

New Markets for Natural Gas: Security of Supply in an Enlarged Europe

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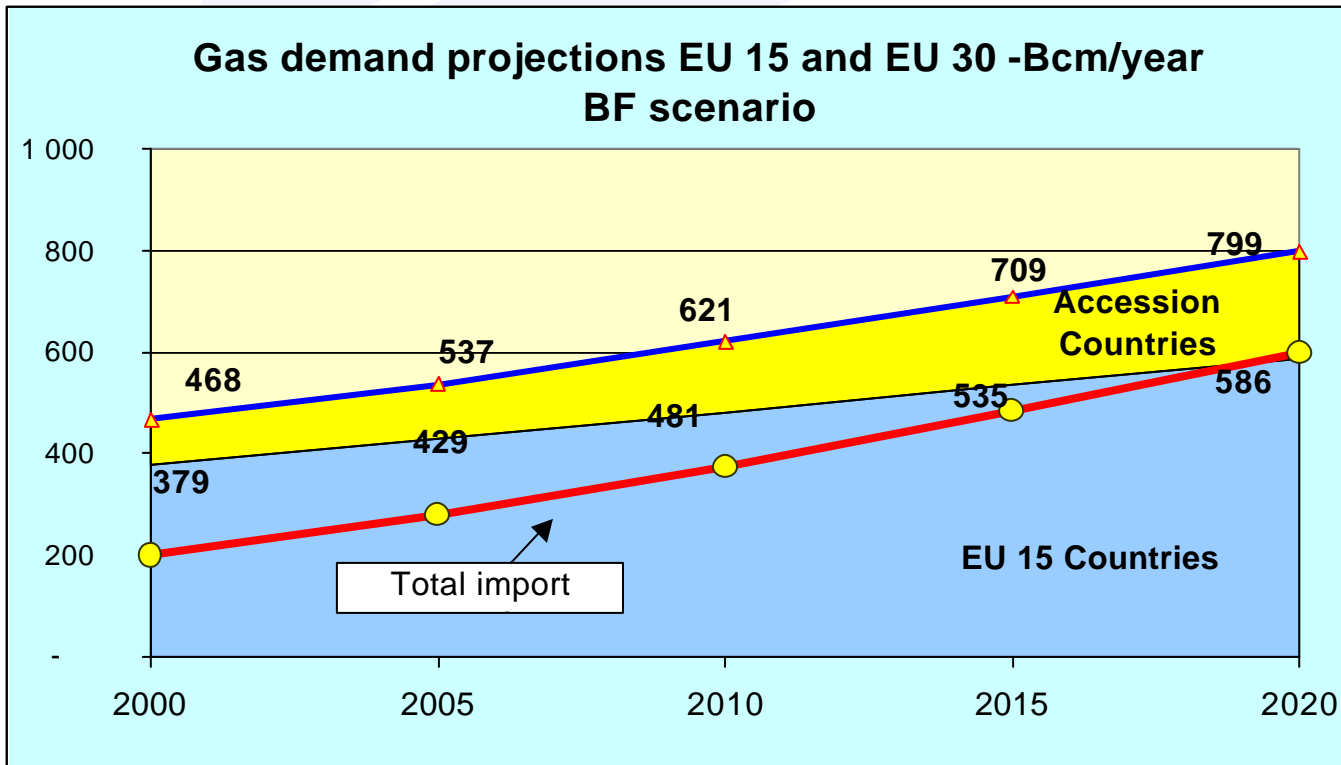
Outline of the presentation

1. **Main problems Europe is facing today and in future:
To close the gap of supply**
2. **Consequences of a disruption in natural gas supply**
3. **The infrastructure question:
Investments needed
New markets and infrastructures: LNG and
regulation issues**



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European gas import needs could reach 600 Bcm in 2020 (from which around 400 Bcm not yet contracted)



Closing gas demand /supply gap in EU-30 in 2020

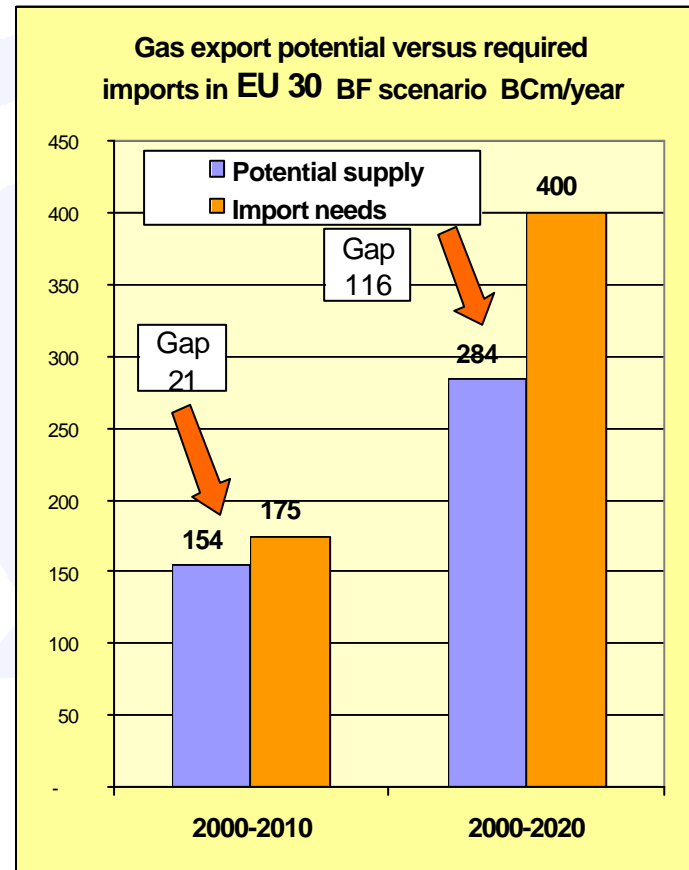
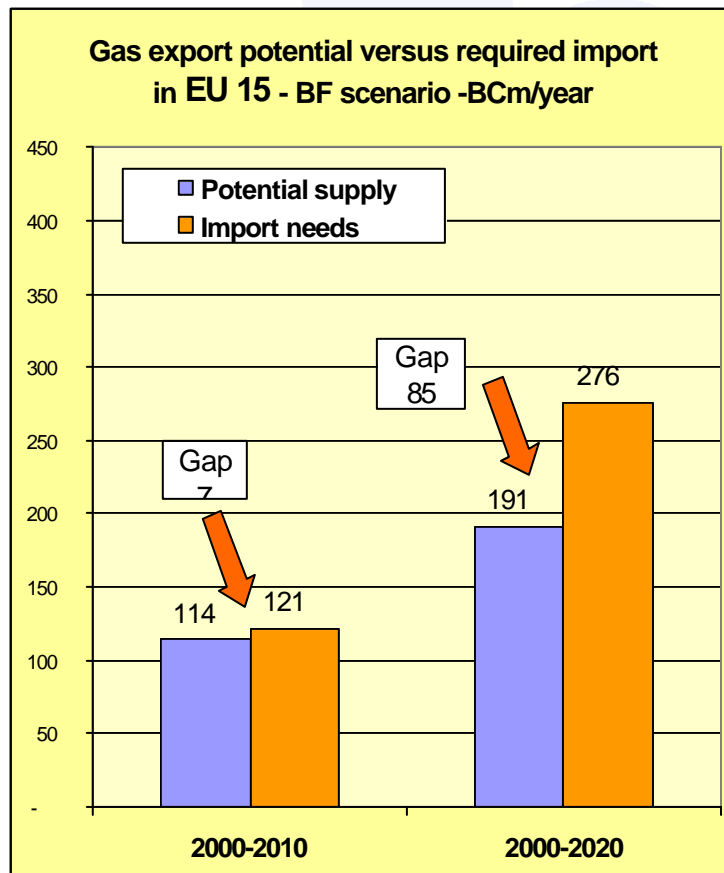
Unit: BCM /year		Import in 2020		Supply Cost
		Likely	Required	Us\$/MMBtu
Norway	Pipe & LNG	100	100	2.0 /2.2
Russia	Pipe & LNG	220	250	1.6 /2.7
MEDA area & West Africa	Pipeline & LNG	152	145	1.1 /1.7 3.0
Caspian & Middle East	Pipeline	40	70	1.1 /1.3
LNG Middle East	LNG	16	15	2.8 /3.0
LNG Atlantic	LNG	20	45	3.0
Total		548	625	

Potential supply from outside Europe-30

Gas exports by EU 30 suppliers in year 2020

Billion m3	EU 30	Far East South Asia	USA	Other	Total Export
Russia	220	20		60 Ukraine/Belarus	300
Norway	100	-	5	-	105
Algeria	100	-	5	5 Maroc /Tunisia	110
Libya	15	-	-	-	15
Iran LNG + pipe Turkey	20	35	5	-	60
Azerbaijan Pipe Turkey	10	-	-	-	10
Turkmenistan Pipe Turkey	5	-	-	55 Russia	60
Egypt	12	-	-	3 Jordan /Syria	15
Irak Pipe Syria + Turkey	5	-	-	5 Syria	10
Nigeria	20	-	15	5	40
Qatar	10	35	5	20 UAE Dolphin/Kuw/E	70
UAE LNG Adgas	1	12	-		13
Other Middle E: LNG Yemen /Oman	5	25	-		30
Angola	5	-	5		10
Trinidad	15	-	15		30
Venezuela	5	-	10		15
Total	548	127	65	153	893

Supply /demand balance in EU 15 and EU 30 – incremental/ 2000





Effects of Gas Supply Disruptions for an Enlarged Europe in 2020

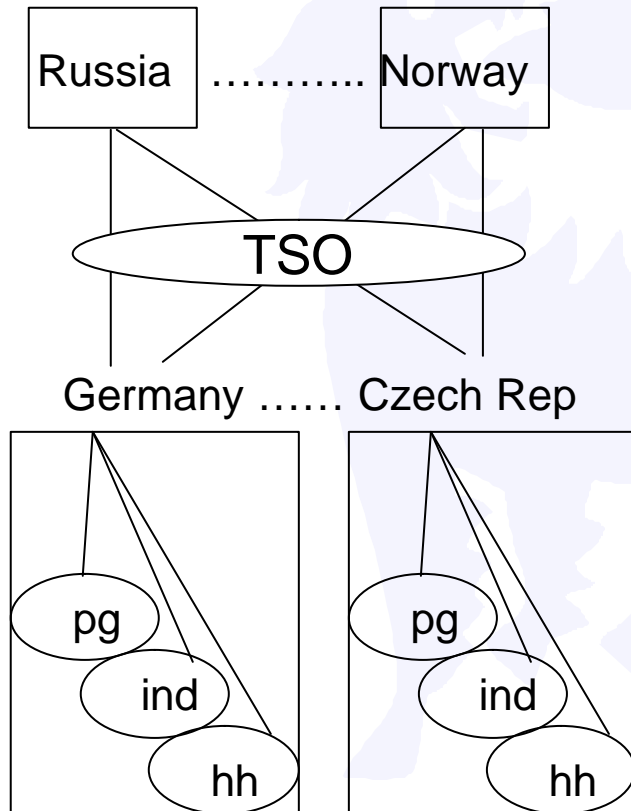
Contents

- Background
- Model outline
- Disruption cases
- Results
- Conclusions

Background

- Concerns regarding long-term gas supply for an enlarged EU
- Identify bottlenecks in supply sources and transport routes
- Strategic supply risk → unexpected disruption with low probability but high impact
- GAME-2003 → Gas Market Equilibrium Model for an Enlarged Europe

Modelling market structure



- ← Producer model - max sales minus production, distribution and transmission costs
- ← TSO model - efficiently allocates scarce transmission capacity
- ← Demand model - Linear consumer demand in 3 sectors based on elasticities and {price,consumption} combinations in base year

Model output

- End-use prices and price of transmission
- Volumes of production, transmission flows, sales and demand
- Bottlenecks in gas transport capacity



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2020 Cases

Demand

- Reference demand
- High demand
- Low demand

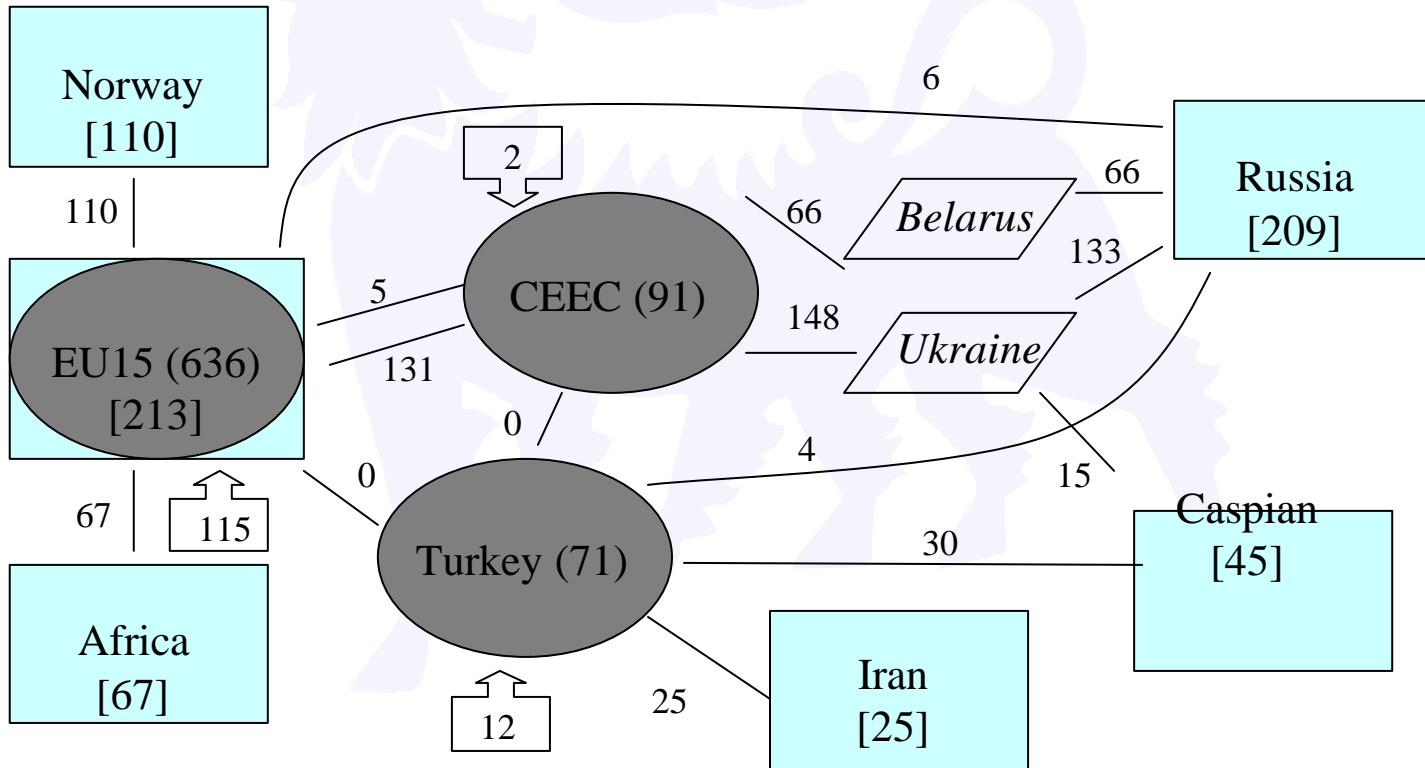
Perfect competition

Disruption of

- Transmission Russia via Ukraine (alternative routes can take over)
- Algerian supply (alternative production can take over)
- Transmission Turkey-Europe

Gas flows - bcm 2020 reference case

[.] production
 (..) consumption
 → pipeline flow
 ⬆️ LNG import



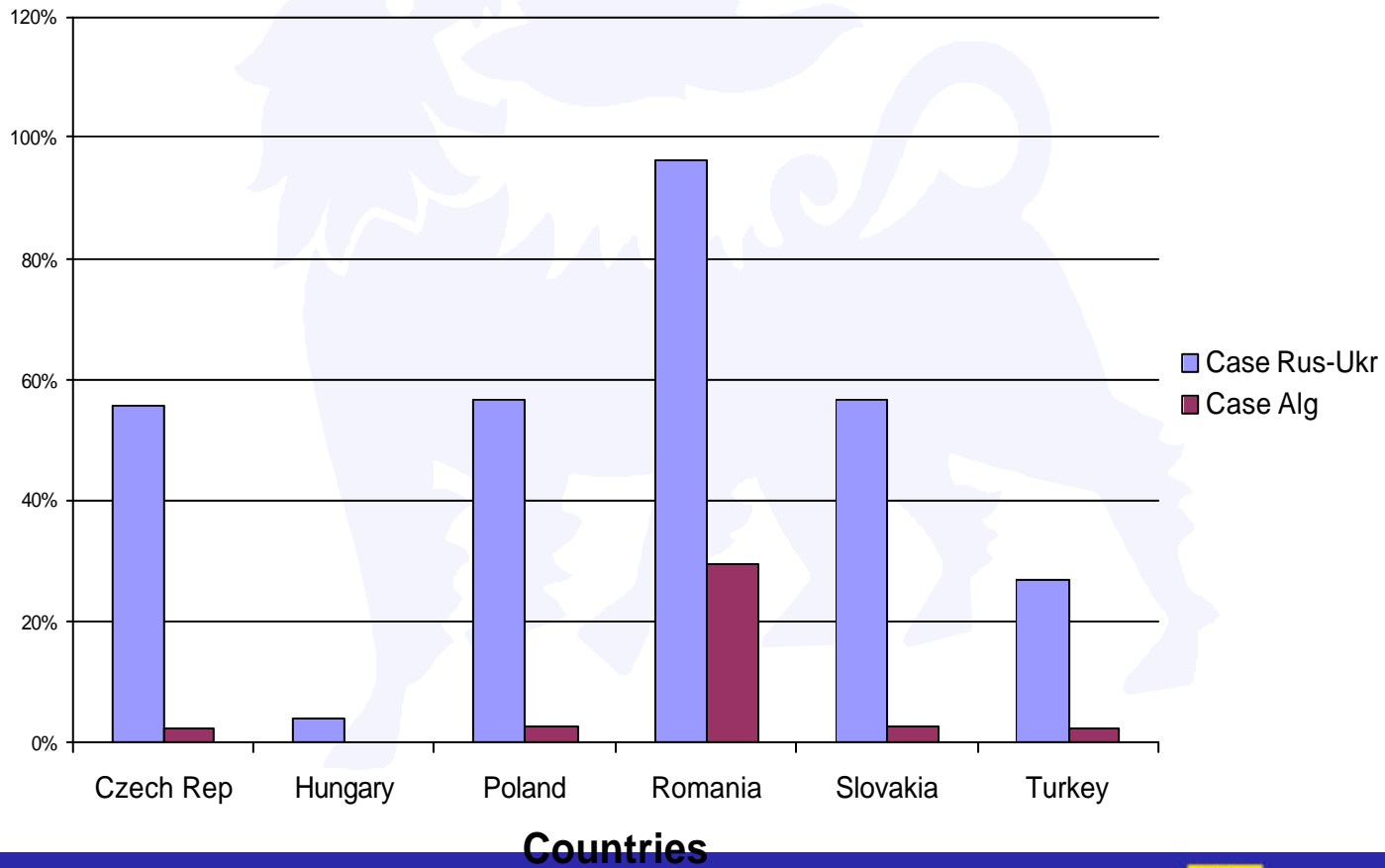
Results - Reference case (1)

- Flows from Russia via expensive routes
 - Blue Stream to Turkey (4 bcm)
 - Baltic to Germany (6 bcm)
- Outflow capacities of Belarus (66 bcm) and Ukraine (148 bcm) are restrictive
- Pipeline capacities Algeria-EU (60 bcm), Caspian-Turkey (30 bcm) and Iran-Turkey (25 bcm) are restrictive

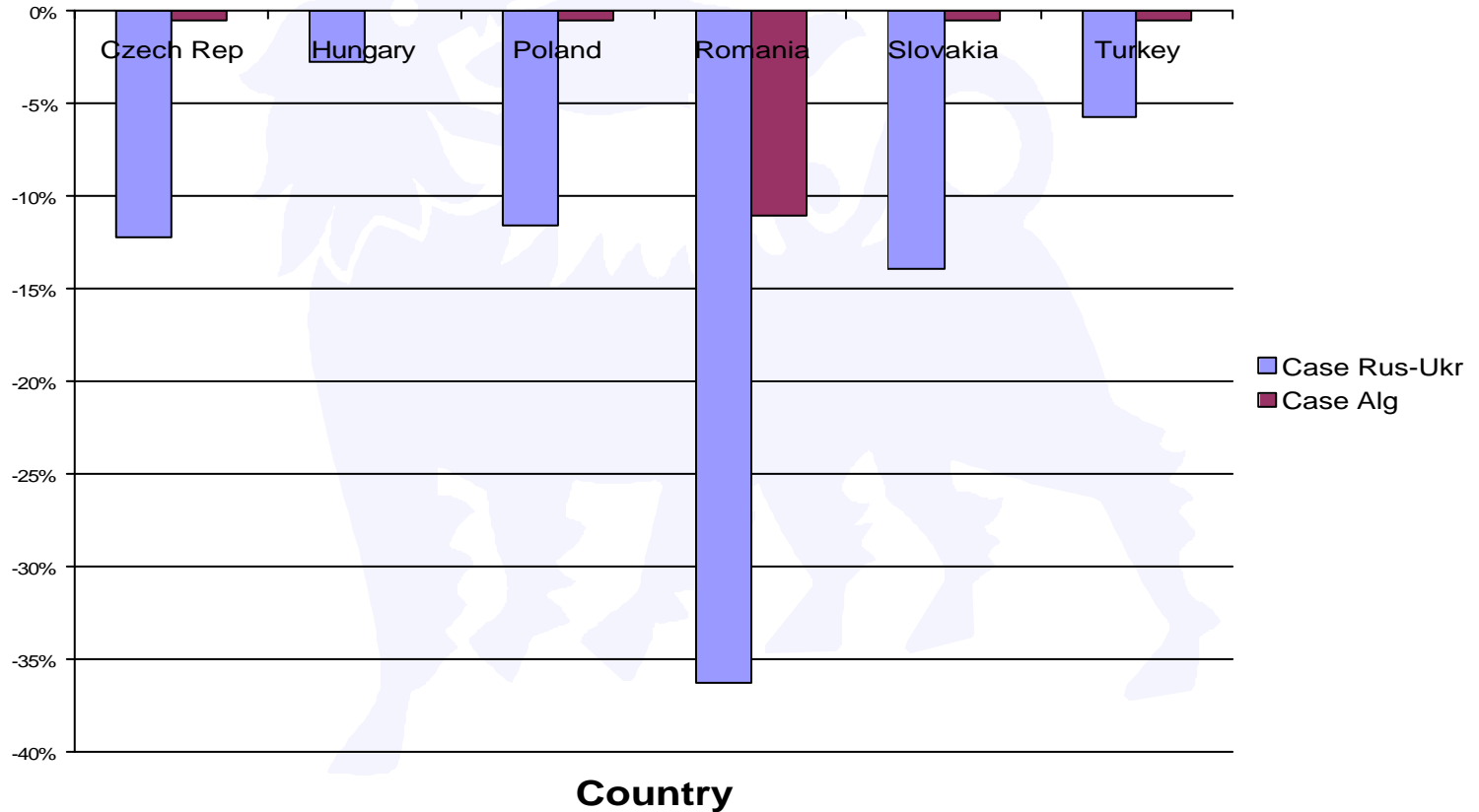
Results - Reference case (2)

- No gas flow from Turkey into Europe
 - disruption case of transmission from Turkey to Europe is not relevant because domestic demand is high
 - alternative with low gas demand in Turkey
 - no Blue Stream import and some transit to Greece and further to Italy (10 bcm)
 - limited outlets for gas transit via Turkey into Europe

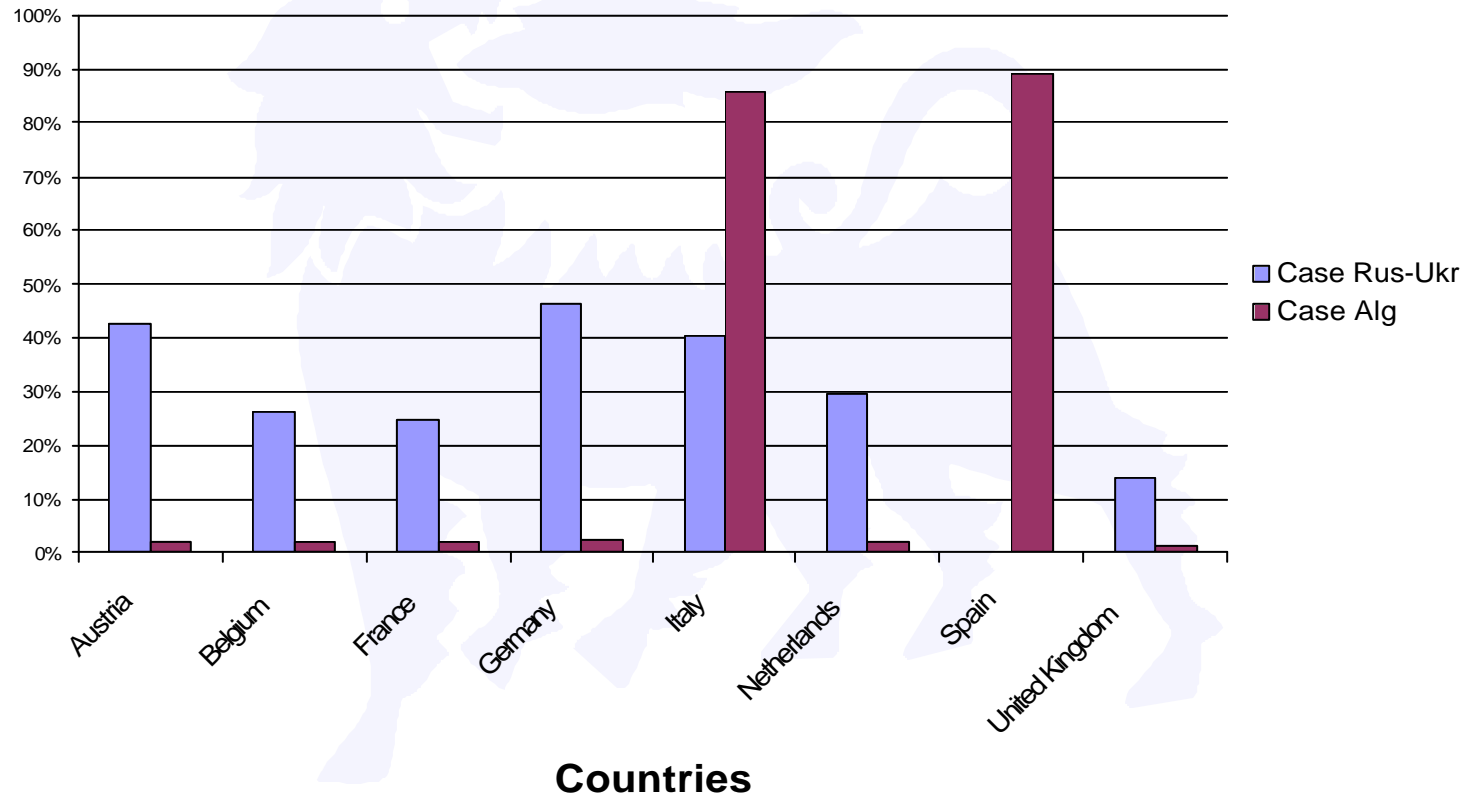
Price changes - CEEC and Turkey



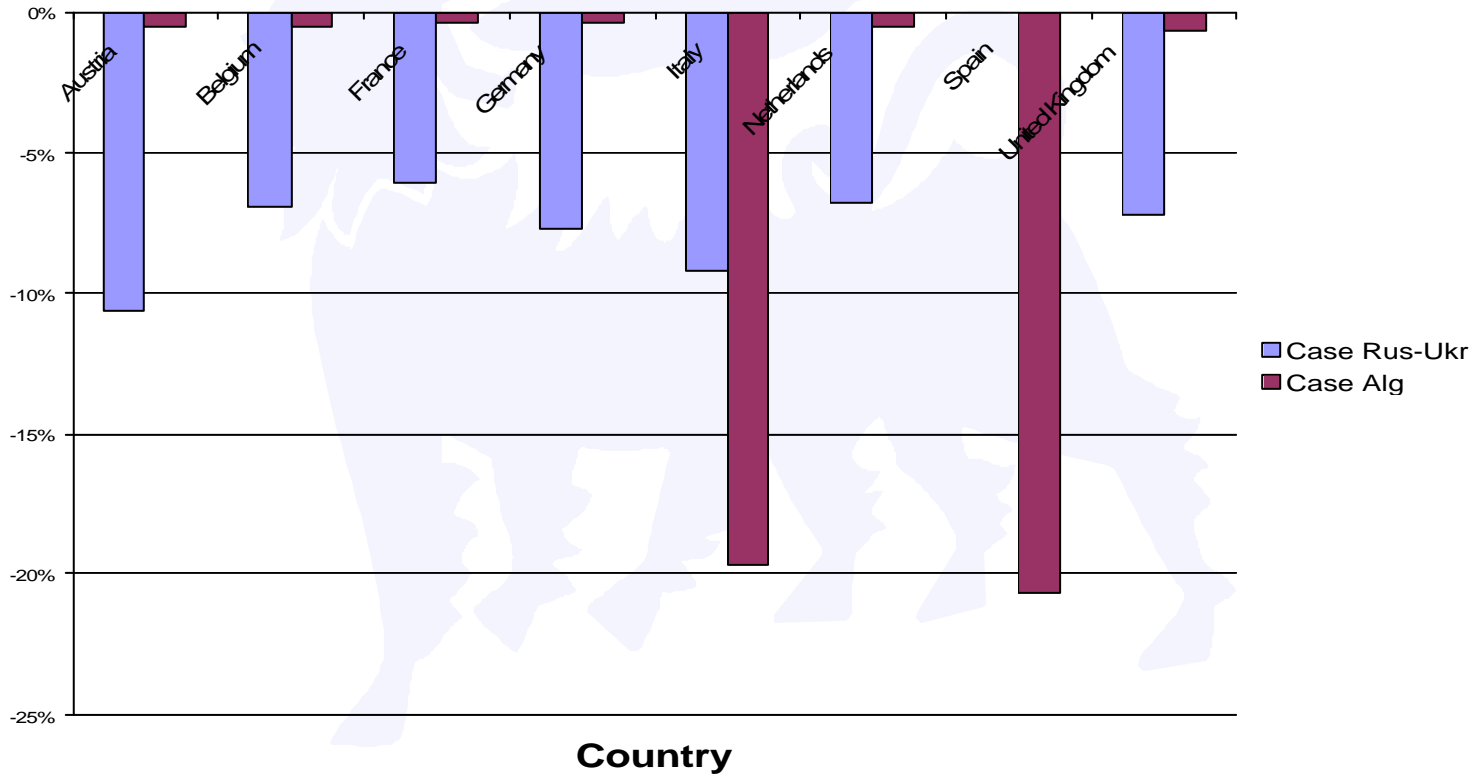
Consumption changes CEEC and Turkey



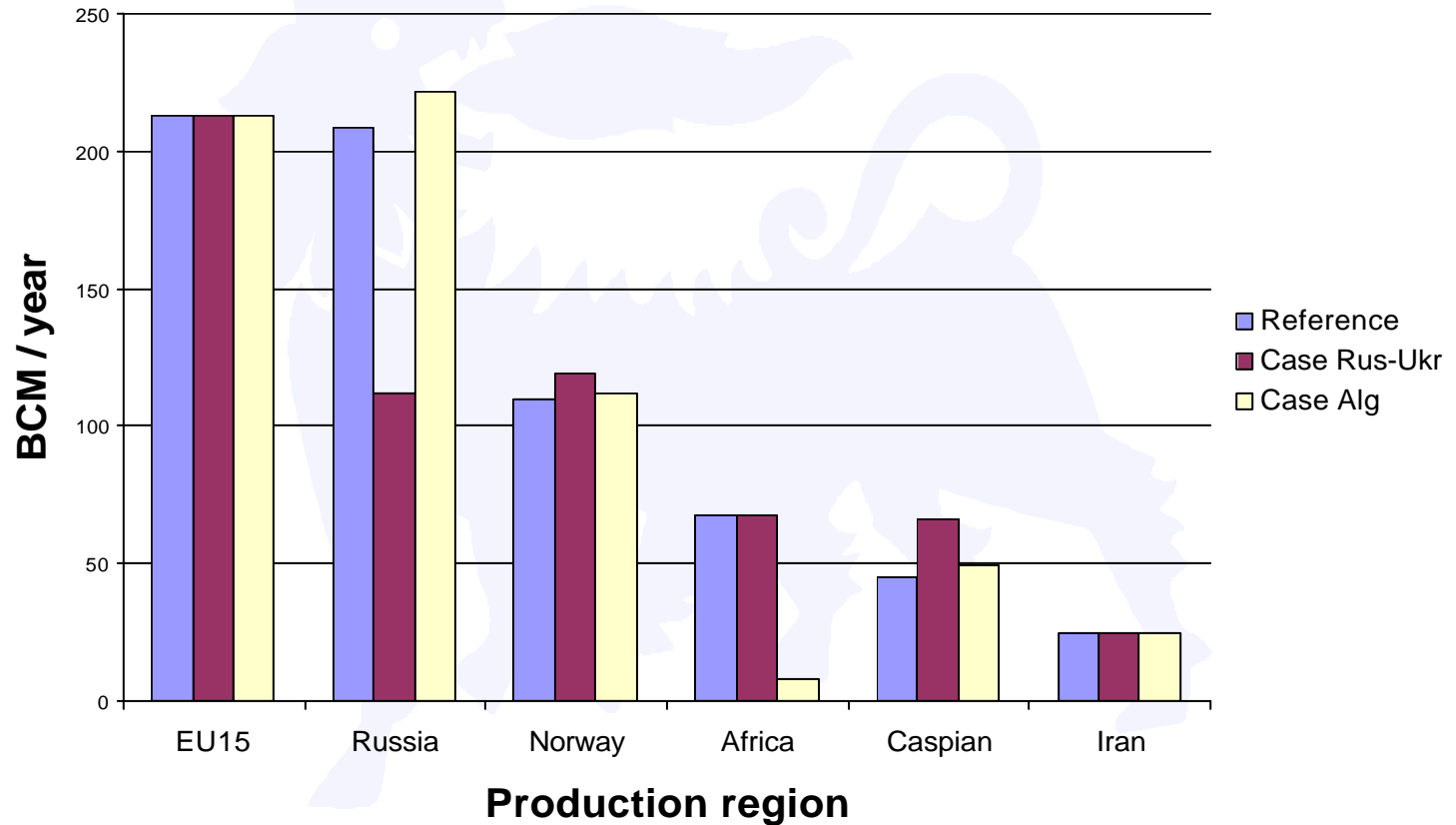
Price changes - Member States



Consumption changes Member States



Production



Results - Case Russia-Ukraine

- Russian production decreases 46% → Caspian region (+48%) and Norway (+8%) partly take over
- Production capacity Norway (120 bcm) is restrictive
- Other Russian outlets restrictive → Belarus (66 bcm), Baltic (30 bcm) and Blue Stream (16 bcm)
- Total consumption decreases 8% → Romania is highly affected

Results - Case Algeria

- Caspian region (+10%), Russia (+6%) and Norway (+1%) partly take over production
- Total consumption decreases 5% → Italy and Spain are highly affected

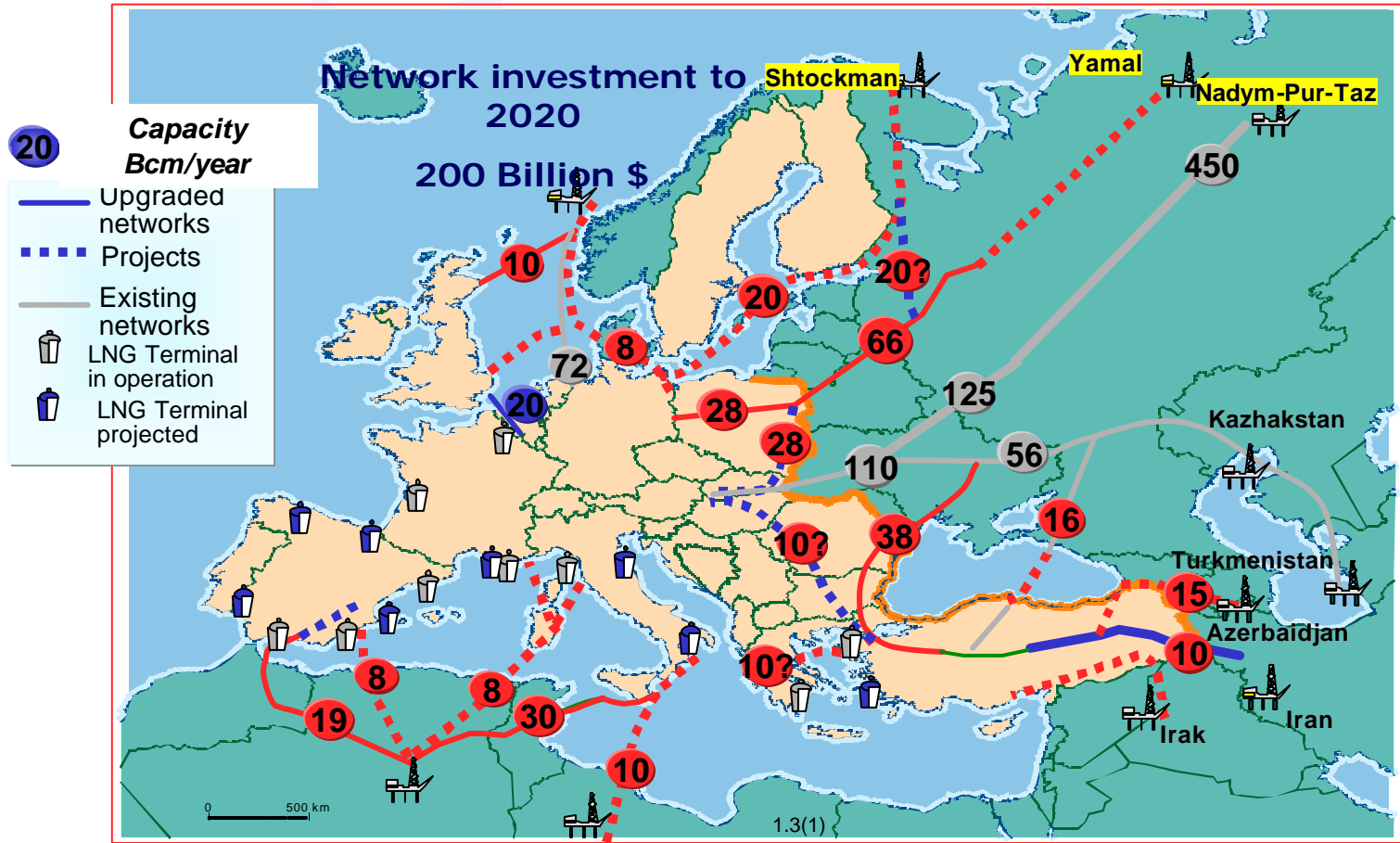
Conclusions (1)

- Turkey's role as transit country depends on
 - domestic demand development
 - pipeline capacity with Greece - Italy and Bulgaria - Romania - Hungary - Austria
 - available supply from Caspian and Iran

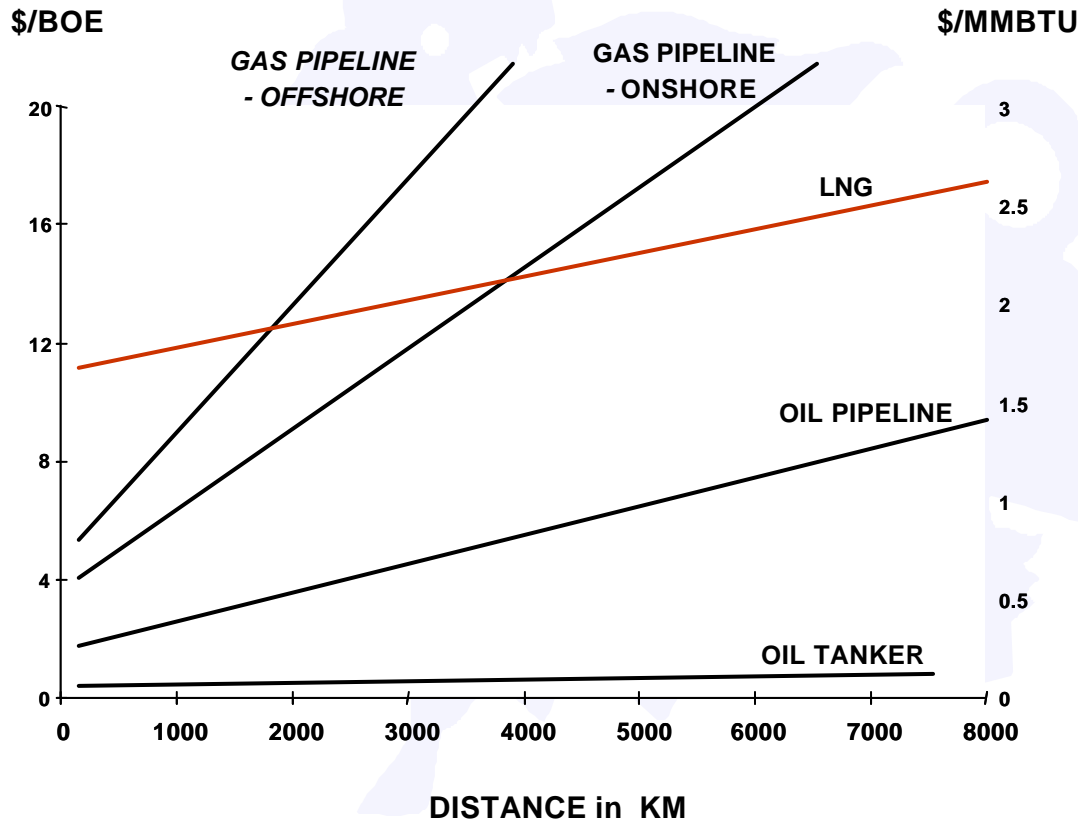
Conclusions (2)

- Bottlenecks in transmission of gas
 - From Belarus and Ukraine into Europe
 - From Iran and Caspian region into Turkey
 - From Bulgaria and Romania into Europe (Turkey as transit)
 - Cross-links between Bulgaria, Romania, Hungary, Slovakia, Czech Republic and Poland
 - From West and South Europe into CEEC
 - To Spain and Greece

Gas transport routes and facilities - Europe 2020



Transport costs via pipeline vs. GNL



Key variables

- Investment coverage
- Infrastructure capacity
- Flexibility/degree utilisation
- Profitability
- Geopolitical/geological aspects

Examples of infrastructure investments

- **Pipeline Algeria to Spain
« Medgaz »**

- **Capacity: 8 Bcm**
- **Length: 747 km**
- **Investment: 1.17
Billion US\$**
- **Equal to: 1 305
(1000Euros/km)**
- **Delivered cost: 1.17
US\$/MMBtu**
- **Production cost in Algeria:
0.45 US\$/MMBtu**

- **LNG project Egypt to Spain
and France**

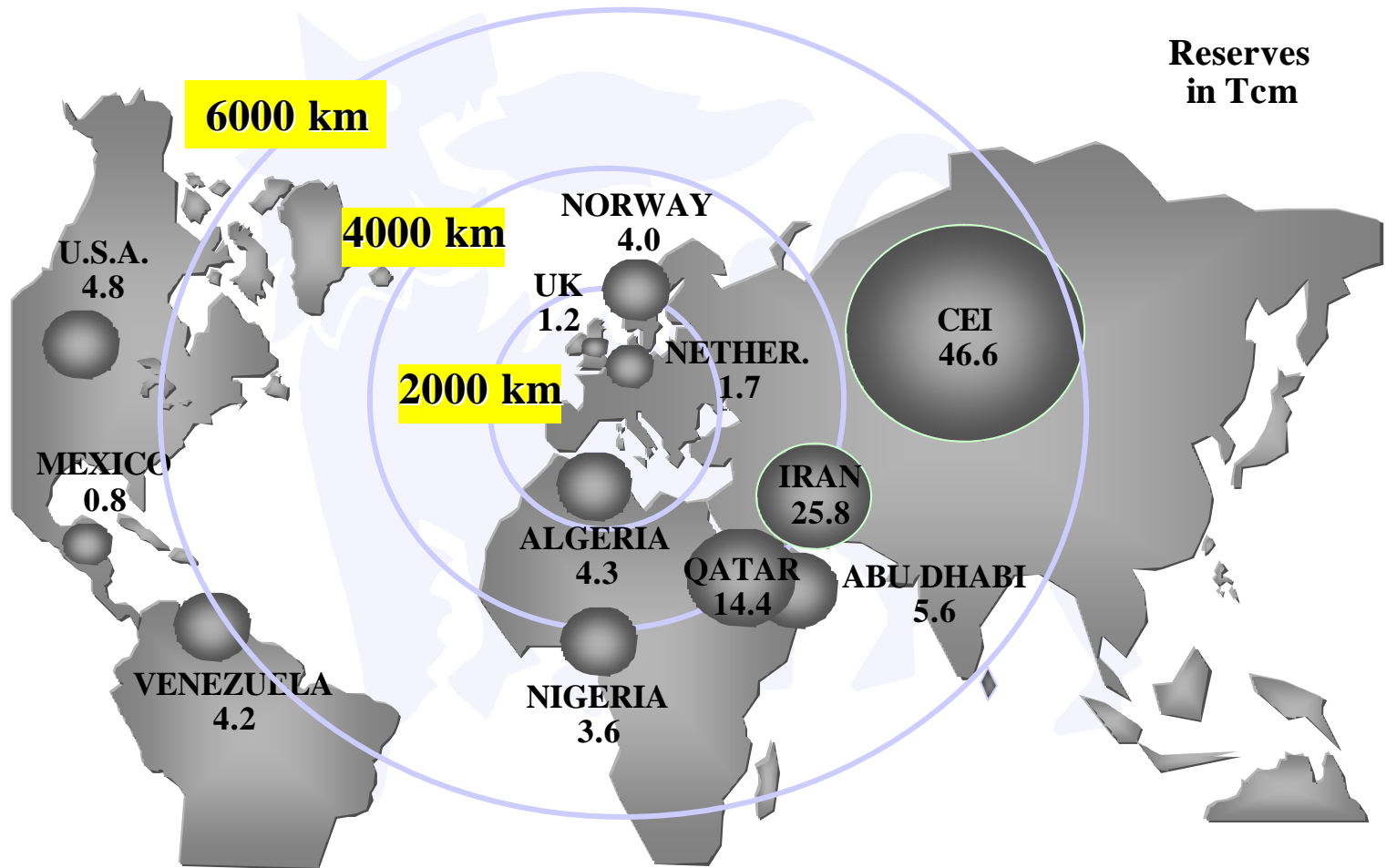
- **Capacity: 4.8 Bcm**
- **Distance: 1,700 miles**
- **Investment: 1.58
Billion US\$**
- **Delivered cost: 2.56
US\$/MMBtu**
- **Liquef. Plant: 900 Million US\$**
- **Tankers: 360**
- **Terminal: 320**

**Production cost in Egypt: 0.65
US\$/MMBtu**

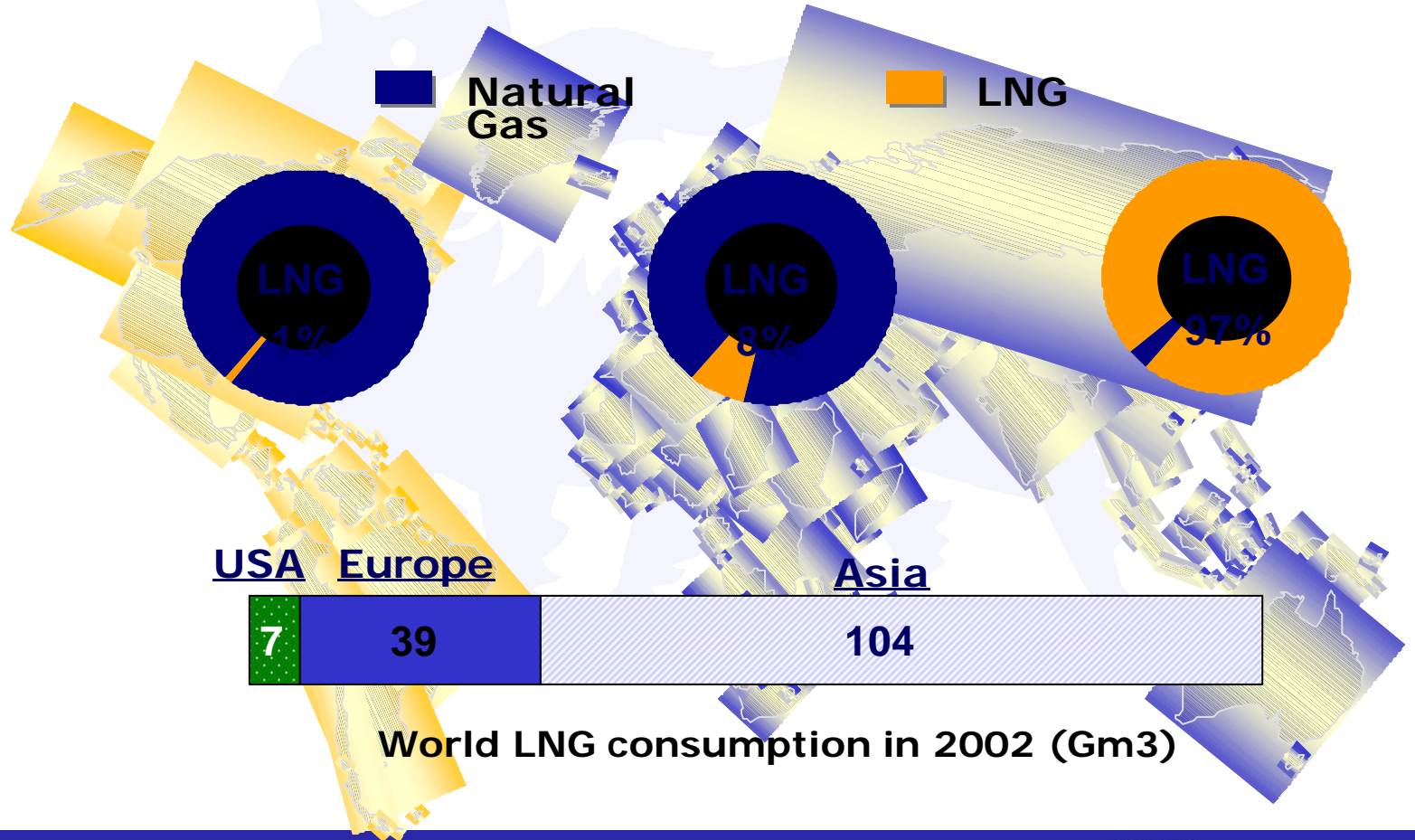
Development of LNG markets: opportunities to improve security of supply ?

- ❑ Different roles played by LNG in 3 markets:
Europe, Asia, USA**
- ❑ The 3 markets were practically separated but
become increasingly interconnected**
- ❑ USA will become a major LNG importer, with
obvious consequences on European supply**
- ❑ For European market, LNG links could be
preferred to improve security of supply**

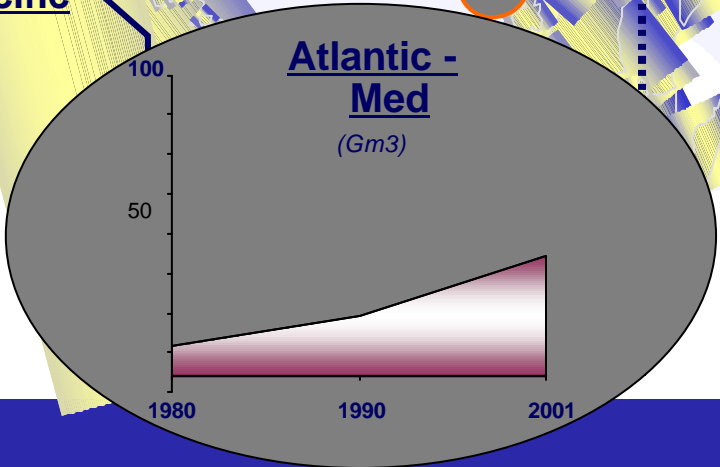
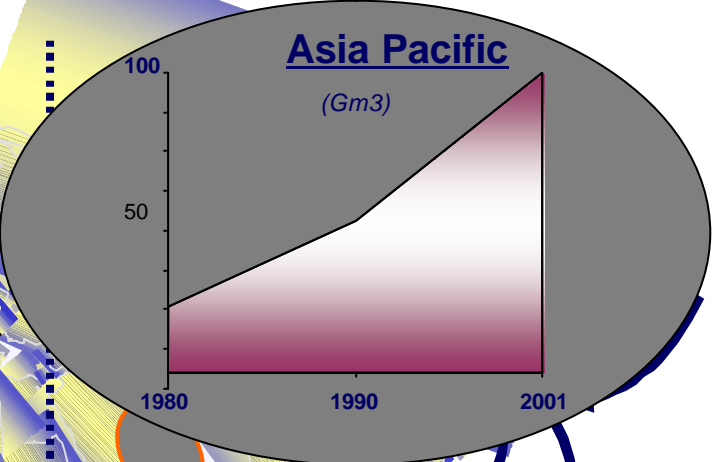
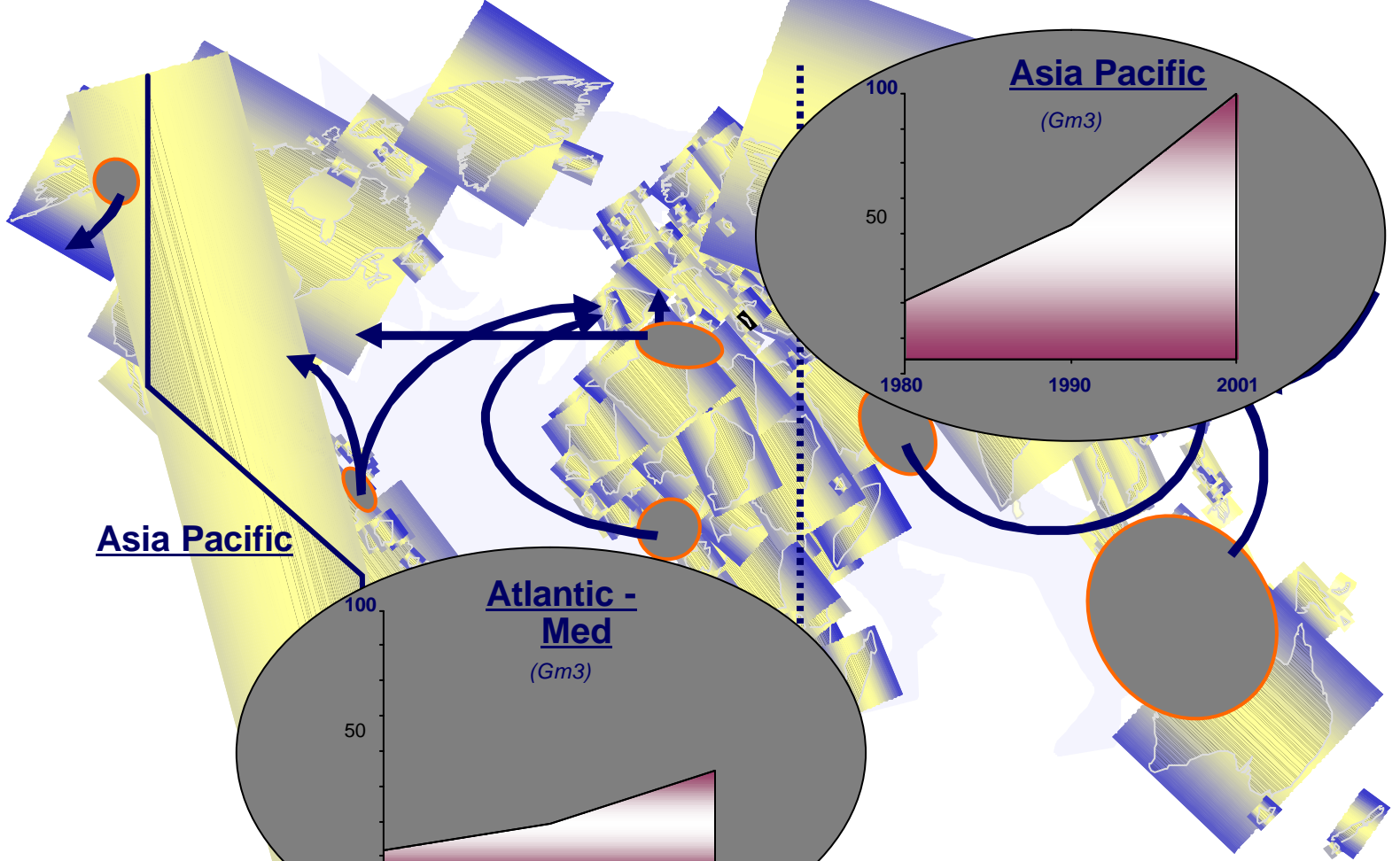
Gas Sources for supplying Europe-30



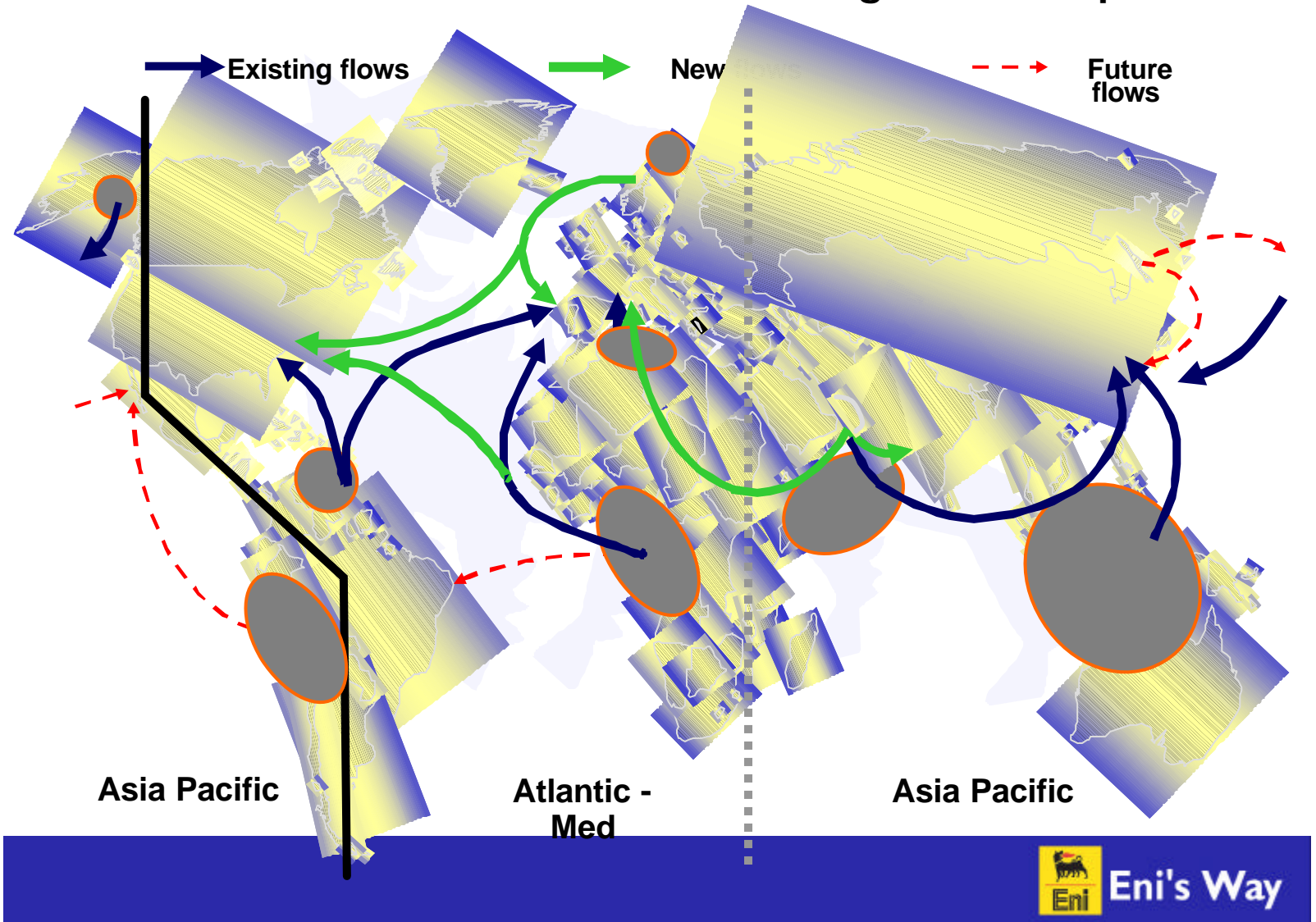
Specific aspects of LNG markets: a very different role on each market



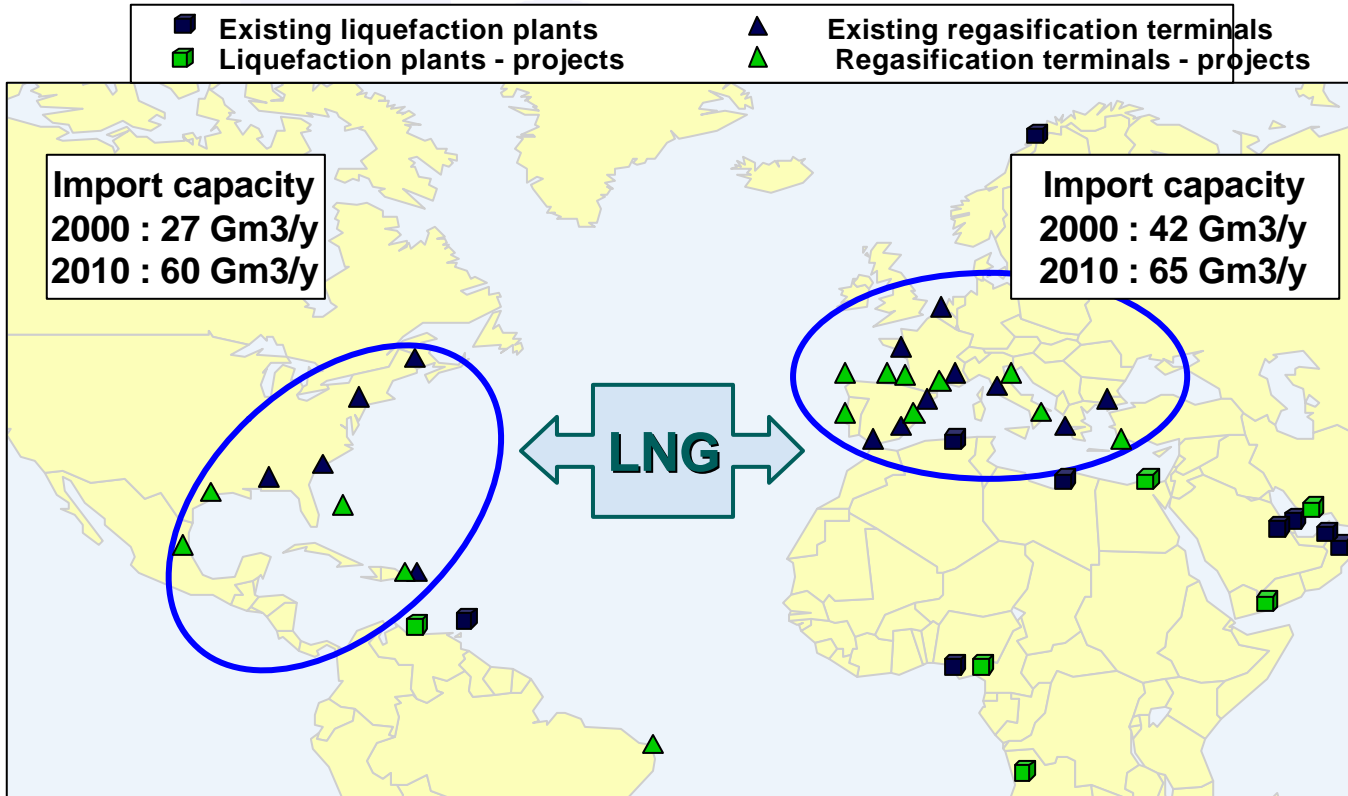
LNG markets: Initial scheme was simple...



... But LNG trade is becoming more complex



LNG markets: development of LNG infrastructure



Source : TOTALFINAELF



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Conclusions

- **Enlargement to EU 30 leads to an increase of external dependence (import gap from 85 to 116 Bcm in 2020, dependence 70% to 75%)**
- **Enlarged Europe is faced with a major challenge over next 20 years: secure investment to import up to 500 Bcm of gas**
- **Development of LNG markets may ease diversification and security of supply**
- **How to bridge the supply /demand gap in 2020: draw on Caspian gas directly or through Russia? Or draw on other sources (Middle East and Atlantic LNG)**
- **Uncertainty about future gas price is not resolved and may hinder financing of required investment**
- **Excess of regulation may hinder a timely development of required infrastructure facilities.**