Long-term changes in the Polish economy in the perspective of extracting of shale gas
Plan of the presentation

- Introduction
- Gas market in Poland
- Towards a global gas market
- Impact of shale gas on a national economy
- Issues of resource richness
- Changes in the IMPEC model
- Conclusions
## Introduction

Gas – a fuel of 21st Century?

### Remaining technically recoverable resources of gas by type and region, end 2011 (tcm)

| Region                  | Total | Conventional | Unconventional | | | | | | Unconv share (%) |
|-------------------------|-------|--------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                         |       |              | Tight          | Shale           | Coalbed         | Unconv share (%) |
| E. Europe/Eurasia      | 174   | 131          | 43             | 10              | 12              | 20              | 24.7            |
| Middle East            | 137   | 125          | 12             | 8               | 4               | -               | 8.8             |
| Asia/Pacific           | 128   | 35           | 93             | 20              | 57              | 16              | 72.7            |
| OECD Americas          | 122   | 45           | 77             | 12              | 56              | 9               | 63.1            |
| Africa                 | 74    | 37           | 37             | 7               | 30              | 0               | 50.0            |
| Latin America          | 71    | 23           | 48             | 15              | 33              | -               | 67.6            |
| OECD Europe            | 45    | 24           | 21             | 3               | 16              | 2               | 46.7            |
| World                  | 752   | 421          | 331            | 76              | 208             | 47              | 44.0            |

Source: IEA 2012: 68
Introduction

Shale gas – the hope for Poland?

Reserves of gas in Europe

Source: Author's elaboration based on EIA 2011
Introduction

Basic questions about shale gas in the context of the Polish economy

- Geological
- Technical

Conditions of exploitation of shale gas

Sustainable development

total costs and benefits associated with the use of these resources

- Economic
  - costs of exploration
  - costs of exploitation
  - prices of gas
- Social risks
- Environmental risks
Gas market in Poland
Demand

Source: Author's elaboration based on BP report
Gas market in Poland

Supply

Sources of gas supply (in Bcm)

Source: Author's elaboration based on BP report
Towards a global gas market

New phenomena on gas markets

US
- Developing of horizontal drilling and hydraulic fracturing for shale gas extracting
- Decrease in unit costs of extraction of shale gas
- Increase of supply of gas
- Decrease of prices of gas
- Cessation of import and export readiness (TAFTA Transatlantic Trade and Investment Partnership?)

…. but recently
- Efficiency of new well are reported to be lower
- gas prices rised again

World
- Reducing the cost of liquefaction and regasification
- Actions toward diversification of supply
- Interest in shale gas exploitation (huge reserves in all continents)
- Significant reduction of contracted russian gas prices for EU (~15%)
- Negotiations on the separation of gas prices from oil prices
Towards a global gas market
Determinants of the future of gas market

- **Supply**: increasing supply and competitiveness
  - development of technologies of liquification
  - development of technologies unconventional gas extraction
  - development of infrastructure for gas transport (network, LNG terminals)

- **Demand**: expansion of demand
  - developing countries
  - the fight against the greenhouse effect

**Questions for price takers**: what price tendencies will be?

Down pressure – speed of supply increase:
  - advances of new technologies
  - supply diversification (spreading of technologies of shale gas extraction)
  - long term efficiency of shale gas extraction

Up pressure: speed of demand increase:
  - growth rates of developing economies
  - prices of other energy sources (mainly coal)
  - environmental policy
Three main uncertainties:

- Prices
  - uncertainty as to world price trends (Poland is gas price taker).
  - import prices of gas in Poland are higher than in Western Europe – creating global market and diversifications of supply will stimulate processes of price convergence
  - diversification (LNG terminal; long term contract with Quatar, imports from Germany, Norway, Czech Republic)

- Size of the recoverable resources of shale gas in Poland
  - aplicability of techchnologies,
  - improvements of existing technologies (R&D)

- The volume of supply of Polish gas
  - full unit costs (including costs exploration, exploitation and uncertainty)
  - efficiency of extraction
  - demand for Polsih gas (domestic and foreign)
### Impact of shale gas on national economy

**Conclusions from literature overview**

**Issues for construction of scenarios for Poland**

<table>
<thead>
<tr>
<th>Supply side</th>
<th>Demand side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investments in</td>
<td>Investments in</td>
</tr>
<tr>
<td>- drilling (depending on life cycle of wells)</td>
<td>- modernization of existing power plants and CHP to replace coal with natural gas</td>
</tr>
<tr>
<td>- gas storage (proportionally to demand)</td>
<td>- construction of new gas power plants and CHP</td>
</tr>
<tr>
<td>- installations for gas liquefaction (to satisfy possible demand for LNG)</td>
<td>- distribution network (depending on location of final customers)</td>
</tr>
</tbody>
</table>
| - transmission network | |}

- Decline in imports
- Exports (gas or LNG)
- Unit costs of production of shale gas sector (must change according to the assumed learning curve)
- Energy efficiency of new and modernized power plants and CHP
- Financing of investments (public-private, domestic-foreign)
- Royalties and taxation
- Prices of primary fuels on world markets
Issues of resource richness

Resource abundance - blessing or curse?

Issues of resource richness

Resource abundance - blessing or curse?

Exploitation of natural resources

- Low quality of institutions
- Variability of prices on world markets
- Conflicts
- Weak democracy

Dutch deseas

Inconvenience to society & environmental damages

Sustainability indicators
- Economy
- Society
- Environment
Changes in the IMPEC model

To do

- Adjust data (separation of new sector)
- Estimate equations for new sector
- Develop indicators of sustainability for the model
- Develop detailed scenarios
## Changes in the IMPEC model

### Adjusting data

Data for IMPEC model is expressed in classifications based on older version of NACE (rev. 1.1)

<table>
<thead>
<tr>
<th>Section C: mining and querying includes natural gas Divisions</th>
<th>Section E: electricity, gas, water Divisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 10 coal</td>
<td>- 40 electricity, gas, steam and hot water</td>
</tr>
<tr>
<td>- <strong>11 oil and gas</strong></td>
<td>- 40.2 Manufacture of gas, distribution of gaseous fuels through mains</td>
</tr>
<tr>
<td>- 11.1 Extraction of crude petroleum and natural gas</td>
<td>- ...</td>
</tr>
<tr>
<td>- ....</td>
<td></td>
</tr>
<tr>
<td>- 12 uranium and thorium ores</td>
<td></td>
</tr>
<tr>
<td>- 13 metal ores</td>
<td></td>
</tr>
<tr>
<td>- 14 other mining and querying</td>
<td></td>
</tr>
</tbody>
</table>

Additional information used to isolate gas extraction and gas manufacturing and distribution
- natural gas supply in quantity units (domestic production and imports)
- natural gas use by final users (sectors) in quantity units
- prices of natural gas
- source *make and use table* (543 products by 83 activities) of the year 2008
- experts estimates of cost structure in the two sectors
- Long term development of shale gas sector in Poland depends on:
  - world market development (prices)
  - possibilities of adaptation of US technologies in Polish geological circumstances

- Impact of shale gas sector on the economy includes investments, both on supply and demand side, and in the long run crowding out of coal as energy source for economy

- Strength of impact depends on size of proved resources of shale gas. The size should be recognized within a few years

- The proposed approach differs compared to other studies, because
  - try to uses interindustry macroeconomic model of Inforum type
  - separates data about gas supply from mining and quarrying sector, enabling easier fixing of unit costs
  - separates gas distribution from energy sector enabling easier control of gas supply
  - will address the risks arising from the resource curse theory