015	2020	2025	2030
Pipeline Russia	123.7	159.0	178.0	183.5	205.8
Pipeline Norway	94.4	109.4	107.8	119.8	113.4
Pipeline Africa	51.3	53.3	53.3	53.3	31.5
LNG Norway	2.6	1.9	1.3	0.8	0.5
LNG Africa	34.0	37.2	44.4	50.6	61.6
LNG Middle East	50.7	42.6	44.5	27.9	55.5
LNG USA	1.0	3.5	5.5	6.7	8.2
Total Import	357.7	406.9	434.9	442.6	476.6
Domestic prod conv-gas	176.8	163.9	152.0	140.9	130.7
Domestic shale gas	0	0	0	0	0
Total supply	534.4	570.8	586.8	583.6	607.2



Results of Test Application: Sensitivity Analysis



Results of Test Application: Social Impact

Shadow prices of final energy carriers

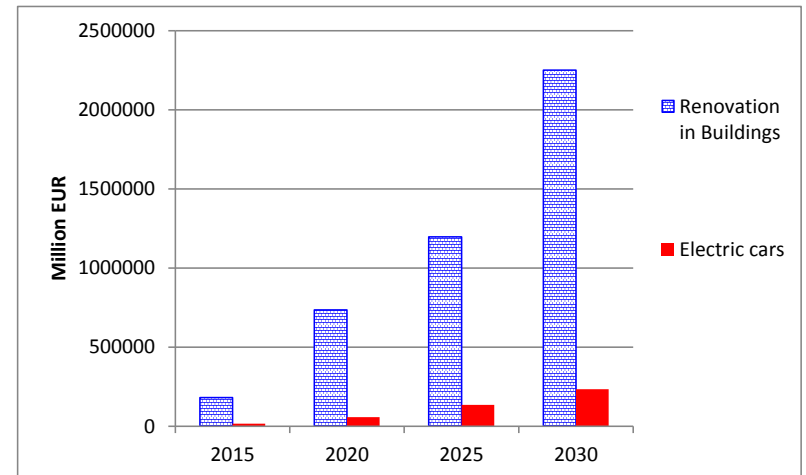
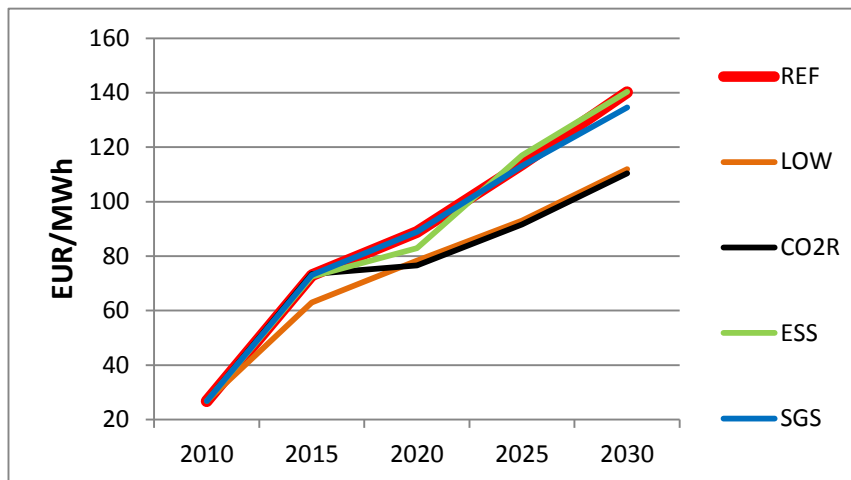
EUR/MWh	2010	2015	2020	2025	2030
Gas	27	73	89	114	140
Electricity	65	168	217	247	283
CO2 [EUR/t CO2]	0	10	14	16	23

Investment in Supply Side

Million EUR	2010	2015	2020	2025	2030
Power Generation	0	199141	322204	286385	271834
Gas Power Generation	0	30289	42598	42843	36779

Investment in Demand Side

Million EUR	2010	2015	2020	2025	2030
Renovation in Buildings		179364	733713	1195451	2,250,087
Electric cars		15946	57024	135281	233440
Total		195310	790738	1330732	2483527



Results of Test Application: Driving Factors

- Gas exporters pricing
- Socio-economical: GDP, economic activity, lifestyle
- Capacity for electricity import
- Geopolitical aspects
- EU regulation: CO₂, RES and Security

Results of Test Application: Messages

- Russian gas does not decline
- Russia shall support CO₂
- Russia shall watch out for prices
- Shale gas does not affect the Russian gas supplies
- Security of Supply measures might lower the competition
- Demand side modeling will require enormous investments

Predefined List of Driving Factors

- Structure and growth of the EU economy;
- Demographics, age structure and immigration;
- Technology change and innovation;
- Availability of shale gas and other unconventional gases;
- Emergence of new LNG exporters;
- New conventional gas discoveries (e.g., Mediterranean Sea between Cyprus and Israel, off-shore Red Sea);
- Energy prices and subsidies (feed-in tariffs)
- EU energy efficiency policy at the level of end-use (building stock refurbishment, new building codes, new efficiency standards);
- EU renewables and nuclear energy policies;
- Potential impacts of policy driven mega-projects a la DESERTEC;
- EU environmental regulation and new internationally binding environmental agreements (under the United Nations Convention on Climate Change - UNFCCC) resulting in stringent greenhouse gas emission limitations;
- Carbon trading schemes and carbon pricing;
- EU energy security policy;
- National energy legislation - e.g., banning fossil fuels for thermal energy purposes in buildings in Denmark, new building codes, subsidies for renewables and electric vehicles all of which have implications for final energy demand;
- Natural gas as the peaking fuel in an electricity supply system dominated by intermittent renewables - a logistic challenge to fill the pipeline;
- Social preferences, behavioural changes and perception of risks and benefits.