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**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 21th Century?

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

	Total	Conven- tional	Unconventional			Unconv share (%)	
			Tight	Shale	Coalbed		
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

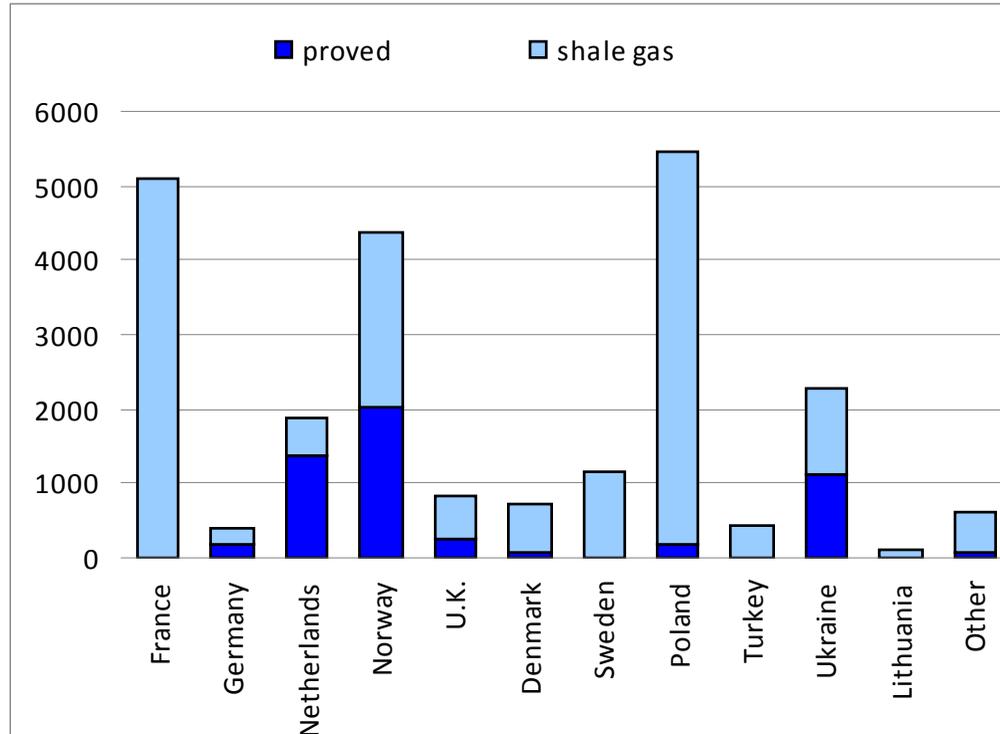
Source: IEA 2012: 68

Introduction

Shale gas – the hope for Poland?

Tu dołożyć szcunki PIG i inne w postaci wykresu. I obliczenia na ile lat wystarczyłoby....

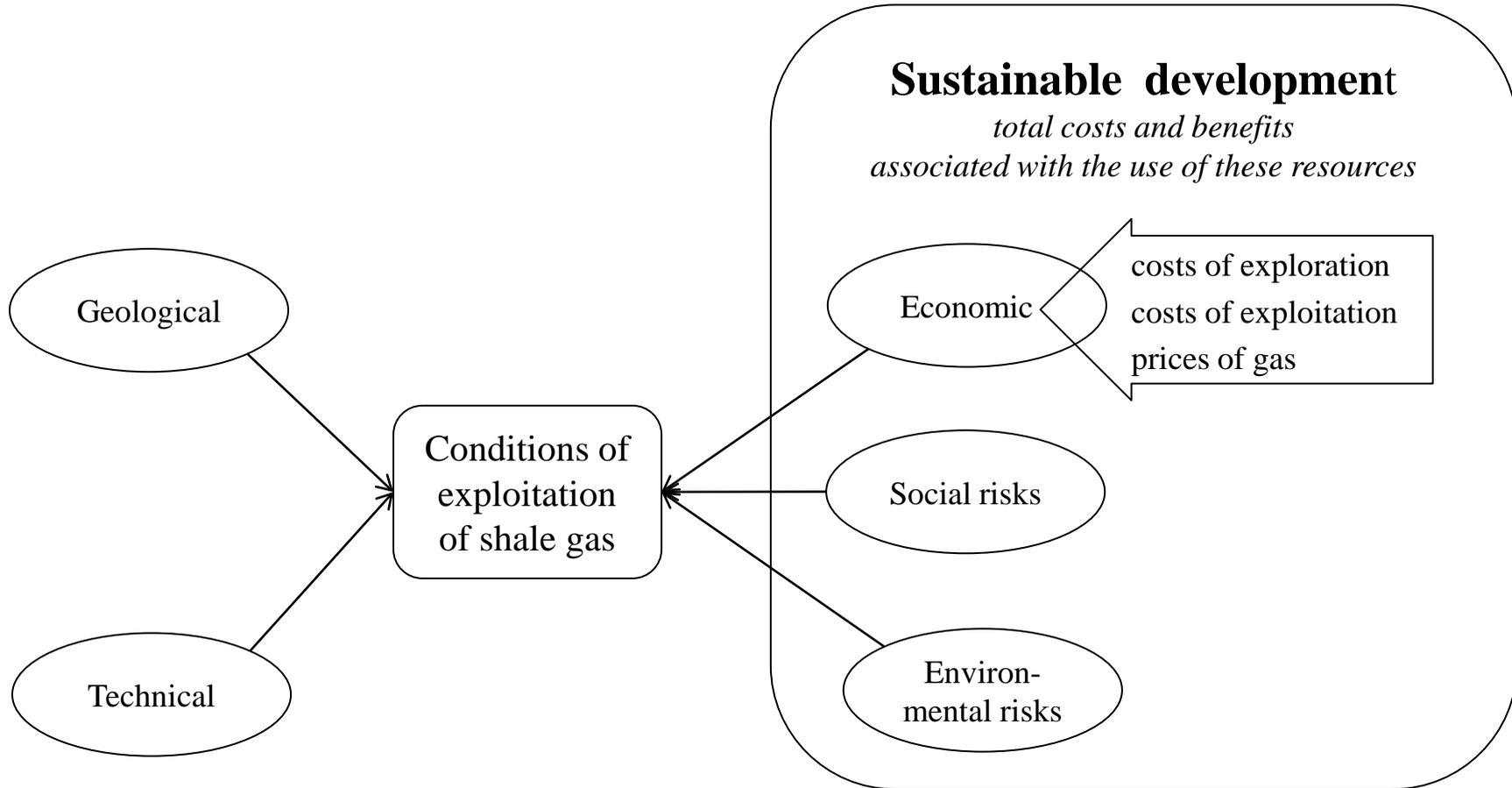
Reserves of gas in Europe



Source: Author's elaboration based on EIA 2011

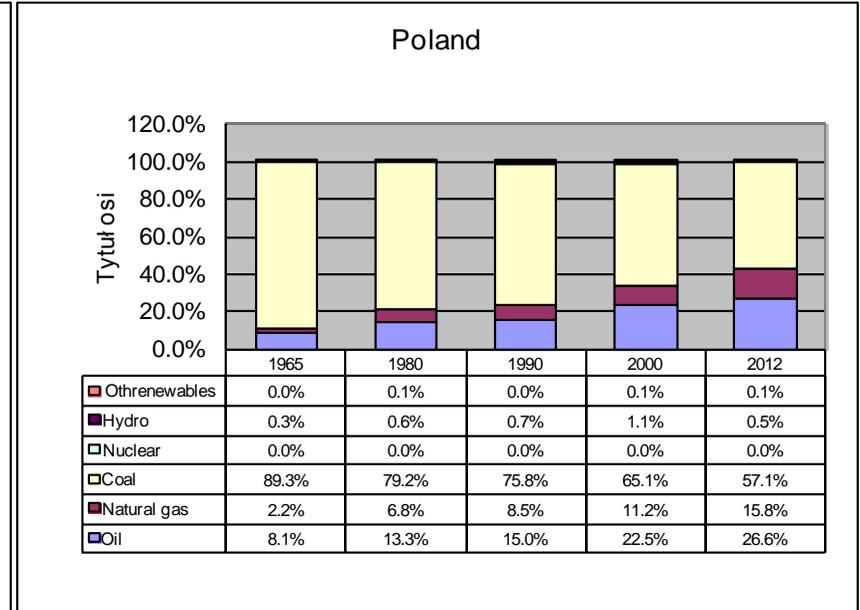
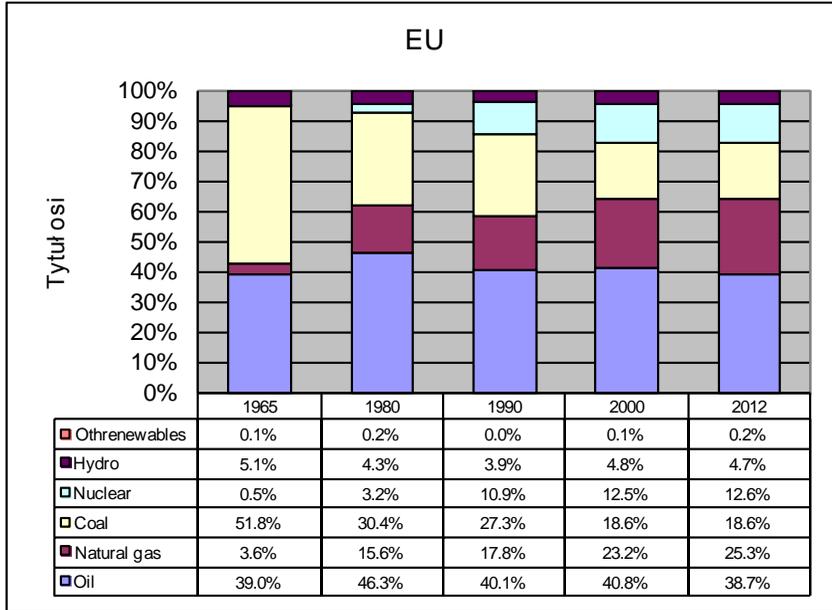
Introduction

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



Gas market in Poland

Demand

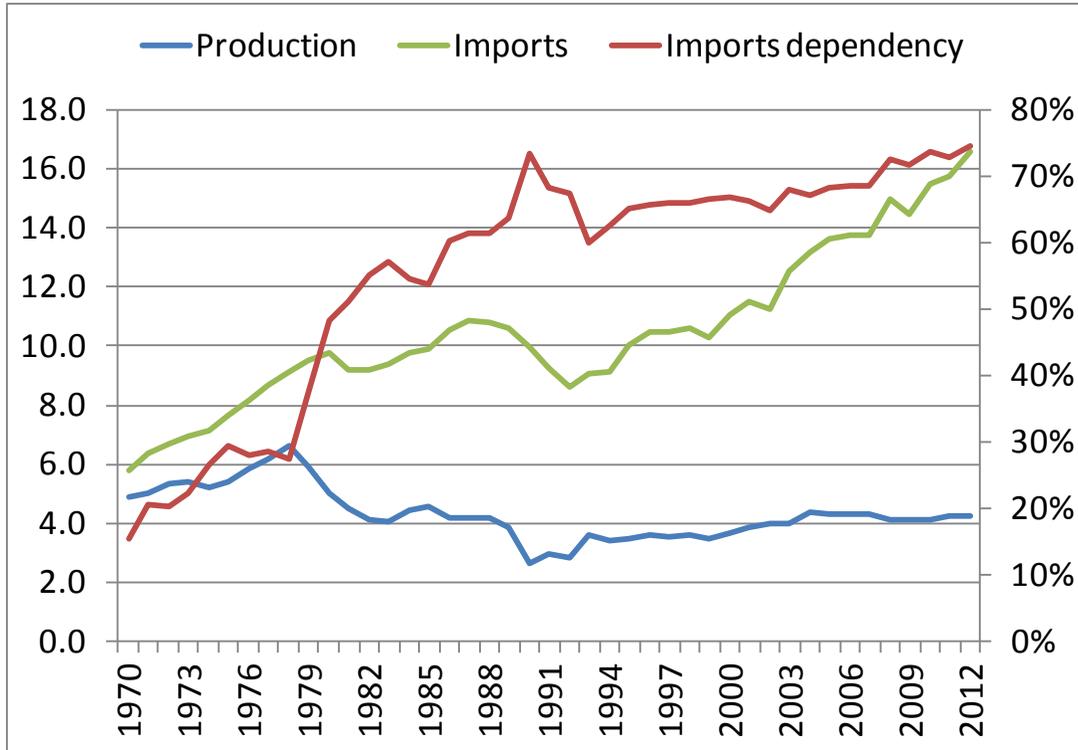


Source: Author's elaboration based on BP report

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

Impact of shale gas on national economy

Conditions for the construction of scenarios for Poland

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 Qatar, imports from Germany, Norway, Czech Republic)
- Size of the recoverable resources of shale gas in Poland
 - applicability of technologies,
 - 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 Polish gas (domestic and foreign)

Impact of shale gas on national economy

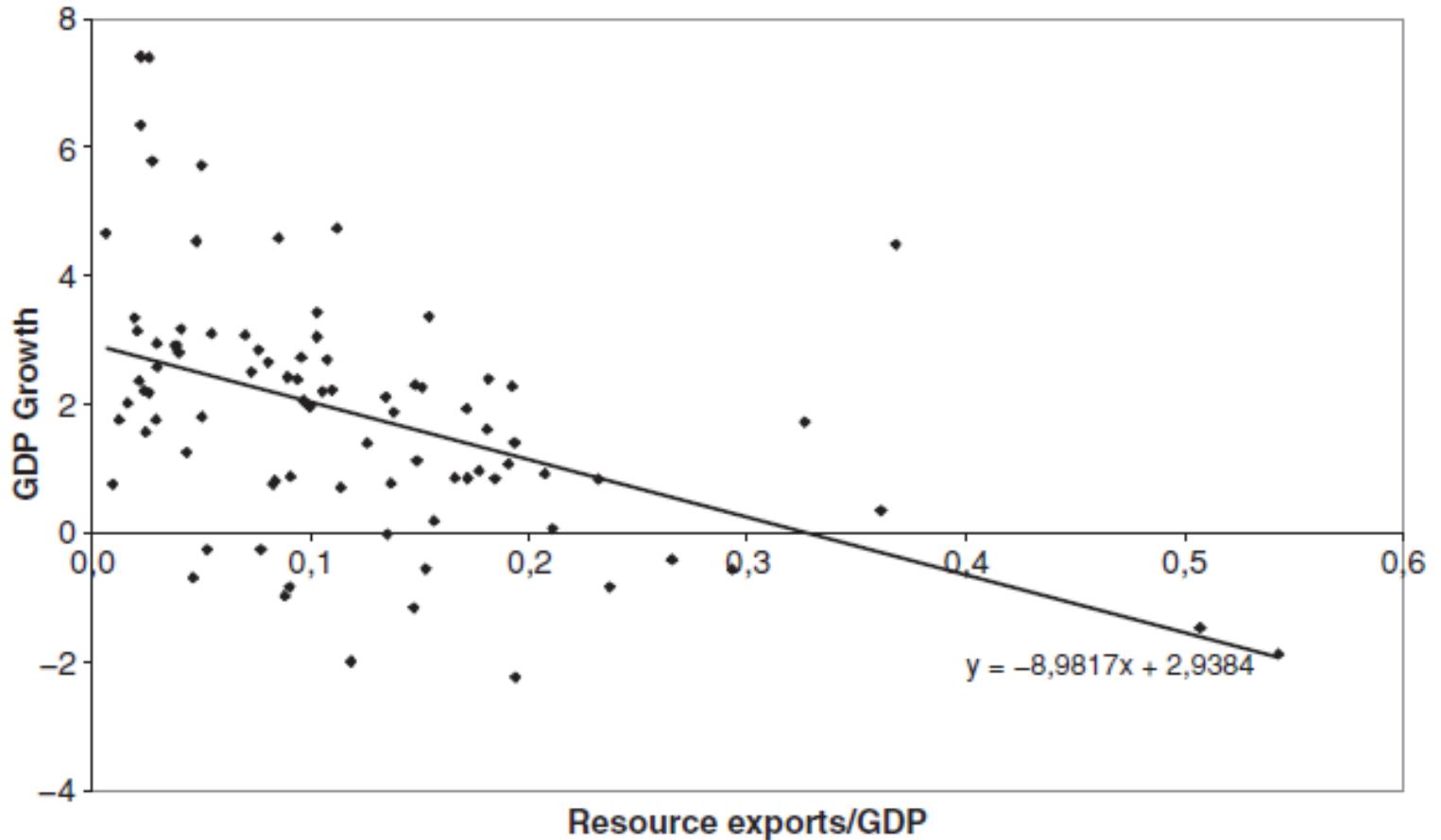
Conclusions from literature overview

Issues for construction of scenarios for Poland

Supply side	Demand side
Investments in <ul style="list-style-type: none">- drilling (depending on life cycle of wells)- gas storage (proportionally to demand)- installations for gas liquefaction (to satisfy possible demand for LNG)- transmission network	Investments in <ul style="list-style-type: none">- modernization of existing power plants and CHP to replace coal with natural gas- construction of new gas power plants and CHP- distribution network (dependson location of final customers)
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	

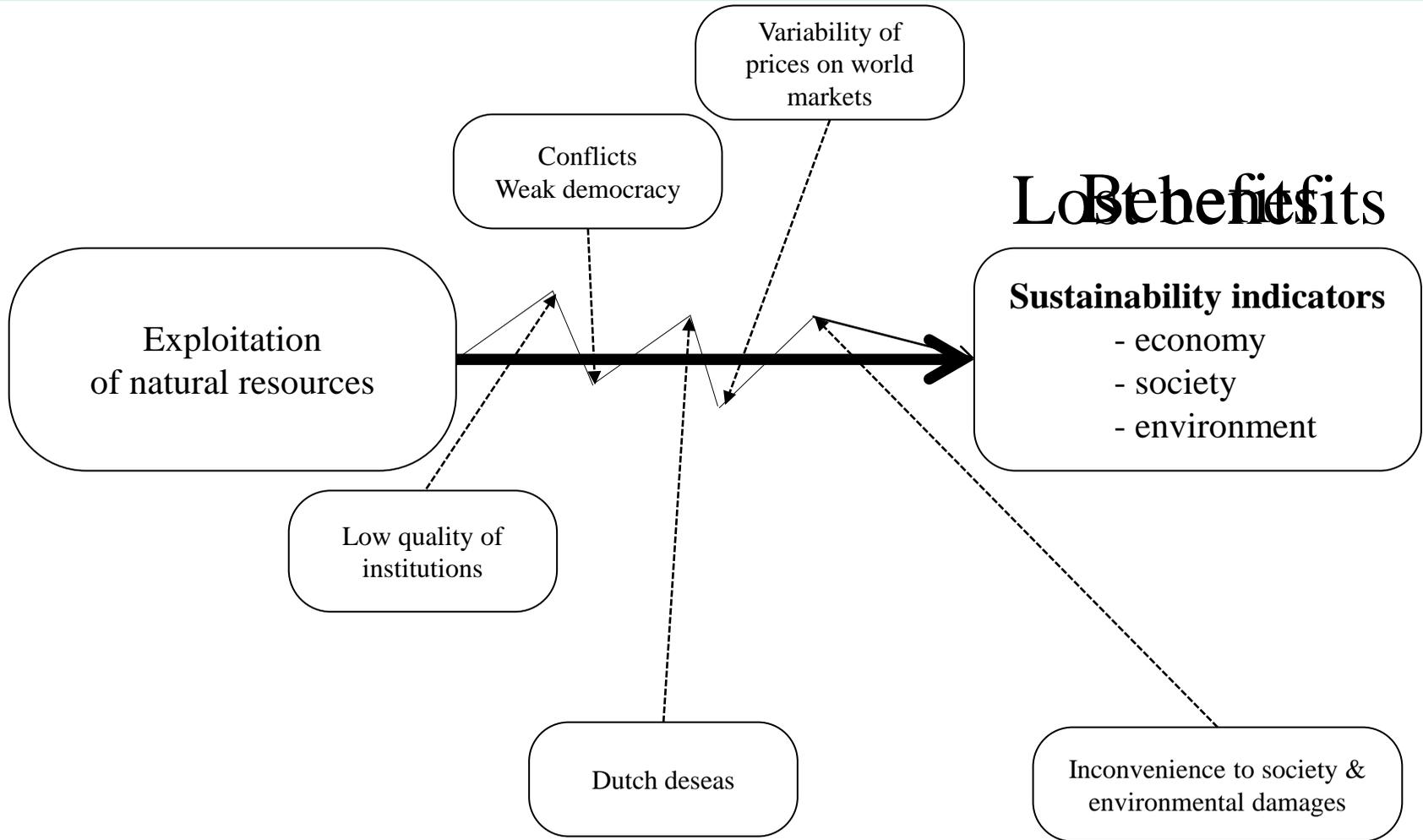
Issues of resource richness

Resource abundance - blessing or curse?



Issues of resource richness

Resource abundance - blessing or curse?



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)

Section C: mining and quarrying includes natural gas

Divisions

- 10 coal
- **11 oil and gas**
 - *11.1 Extraction of crude petroleum and natural gas*
 -
- **12 uranium and thorium ores**
- **13 metal ores**
- **14 other mining and quarrying**

Section E: electricity, gas, water

Divisions

- **40 electricity, gas, steam and hot water**
 - *40.2 Manufacture of gas, distribution of gaseous fuels through mains*
 - ...

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

Conclusions

- 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 use 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