Governments play an important role in the energy sector

Except in the US, states/governments have ownership of the subsurface; they issue the:

- Exploration license
- Production license
- Permission for transportation route
- Take (partial) ownership / sit on board

And they manage the risk climate:

- Verify and impose environmental rules
- Tax profits and economic rents
- Regulate markets
- Set investment conditions/ macroeconomic climate/ monetary policy
- Rule of Law

They also:

- Set bilateral and multilateral business framework (UN, WTO)
- Foreign/security/trade policies/trade promotion
- Provide capital/export capital/ex-imp banks
National Oil Companies Control 94 Percent of World’s Reserves

Billion Barrels of Oil Equivalent

Source: Credit Suisse First Boston
Instruments of Energy Security

- Prevention
  - Multilatéral cooperation: IEF, IEA, Charter Treaty, foreign policy, economic cooperation, trade policy
  - Cross border: horizontal and vertical integration of companies
  - Diversification
  - R & D

- Deterence
  - Security policy: unilateral
  - Economic and political sanctions
  - Security Council
  - Strategic alliances: EU Partnership and cooperation agreements, Early warning mechanism, Energy memorandum of understandings

- Containment
  - Diversification: energy systems flexibility, stand-by arrangements, storage, energy savings, promotion of domestic energy production (subsidies and taxes)

- Crisis management
  - Strategic reserves, demand managements, energy sharing, pricing policy (temporary price caps)
Energy security

- Supply security - source security
  - transit security
- Demand security
- Financial security
- Economic security
- Environmental security
- Technological Security
- Cyber security
Ukraine – Russia 2009 Gas Crisis

Source: European Commission, Eurogas, AIE
% of missing gas supply – 300 mcm/d for 14 days (3% of annual Russian deliveries, 0.5% of total yearly energy consumption)
### Share of RU Gas (2009 - %)

<table>
<thead>
<tr>
<th>Country</th>
<th>In total gas imports</th>
<th>In total energy consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU27</td>
<td>33</td>
<td>5.7</td>
</tr>
<tr>
<td>Finland</td>
<td>100</td>
<td>10.2</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>100</td>
<td>25.6</td>
</tr>
<tr>
<td>Estonia</td>
<td>100</td>
<td>23.4</td>
</tr>
<tr>
<td>Latvia</td>
<td>100</td>
<td>32.3</td>
</tr>
<tr>
<td>Lithuania</td>
<td>100</td>
<td>26.2</td>
</tr>
<tr>
<td>Slovakia</td>
<td>100</td>
<td>28.4</td>
</tr>
<tr>
<td>Slovenia</td>
<td>99</td>
<td>7.4</td>
</tr>
<tr>
<td>Romania</td>
<td>98</td>
<td>4.5</td>
</tr>
<tr>
<td>Hungary</td>
<td>92</td>
<td>28.7</td>
</tr>
<tr>
<td>Poland</td>
<td>92</td>
<td>7.8</td>
</tr>
<tr>
<td>Austria</td>
<td>82</td>
<td>15.5</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>69</td>
<td>8.9</td>
</tr>
<tr>
<td>Slovenia</td>
<td>62</td>
<td>7.4</td>
</tr>
<tr>
<td>Germany</td>
<td>51</td>
<td>9</td>
</tr>
<tr>
<td>Greece</td>
<td>50</td>
<td>14.4</td>
</tr>
<tr>
<td>Italy</td>
<td>32</td>
<td>4.2</td>
</tr>
<tr>
<td>Luxemburg</td>
<td>24</td>
<td>6.2</td>
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<tr>
<td>France</td>
<td>19</td>
<td>4.5</td>
</tr>
<tr>
<td>Belgium</td>
<td>5</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Source: European Commission, Industry, own calculations
Treaty on the Functioning of the European Union
The building of an energy policy

Primary Law

**Article 122 (1) TFEU** Without prejudice to any other procedure provided for the treaties, the Council, on a proposal from the Commission, may decide, in a spirit of solidarity between Member States, upon the measures appropriate to the economic situation, in particular if severe difficulties arise in the supply of certain products, notably in the area of energy.

**Article 170 TFEU** deals with TEN in the area of energy infrastructure (principle introduced in the Maastricht Treaty under Article 129 b in 1992).

**Article 194 (1) TFEU** sets the four objectives of EU Energy policy
a) ensure the functioning of the energy market;
b) ensure security of energy supply in the Union;
c) promote energy efficiency and energy saving and the development of new and renewable forms of energy; and
d) promote the interconnection of energy networks....

**BUT article 194 (2)** refers to the right of the Member State to determine its choice between different energy sources and article 194 (3) that fiscal matters require unanimity.
The diversity of the EU Energy Mix - 2010

Source: EU Energy Trends to 2030, European Commission
Estimates of the prospective annual abatement cost in €/t of avoided emissions of GHG i.e. annual additional operating cost (including depreciation) less potential cost savings (costs are negative if the cost savings are considerable)

Source: McKinsey, 2010
EU: The real price of CO2

Source: David Hone, 2013, Shell Company.
The CO2 market in the EU

€ per tonne CO2
EU Energy Roadmap 2050

The signalling of governments about their long term intentions can change the market dynamics.

Energy roadmap 2050, a case of backcasting based on 80% reduction of GHG emissions. It is often treated as forecasting or as a policy action plan.
Basis of scenarios: 80% reduction in domestic GHG emissions by 2050

Conclusion on efficient pathway:
-25% in 2020
-40% in 2030
-60% in 2040

Source: European Commission
CO2 Emissions China

1.4 Gt emission gap in 2010

Year:
- 1997
- 1999
- 2001
- 2003
- 2005
- 2007
- 2009

Mt CO₂:
- 0
- 1,000
- 2,000
- 3,000
- 4,000
- 5,000
- 6,000
- 7,000
- 8,000
- 9,000
- 10,000

Fuel Types:
- Other fuels
- Process emission
- Natural gas
- Petroleum
- Coal
- Provincial aggregation

Amounts:
- 197 Mt
- 172 Mt
- 33 Mt
- 989 Mt
Energy 2050 Roadmap: Electricity
“Up to 50% growth”
<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Capacity factor (%)</th>
<th>Levelized capital cost</th>
<th>Fixed O&amp;M</th>
<th>Variable O&amp;M (including fuel)</th>
<th>Transmission investment</th>
<th>Total system levelized cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispatchable Technologies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional Coal</td>
<td>85</td>
<td>65.7</td>
<td>4.1</td>
<td>29.2</td>
<td>1.2</td>
<td>100.1</td>
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<tr>
<td>Advanced Coal</td>
<td>85</td>
<td>84.4</td>
<td>6.8</td>
<td>30.7</td>
<td>1.2</td>
<td>123.0</td>
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<tr>
<td>Advanced Coal with CCS</td>
<td>85</td>
<td>88.4</td>
<td>8.8</td>
<td>37.2</td>
<td>1.2</td>
<td>135.5</td>
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<td>Natural Gas-fired</td>
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<tr>
<td>Conventional Combined Cycle</td>
<td>87</td>
<td>15.8</td>
<td>1.7</td>
<td>48.4</td>
<td>1.2</td>
<td>67.1</td>
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<tr>
<td>Advanced Combined Cycle</td>
<td>87</td>
<td>17.4</td>
<td>2.0</td>
<td>45.0</td>
<td>1.2</td>
<td>65.6</td>
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<td>Advanced CC with CCS</td>
<td>87</td>
<td>34.0</td>
<td>4.1</td>
<td>54.1</td>
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<td>93.4</td>
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<td>Conventional Combustion Turbine</td>
<td>30</td>
<td>44.2</td>
<td>2.7</td>
<td>80.0</td>
<td>3.4</td>
<td>130.3</td>
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<td>Advanced Combustion Turbine</td>
<td>30</td>
<td>30.4</td>
<td>2.5</td>
<td>68.2</td>
<td>3.4</td>
<td>104.6</td>
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<tr>
<td>Advanced Nuclear</td>
<td>90</td>
<td>83.4</td>
<td>11.5</td>
<td>12.3</td>
<td>1.1</td>
<td>108.4</td>
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<td>Geothermal</td>
<td>92</td>
<td>76.2</td>
<td>12.0</td>
<td>0.0</td>
<td>1.4</td>
<td>89.6</td>
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<tr>
<td>Biomass</td>
<td>83</td>
<td>53.2</td>
<td>14.3</td>
<td>42.3</td>
<td>1.2</td>
<td>111.0</td>
</tr>
<tr>
<td>Non-Dispatchable Technologies</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td>34</td>
<td>70.3</td>
<td>13.1</td>
<td>0.0</td>
<td>3.2</td>
<td>85.6</td>
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<tr>
<td>Wind - Offshore</td>
<td>37</td>
<td>193.4</td>
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<td>0.0</td>
<td>5.7</td>
<td>221.5</td>
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<tr>
<td>Solar PV¹</td>
<td>25</td>
<td>130.4</td>
<td>9.9</td>
<td>0.0</td>
<td>4.0</td>
<td>144.3</td>
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<tr>
<td>Solar Thermal</td>
<td>20</td>
<td>214.2</td>
<td>41.4</td>
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<td>5.9</td>
<td>261.5</td>
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<tr>
<td>Hydro²</td>
<td>52</td>
<td>78.1</td>
<td>4.1</td>
<td>6.1</td>
<td>2.0</td>
<td>90.3</td>
</tr>
</tbody>
</table>

¹ Costs are expressed in terms of net AC power available to the grid for the installed capacity.

These results do not include targeted tax credits.

Energy 2050 Roadmap: Oil Imports (000 toe)
A spread in 2050 of 463 million toe (9.3 million barrels/day)

Source: European Commission, Energy Roadmap 2050
EU 2050 Roadmap: Gas Imports (000 toe)
A spread in 2050 of 222 million toe (242 bcm)

Source: European Commission, Energy Roadmap 2050
Energy 2050 Roadmap: EU Hydrocarbons production

Mio toe

- Oil
- Natural Gas
- Total
The EU at the forefront of energy geopolitics?

Source: Based on data from New Policies Scenario, World Energy Outlook, IEA 2011.
US Security Strategy

"An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States, and such an assault will be repelled by any means necessary, including military force." Jimmy Carter, Address at Joint Session of Congress, The Capitol, Washington DC, January 30, 1980.

"With most of the world's nuclear powers and some half of humanity, Asia will largely define whether the century ahead will be marked by conflict or cooperation, needless suffering or human progress. As President, I have therefore, made a deliberate and strategic decision – as a Pacific nation, the United States will play a larger and long-term role in shaping this region and its future..." Remarks by President Obama to the Australian Parliament, November 17, 2011
EU Security Strategy

2003 « European Security Strategy : A secure Europe in a better World »

« Energy is a special concern for Europe. Europe is the world’s larger importer of oil and gas. Imports account for about 50% of energy consumption today. This will rise to 70% in 2030. Most energy imports come from the Gulf, Russia and North Africa »


« Greater diversification of fuels, sources of supply, and transit routes, is essential as are good governance, respect of rule of law and investment in source countries. EU policy supports these objectives through engagement with Central Asia, the Caucasus and Africa, as well as through the Eastern partnership and the Union of the Mediterranean. Energy is a major factor in EU-Russia relations. Our policy should address transit routes, including Turkey and Ukraine. With our partners, including China, India, Japan and the US, we should promote renewable energy, low carbon technologies and energy efficiency, alongside transparent and well-regulated markets »
Natural Gas Prices (March 2013)

Gas prices (US and EU Imports)

- Russian Natural Gas border price in Germany, US Dollars per Thousands of Cubic Meters
- US Natural Gas spot price at the Henry Hub terminal in Louisiana

Source: IMF
Natural gas prices (1) and oil prices

RU Natural Gas Price

Crude Oil Brent

(1) Russian Natural Gas border price in Germany, US Dollars per Thousands of Cubic Meters

Source : IMF
## Production Cost of Natural Gas (US$ mmBTU)

<table>
<thead>
<tr>
<th>Country</th>
<th>Conventional *</th>
<th>Shale gas*</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>3 - 7</td>
<td>3 - 7</td>
</tr>
<tr>
<td>EU</td>
<td>5 - 9</td>
<td>5 - 10</td>
</tr>
<tr>
<td>China</td>
<td>4 - 8</td>
<td>4 - 8</td>
</tr>
<tr>
<td>Russia</td>
<td>0 – 2 (1) 3 – 7 (2)</td>
<td>-</td>
</tr>
<tr>
<td>Qatar</td>
<td>0 - 2</td>
<td></td>
</tr>
</tbody>
</table>

(1) West Siberia (2) East Siberia

**Cost of liquefaction**: 1.5 – 2
**Shipping**: .3 - .9
**Regasification**: .3
**Total**: 2.1 - 3.2

Sources: *AIE and **industry estimates*
US Shale Gas: exports or no exports

- Political battle over expansion of gas exports: “Exports could harm the nation’s (US) ability to reach energy independence, combat pollution and preserve the environment and improve the economic competitiveness of American manufacturers”... “US might shortchange its new found domestic energy security with increased exports”
- But export market would stabilise US prices (reduce the volatility of the market) and encourage more gas-directed exploration
- Up to now only one export license for LNG (Sabine Pass Liquefaction Project)
- US not a low cost producer in terms of lifting costs
- Handicap for renewables (low prices for electricity from gas)
- Extremely high initial decline rates of wells with steep trends (may lose more than 85% of their initial output within the first 12 to 18 months) – significant decrease in the recovery factor
- TX Barnett and La Haynesville formations: to keep production flat needed over the last 12 months 2000 new production wells.
- Recovery efficiency of 8 to 12% contrasting significantly with recovery efficiencies of 75 to 80% for conventional gas fields
Cheap shale gas in Europe: very limited hope

- Exploration expenditures greater than in the US
- Higher cost of drilling and completion
- Important investments in infrastructure
- Slower procedures, strict controls

Source: CEDIGAZ (SPE 9 November 2011)
Shale gas in Europe

Best estimate technically recoverable reserves shale gas
W Europe : 12 tcm
E Europe : 4 tcm
Production cost : WE Low 4.4 - Best 7 - High 21 $/mmbtu
EE 4 6.5 19


Source for the map : AIE
EU-Russia Energy Relations

« This is not a pipe»
Painting by René Magritte
SOMETIMES A PIPE IS JUST A PIPE
Trade with Russia is dominated by Oil

Imports from Russia in 2010 (000 mio €)

- Oil: 100.4
- Gas: 14.9
- Coal: 3.7
- Other trade: 29.4

Source: European Commission 2011
Sources: Bank of Russia 2012, Industry, own calculations
Russian Production and Reserves

Source: BP Statistical Review of World Energy [2011]
Degree of Energy Dependence in 2030

Source: Based on BP Energy Outlook 2030, January 2013
Is there a physical energy security problem from Vladivostok to Lisbon?

There is a pretty good fit in 2030 between supply and demand. With political will this Eurasian Continent could rely on its own energy resources and be energy independent.

Thank you for your attention

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