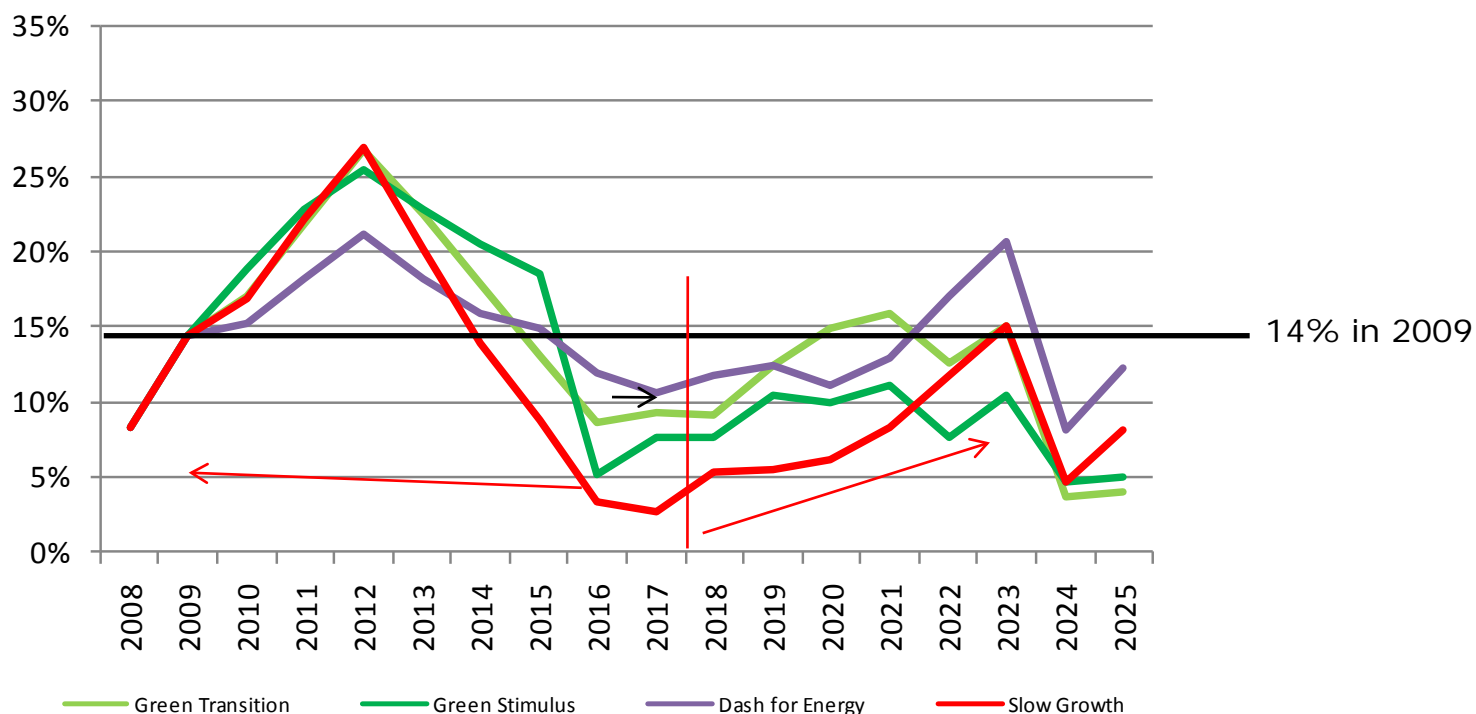




**Will GB's lights stay on and will
the gas keep flowing: a look at
the next decade?**

**Alistair Buchanan CBE
19th February 2013**

OFGEM ADVISES HMG ON CAPACITY OUTLOOK



SOURCE: OFGEM PROJECT DISCOVERY OCTOBER 2009

WHAT DOES RED LINE MEAN?

SLOW GROWTH

Supply Risk: Deferred investment.

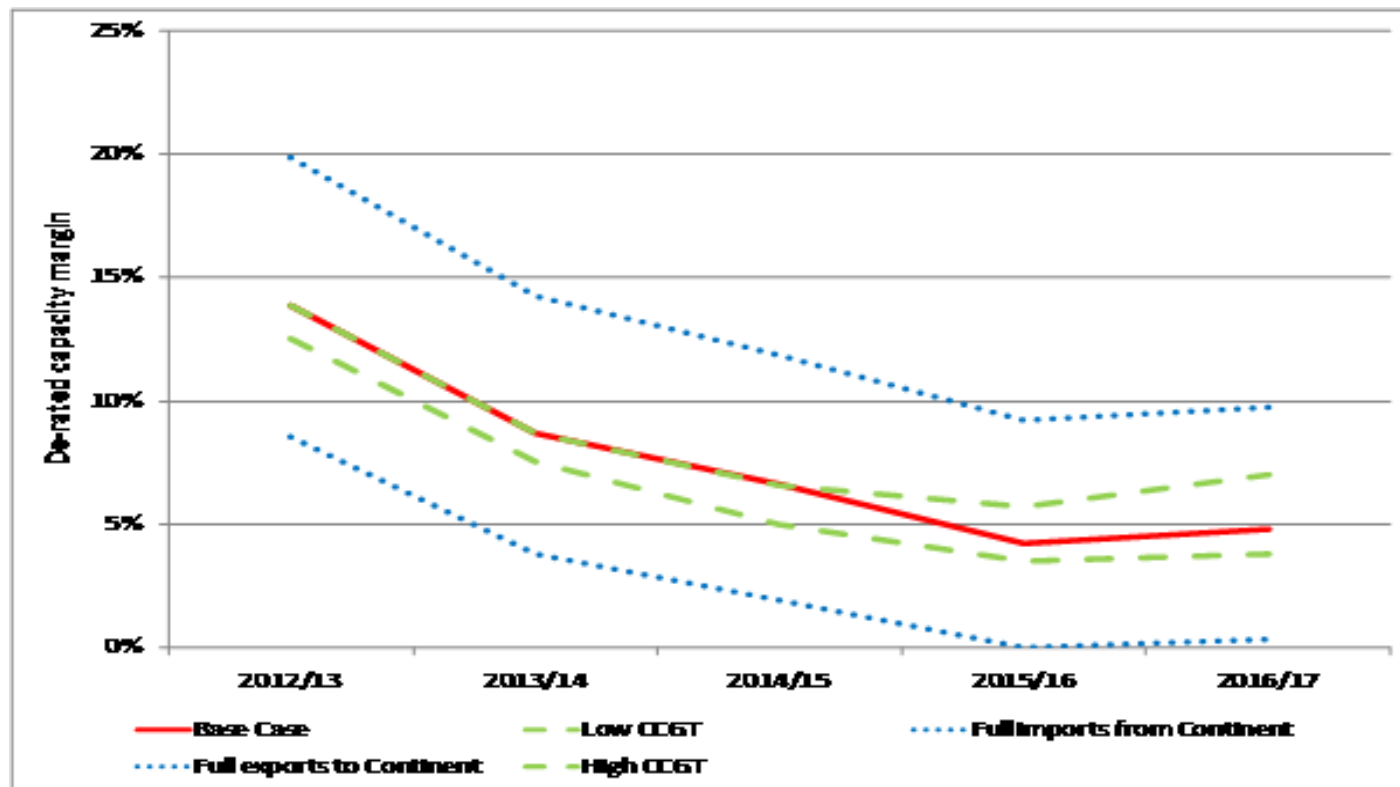
CO₂ Impact: Down 18% by 2020.

Impact on Bills: Up 22% by 2020.

Investment Required: £95bn.

SO: £95BN NEEDED – NOT THE BIGGER £200BN (YET!)

OFGEM'S FOCUS IS MID-TERM (10 YEARS)



SOURCE: OFGEM CAPACITY REPORT OCTOBER 2012

WHY DID WE GET TO THIS OUTLOOK?

High Policy of GB Government: 2005-2010

- (1) Signed two key European Directives that cleans or closes fossil plant:
 - Large Combustion Plant Directive (impact by 2016).
 - Industrial Emissions Directive (impact by 2021-23).
- (2) Agreed to 20/20/20 targets with Brussels.
- (3) Opted for 50% cut in emissions by mid 2020's.
- (4) Lead player on climate change at Durban.
- (5) Stern advised us of "ultimate failure of markets" if we don't act on climate change.
- (6) CCC created "it establishes **legally binding** limits on carbon emissions."

ALL GOALS/TARGETS MADE IN FINANCIAL "BOOM"

FINANCIAL “BUST” LEFT PREDICAMENT

IN

Wind

Water

Nuclear

CCS (Clean Coal)

Other renewables

OUT

Unabated coal

Old gas

Oil

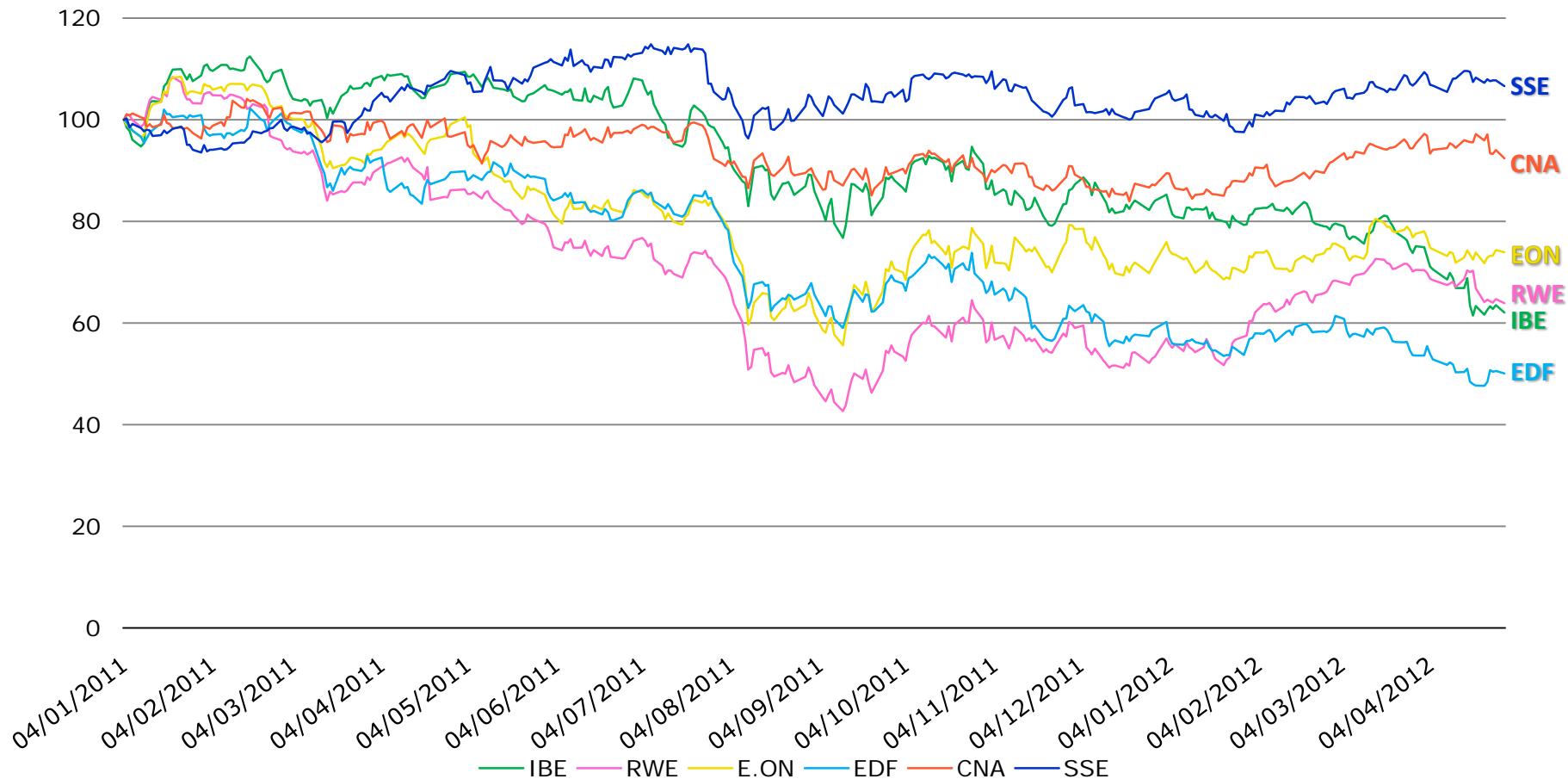
BUT

- (1) Single big assets replace smaller/flexible units.
- (2) Nascent Technology.
- (3) Huge up-front costs.
- (4) Financially challenging.

VISIONARY POLICY COLLIDED WITH FINANCIAL CRASH

FINANCING OUTLOOK HAS GOT WORSE

Big 6 Share Prices
Jan/11 - Apr/12



FOUR OF BIG 6 SHARE PRICE COLLAPSE

EUROPEAN UTILITIES SECTOR DE-RATED

European Utilities Sector has been de-rated



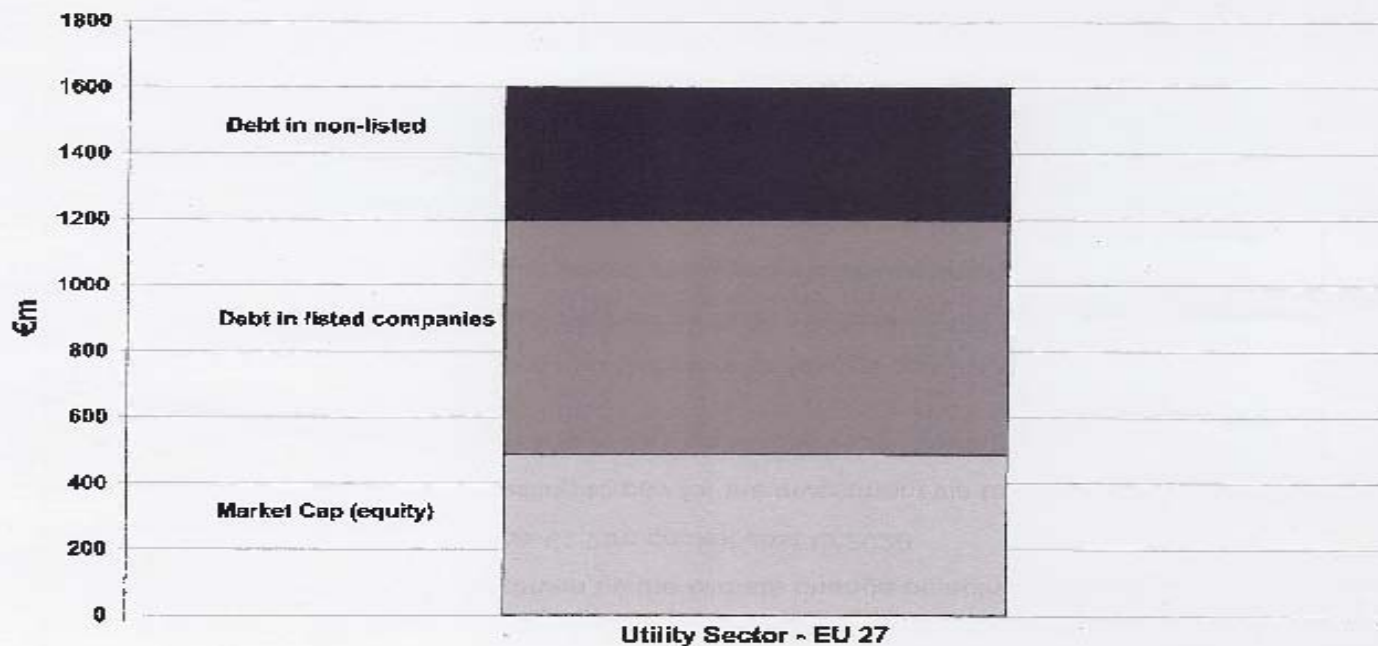
Source: Bloomberg, CIRA

11

RWE/EON IN RECOVERY. IBERDROLA (SPAIN) HAS CHALLENGES

DEBT DOMINATES EQUITY

European Utility Capital Structure - EU 27



LITTLE EXTRA LEVERAGE OFF EQUITY BASE

RENEWABLE STOCKS LOSE VALUE OF LAST SEVEN YEARS!

Market Cap of EU Renewable Energy Stocks

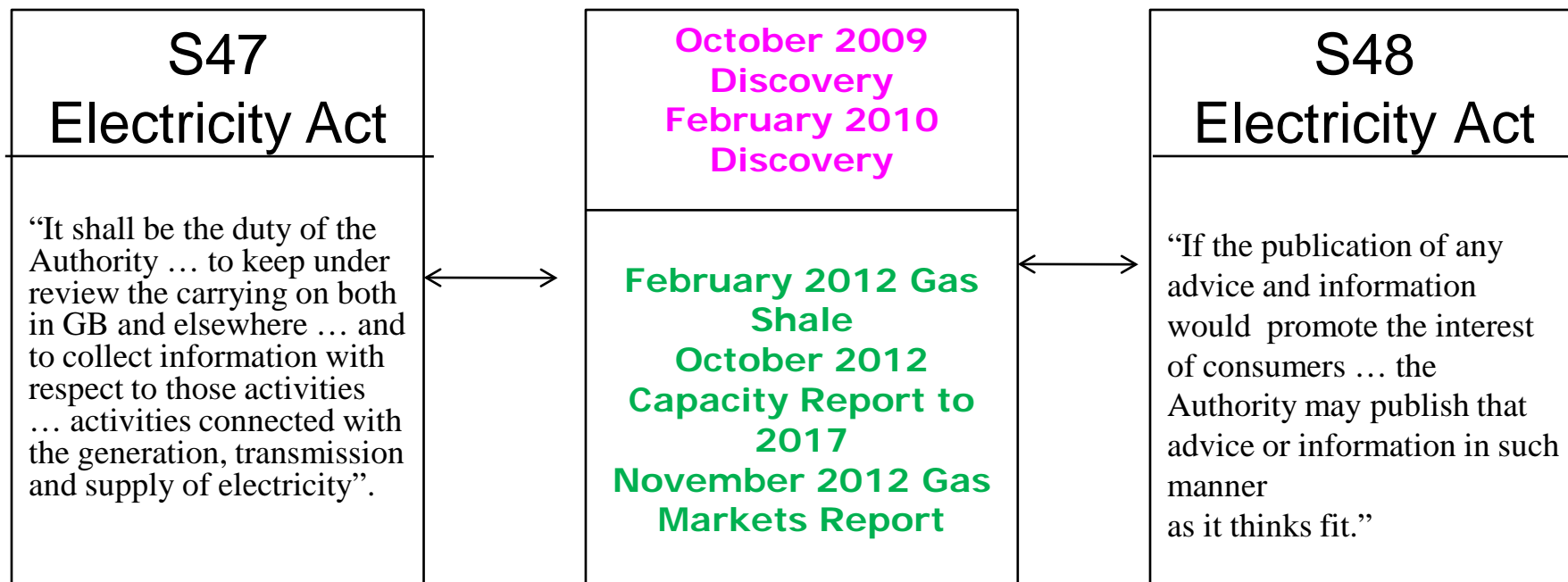


Source: Bloomberg, CIRA

15

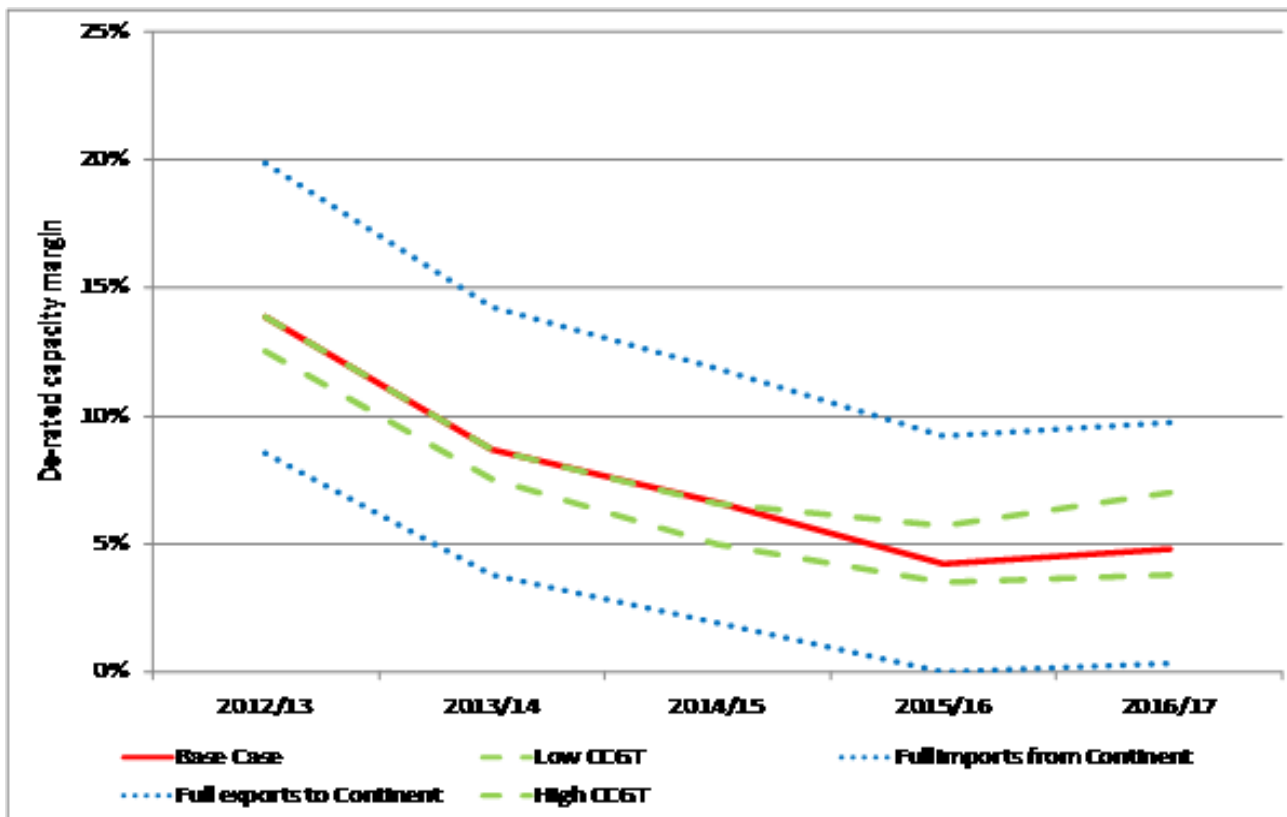
GB'S CHOICES DON'T MARRY WITH FINANCING

OFGEM'S ROLE



NOW ADVISING HMG ON 2012-25 PERIOD

BACK TO DISCOVERY



SO WHAT'S NEW IN 2012?

LCPD NOOSE TIGHTENS

Source: National Grid

BEFORE: Opted Out Plant status at April 2012

	<u>COMPANY</u>	<u>TEC MW</u>	<u>COMMENT</u>
<u>COAL</u>			
Ironbridge	EON	964	Converting 485 MW to biomass.
Kingsnorth	EON	1966	TEC withdrawn 3/2013.
Didcot A	RWE	1558	TEC withdrawn 3/2012.
Tilbury	RWE	810	Converted to biomass.
Ferrybridge 1&2	SSE	994	
Cockenzie	Iberdrola	551	TEC withdrawn 3/2013.
<u>OIL</u>			
Grain	EON	1355	
Fawley	RWE	940	
Littlebrook	RWE	1245	Reduction to 800 MW at 3/2013

OPTIONS BEING CLOSED DOWN

SUMMER 2012 LCPD NEWS

Source:

RWE 18/9/2012

EON 01/08/2012

NOW: Opted Out Plant status at September 2012

	<u>COMPANY</u>	<u>TEC MW</u>	<u>COMMENT</u>
<u>COAL</u>			
Ironbridge	EON	964	Converting 485 MW to biomass.
Kingsnorth	EON	1966	TEC withdrawn 3/2013.
Didcot A	RWE	1558	Will close 31/3/2013.
Tilbury	RWE	810	Ceases Q2 2013. Bio re-fit?
Ferrybridge 1&2	SSE	994	
Cockenzie	Iberdrola	551	TEC withdrawn 3/2013.
<u>OIL</u>			
Grain	EON	1355	Will close 31/3/2013.
Fawley	RWE	940	Will close 31/3/2013.
Littlebrook	RWE	1245	Reduction to 800 MW at 3/2013

CLOSURE EVEN SOONER

REVERSE/BREAK LCPD?

- (1) Judicial Review?
- (2) GB's International Reputation?
- (3) Sued by compliant operators?
- (4) Plant cannibalised?
- (5) Plant is expensive to re-start.

IN FACT FOCUS ON IED CLOSURES NOW!

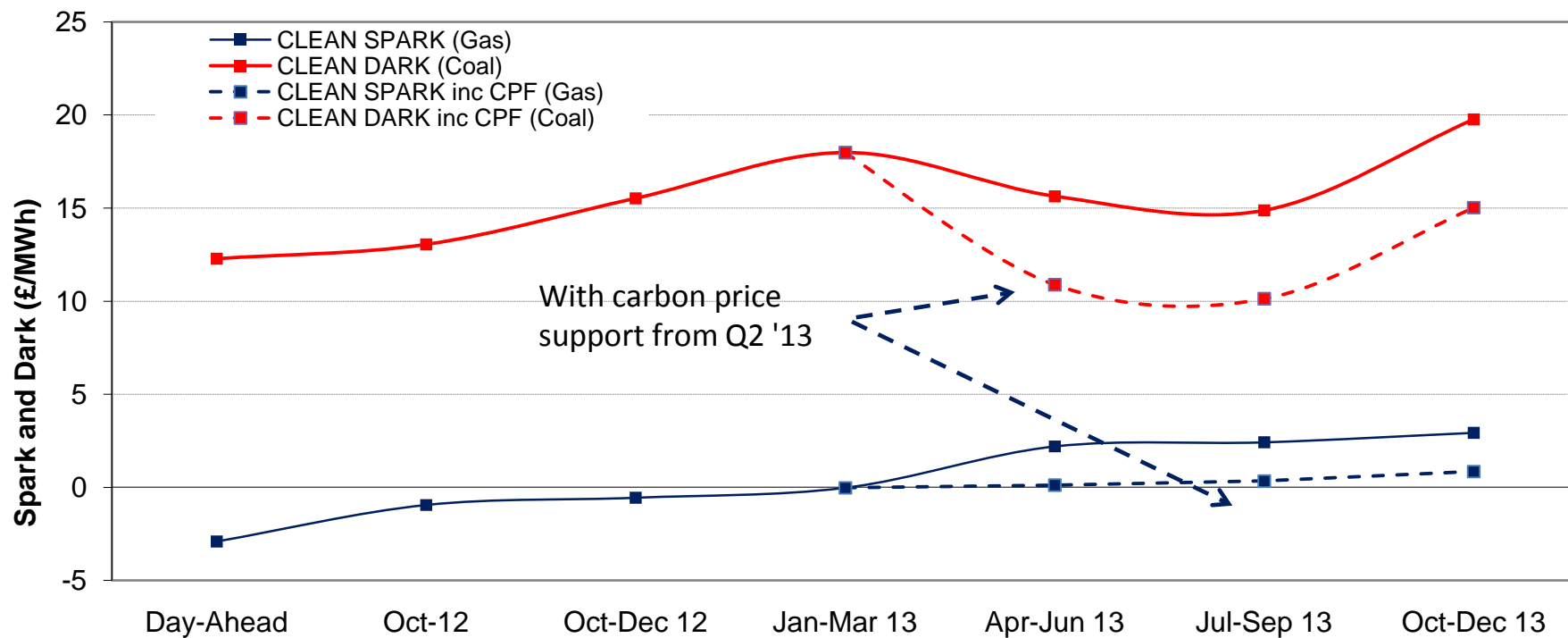
SUMMER 2012 – OTHER PLANT CLOSURES

- Gas closures : Old plant.
: Ahead of IED.
: Uneconomic.
- Gas Mothballed : Shallow.
: Deep.

PEAK OF AVAILABLE CAPACITY – SEE DISCOVERY

WHY IS GAS PLANT COMING OFF BARS?

Spark (Gas) and Dark (Coal) spread includes additional O&M and transportation costs



NEW CARBON TAX AND CHRONIC EMR UNCERTAINTY

THERMAL PLANT COMMISSIONING HAS DRIED UP: EU & GB

EUROPE

2008-2011 33GW Cancelled.

2008-2011 20GW delayed.

Source: IHS

IN GB EARLIEST FOR NEW CCGT = 2017!!

WHERE'S THE NEW PLANT THEN?

Nuclear

- RWE/EON out of Horizon (delay).
- SSE/IBE out of Nugen (delay).
- Hinkley B running well behind 2017 date in White Paper.

CCS

- 0/4 success rate in £1bn fast forward scheme.
- Some small scale options.
- Shell/SSE at Peterhead or another go at Longannet?

Offshore

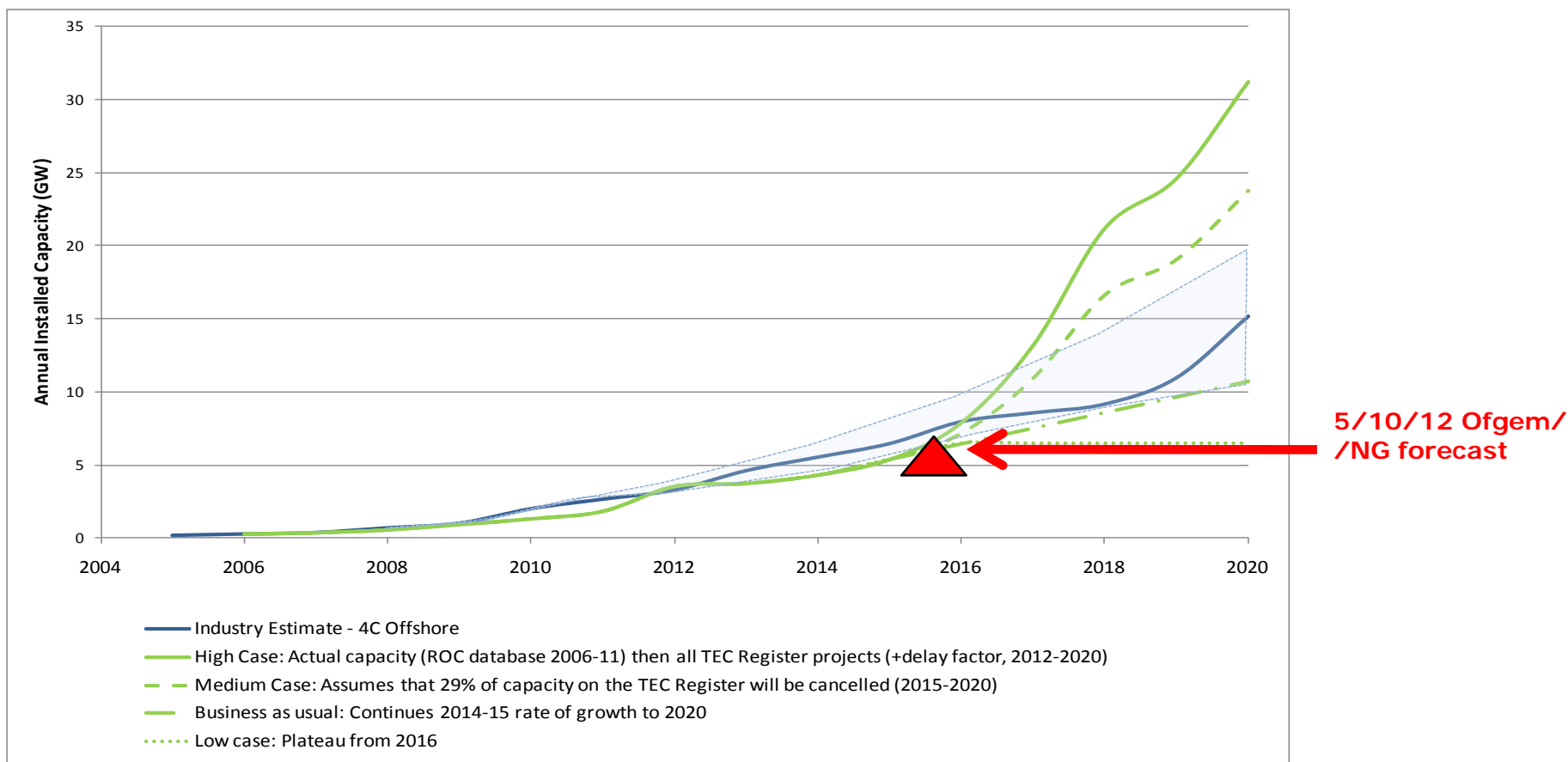
- Load factor 10% below plan as in ramp up stage.
- Expect delivery of GW at low-end.

Biomass

- Siemens/Drax mega project on-hold.

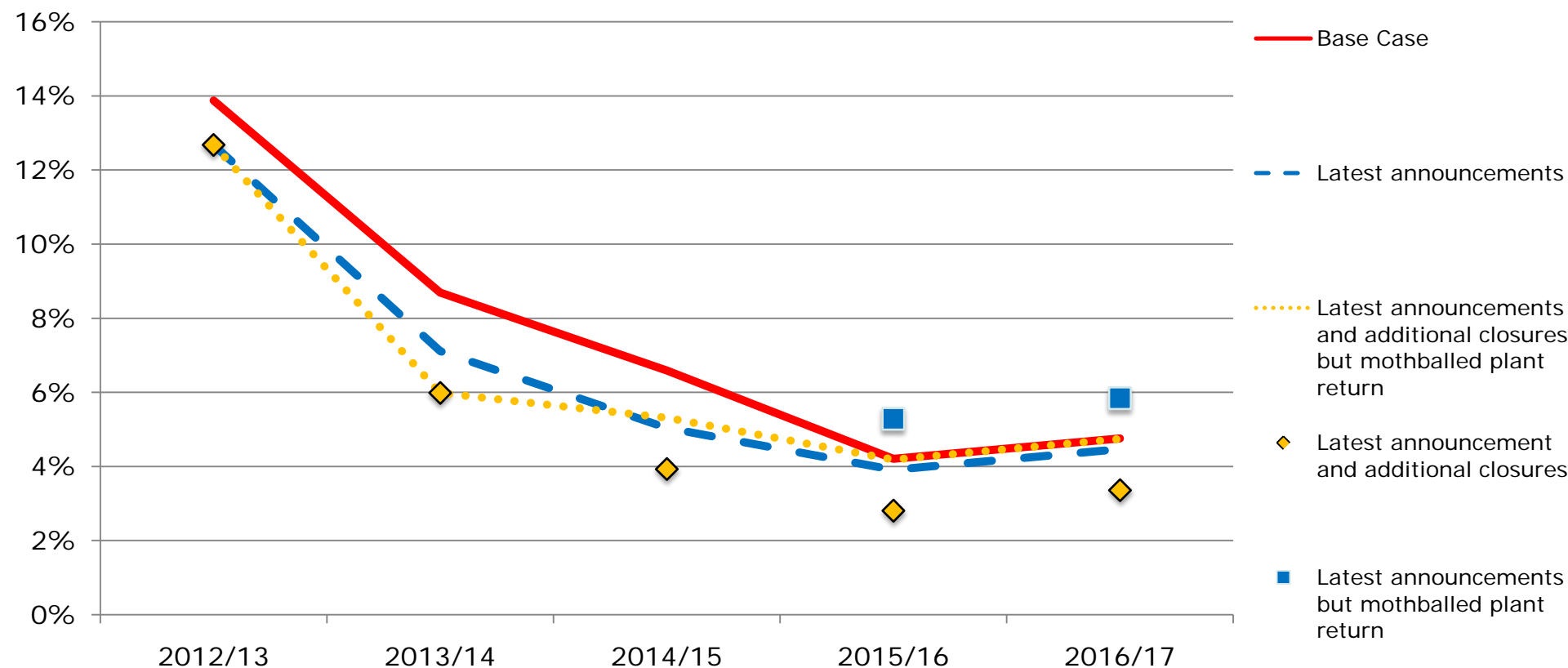
DELAY DOES NOT MEAN FAILURE

OFFSHORE RUN RATE



11GW BY 2020 NOT 30GW OF HIGH CASE

SO: CAPACITY REPORT OCTOBER 2012 SHOWED



CRUNCH EVEN EARLIER THAN DISCOVERY

IMPLICATIONS OF OCTOBER 2012 CAPACITY REPORT

- (1) We need gas as transition or bridge.
- (2) Gas in power stations will not fall from 40% to 20-30% by 2020 but rather increase to 60-70%.
- (3) Renewable – especially wind – are progressing but in an orderly way. Round 2 Offshore may just be completed by 2020.
- (4) We need to understand:
 - The impact of interconnection.
 - The impact of shocks (systemic faults).
 - The security of our gas supply.

FOCUS ON GAS SECURITY EVEN GREATER WHEN VIEWED WITH EUROPEAN ELECTRICITY

Germany : Switch to gas from nuclear 15-38bcm gas
p.a. more!

Belgium : Close nuclear policy – more gas.

France : Will Hollande add gas?

GB NOT ALONE IN LOOKING TO GAS

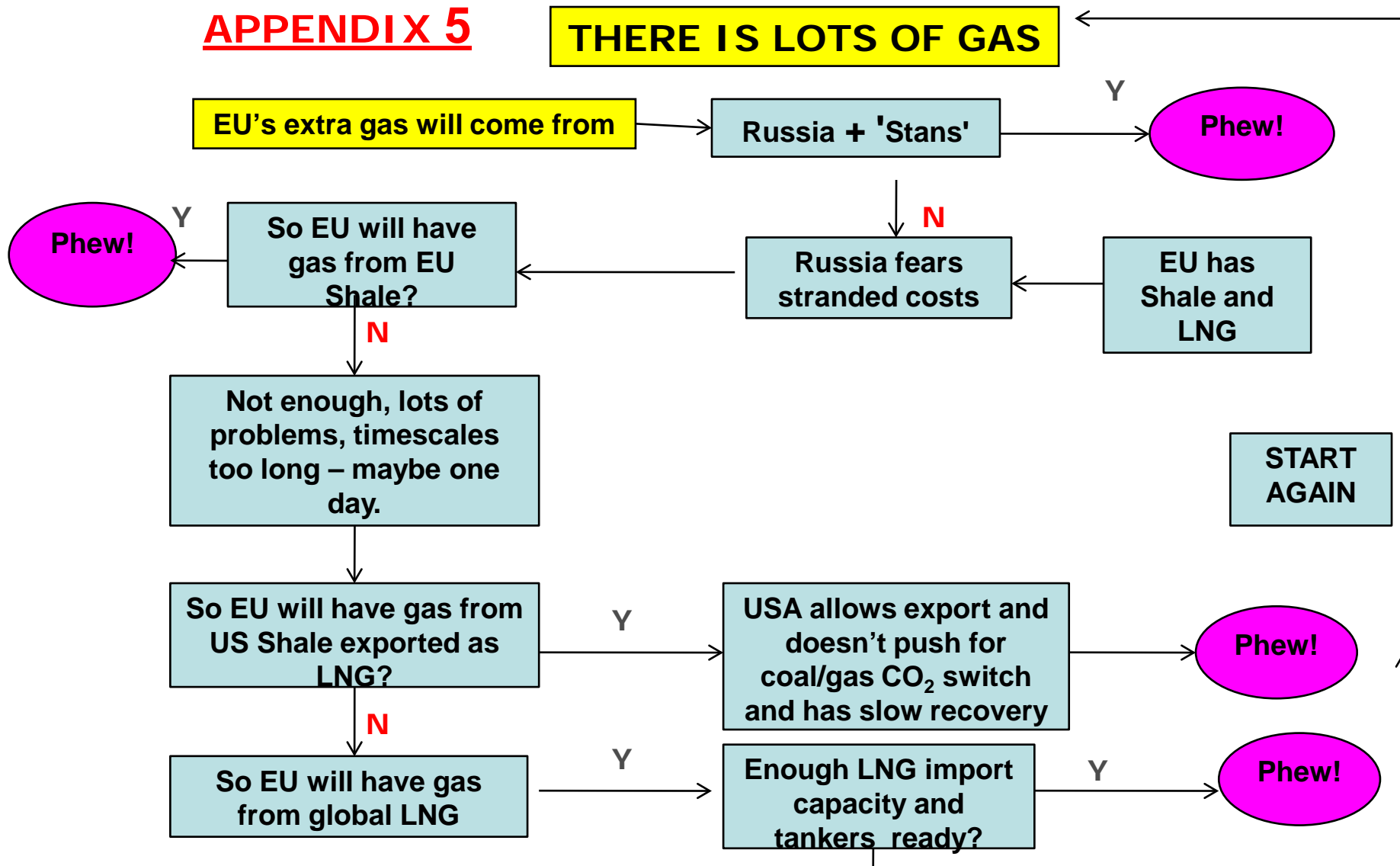
PART 1 - CONCLUSION

“Events dear boy events has led the power generation sector in GB and Europe to turn more to gas.”

PART 2 – SO WHAT’S THE OUTLOOK FOR GAS?

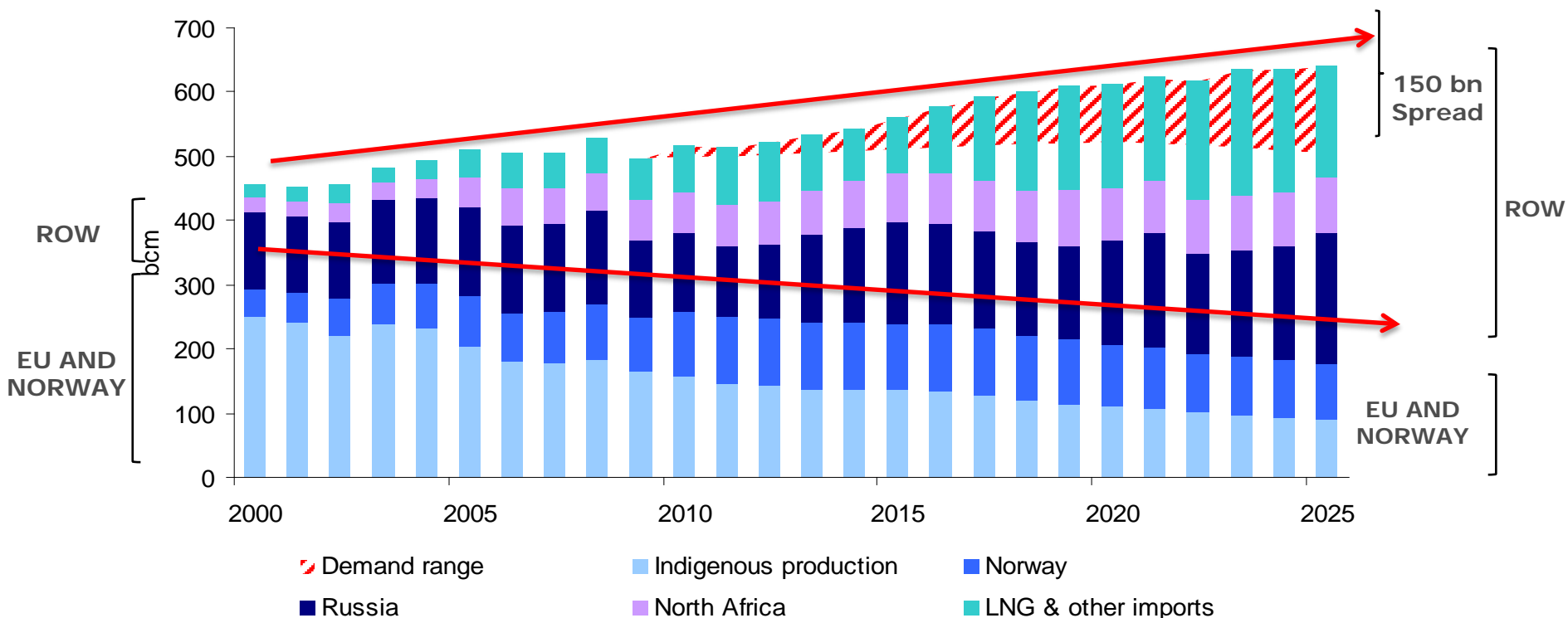
APPENDIX 5

THERE IS LOTS OF GAS



GAS DEMAND IN EU (INCLUDING GB)

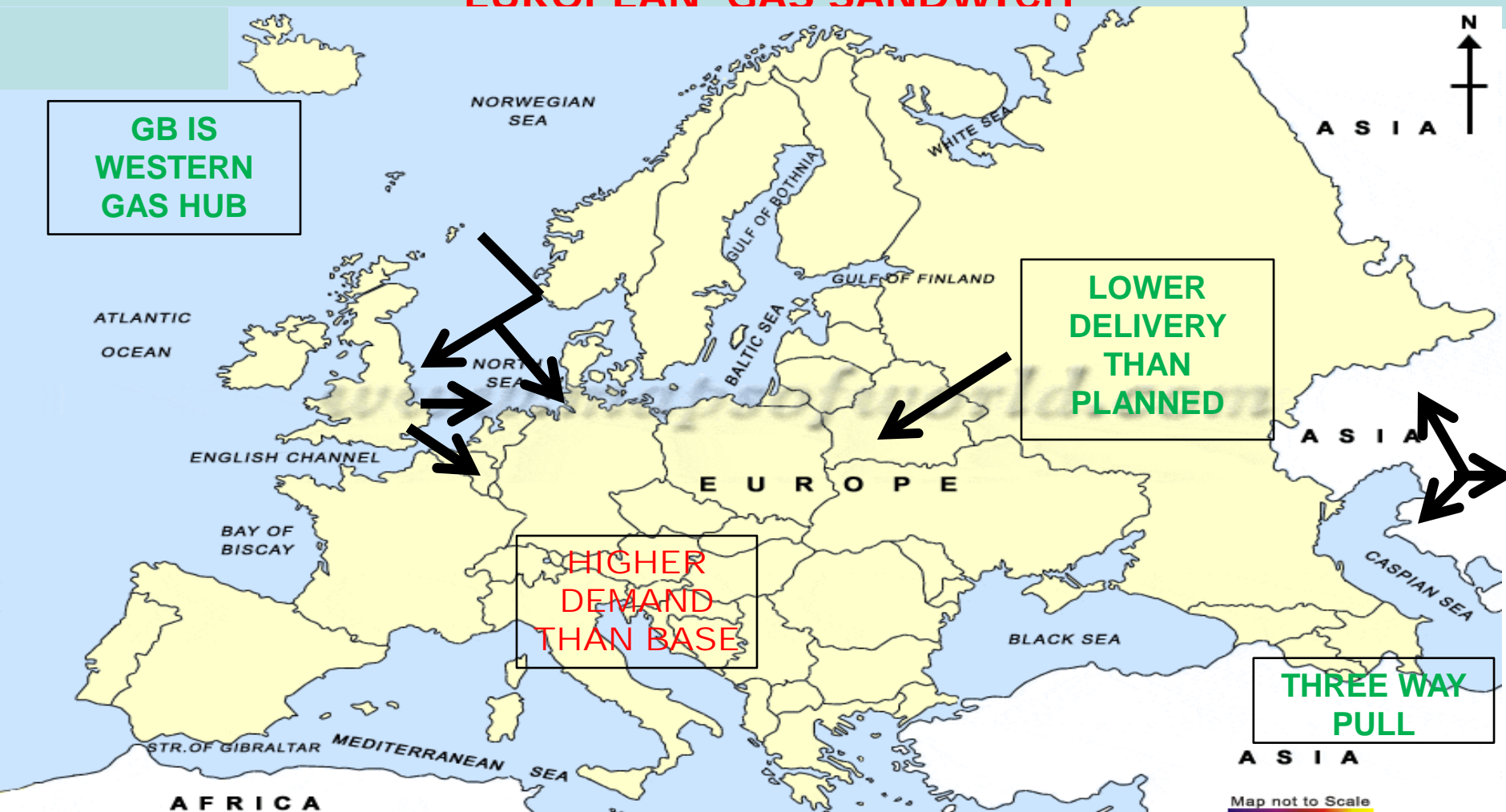
Increasing dependence on non-European imports



There are risks to gas security of supply due to increasing imports from non-European sources (Russia, Qatar, North Africa)

SOURCE: NATIONAL GRID

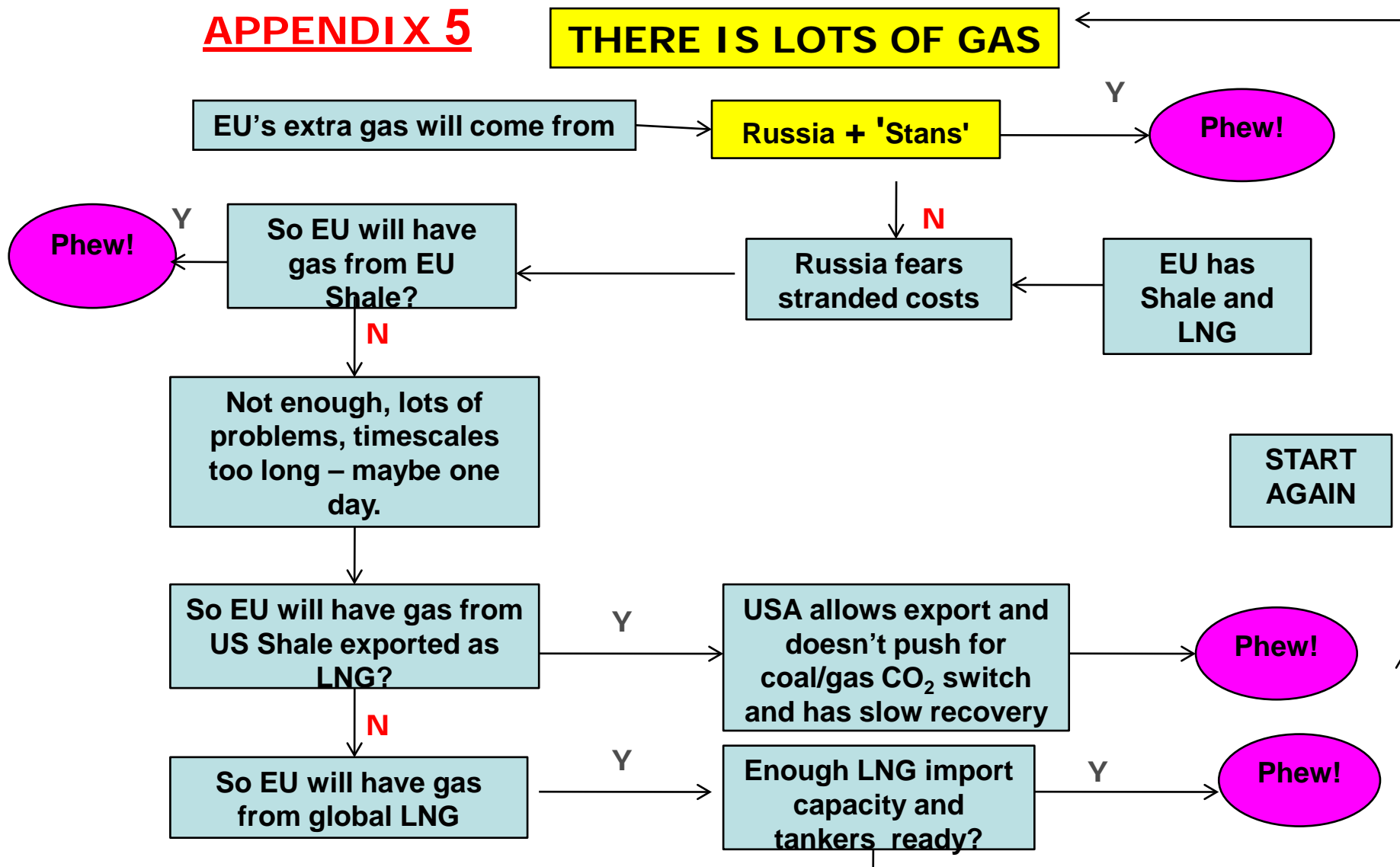
EUROPEAN GAS SANDWICH



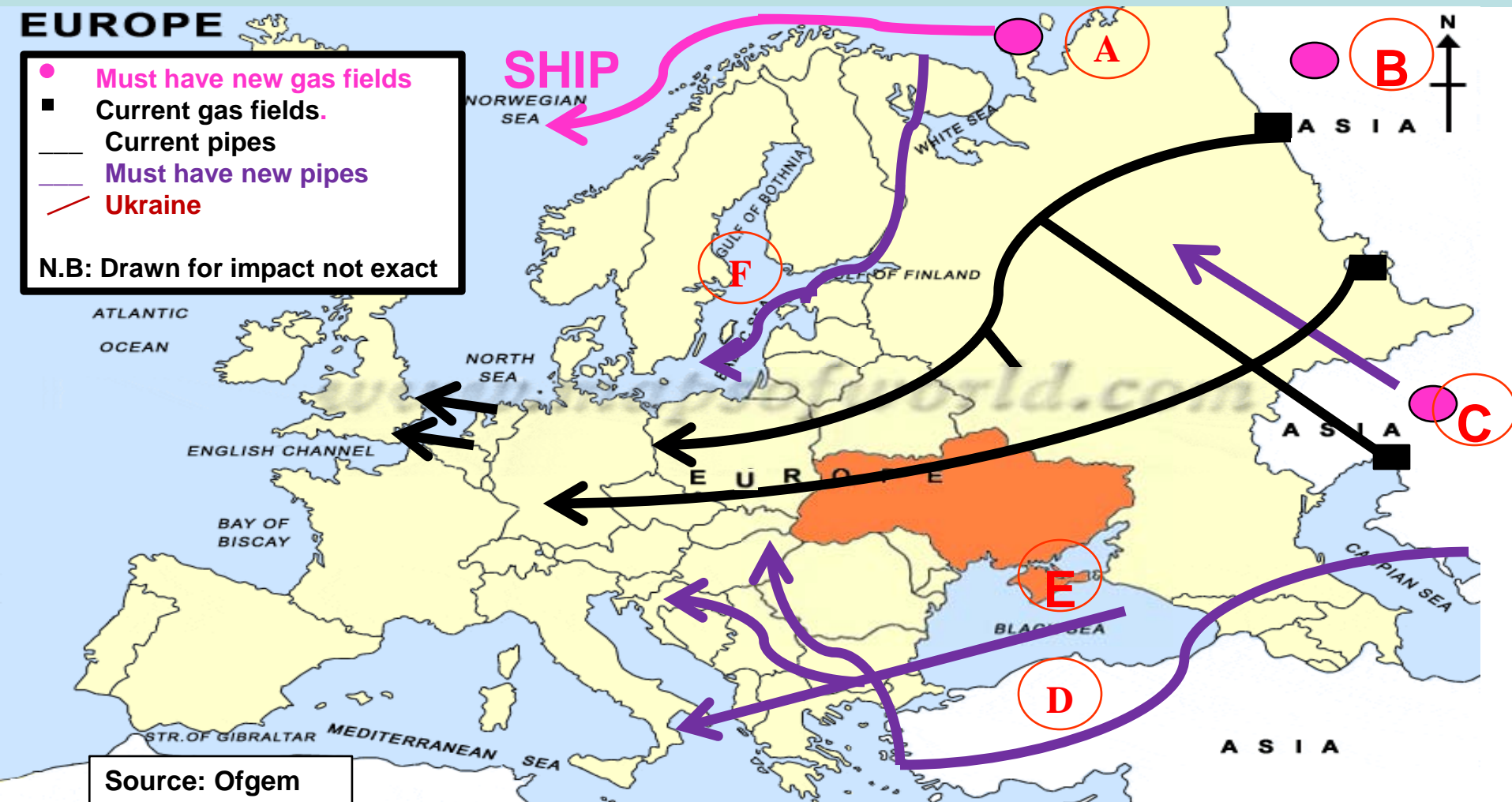
ANALYSE THE CORE SUPPLY HUBS

APPENDIX 5

THERE IS LOTS OF GAS

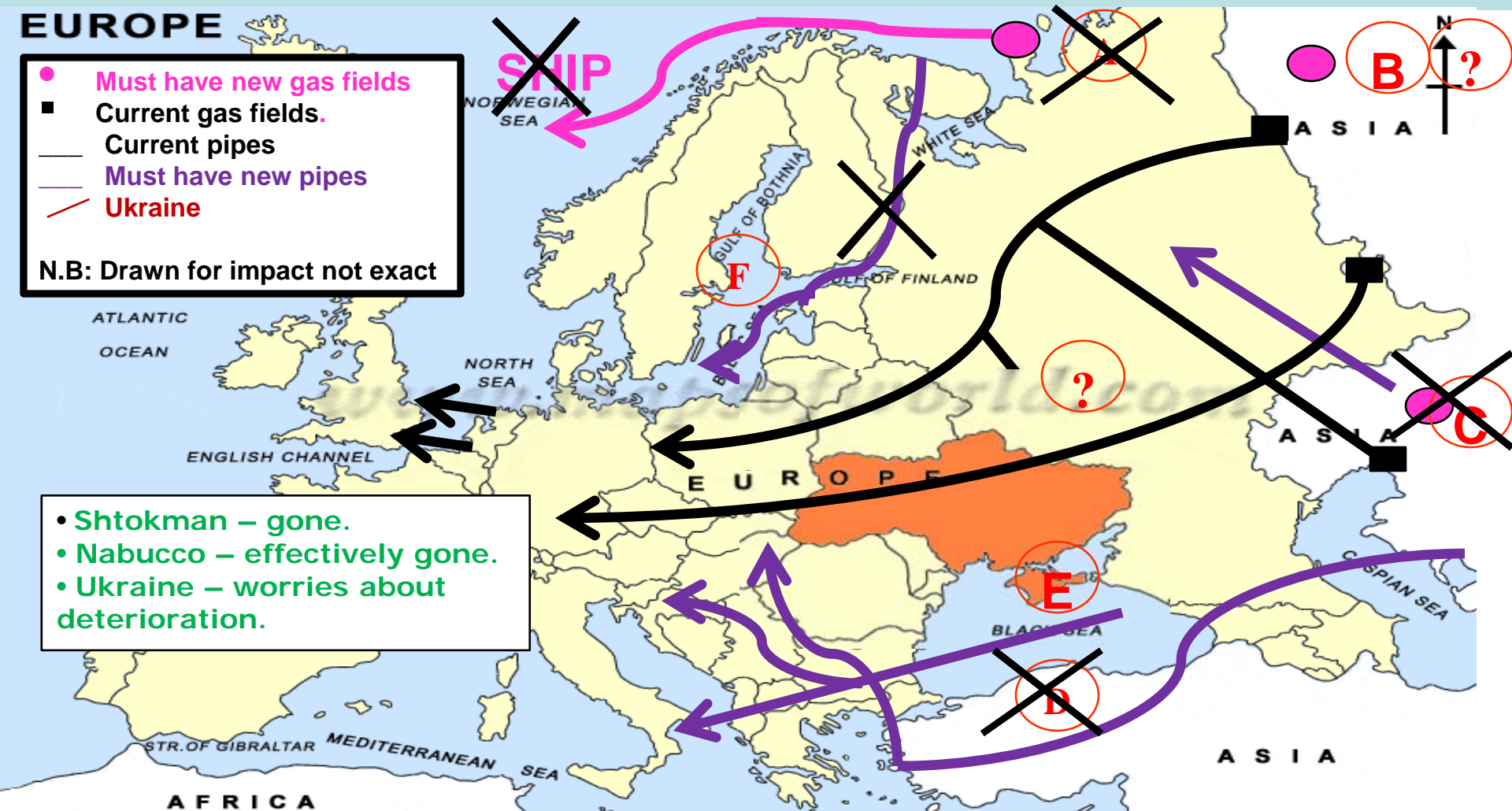


EXPECTED GAS FROM RUSSIA AND "STANS"



RUSSIA TO INCREASE DELIVERIES BY 80BCM?

WINTER 2012 – ALL CHANGE ON RUSSIAN DELIVERIES



SHTOKMAN/NABUCCO ALONE = 80BCM

IMPACT OF SHORTFALL

	2020 BCM	
Base demand case	630	
Gazprom to EU	185	No Shtokman.
Gas Shale	10	Poyry/Ofgem base case.
LNG to EU	140	Import capacity ramp up is assumed.
Other Supplies, Norway etc	268	No Iranian gas taken, Nabucco limited, TAP for Shah Deniz.
Total supply	<u>603</u>	
Shortfall in supply	<u>27</u>	To be met by Shale/Norway or LNG.

Source: A. Buchanan

CAUSE FOR SOME CONCERN?

ARE GAZPROM CONCERNED?

“ Gazprom invests sufficiently. We have always invested in production and transportation as much as needed to meet already signed contracts and not focusing on demand forecasts... As a result Gazprom has enough production capacity but does not suffer from surplus”

Alexei Miller June 2009

Source: Gazprom

MANAGING CHANGING GLOBAL PROFILES

RECENT GAZPROM BEHAVIOURS

- *February 2012:*

“supply volumes to Western Europe had been reduced, up to 10%, for a few days.”

Source: Russia News Agencies

- September 2012:

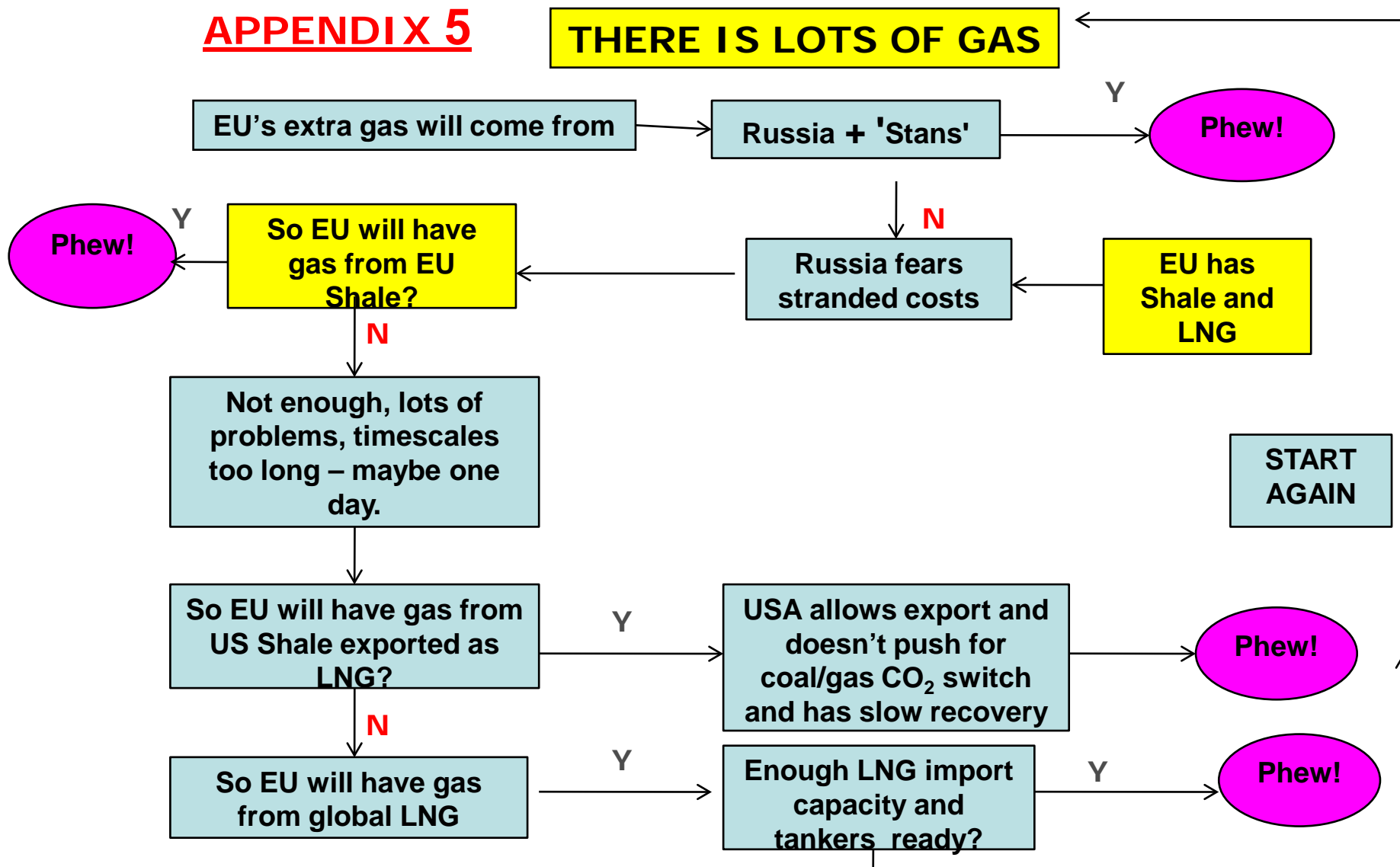
“Gazprom confirms it has **no plans to interrupt supplies** following the announcement of the EU enquiry”.

Source: FT

IMPLICATIONS BEHIND THE WORDS? OR NOT?

APPENDIX 5

THERE IS LOTS OF GAS



GB: LOTS OF SHALE – POTENTIALLY?

- Lancashire – Cuadrilla?
- South-East of England?
- Into Cumbria – nuclear waste deposit?

Source: FT/DECC/ECC – OCTOBER 2012

HOW WILL PLANNING IMPACT PICTURE?

BUT GB RESOURCES SMALL VIS EU

EUROPE	Proved Natural Gas Reserves	Technically recoverable shale gas
France	6	5097
Germany	176	227
Netherlands	1388	481
Norway	2039	2350
UK	255	566
Denmark	59	651
Sweden	-	1161
Poland	164	5295
Turkey	6	425
Ukraine	1104	1189
Lithuania	-	113
Others	77	538

Source: Poyry/Ofgem

FOCUS POLAND, FRANCE, NORWAY, SWEDEN, UKRAINE

EU SHALE CHALLENGES: PHYSICAL

- (1) Quality of geology.
- (2) Access to pipes network.
- (3) Density of well sites.
- (4) Access to technology.

THIS IS NO CAKE-WALK

EU SHALE CHALLENGES: BUREAUCRATIC

- (1) New Water Directive due 2013 will now include shale.
- (2) REACH (Chemical) Directive impacts all shale development (Helsinki registration).
- (3) Review of EIA's in 2013 – also awaiting EPA's review from USA.
- (4) Will EU take a position on whether shale is in/out targets?
- (5) Local politics/bureaucracy i.e. France, Lithuania, Poland.

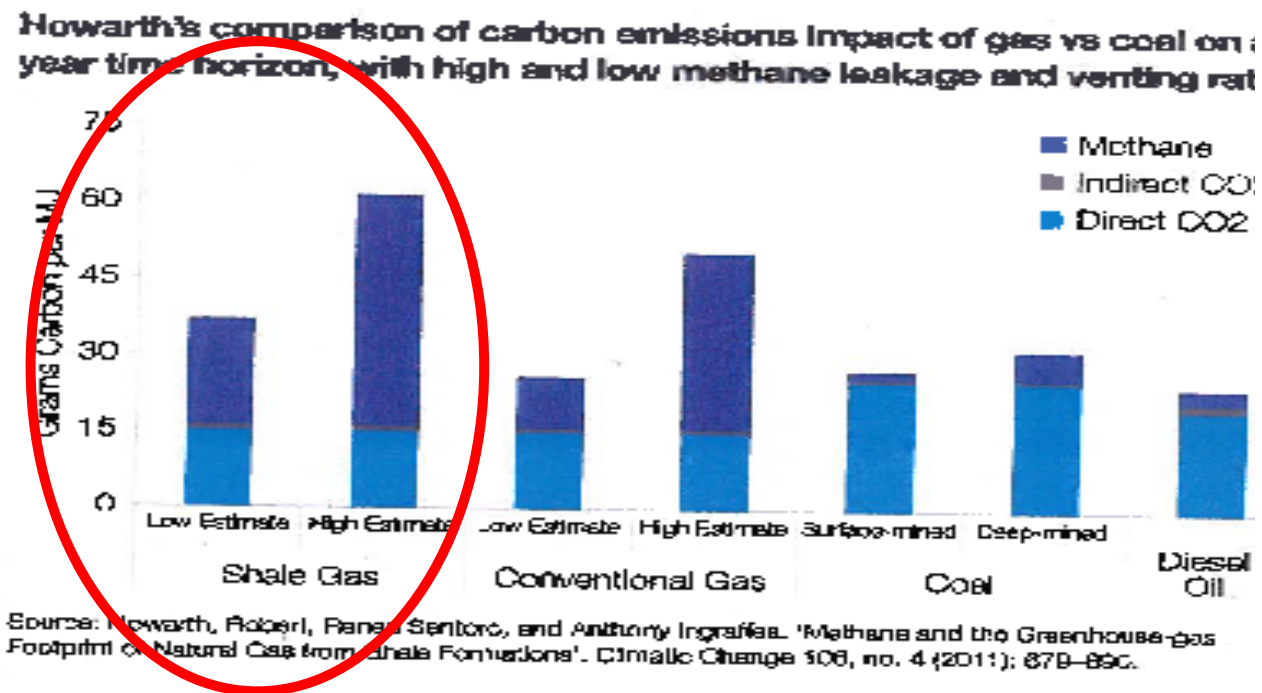
RED TAPE CHALLENGE FOR SHALE

EU SHALE CHALLENGES: ENVIRONMENTAL

- Fracking.
- Fugitive Methane.
- Other.

ENVIRONMENTAL ISSUES NOT ONE DIMENSIONAL

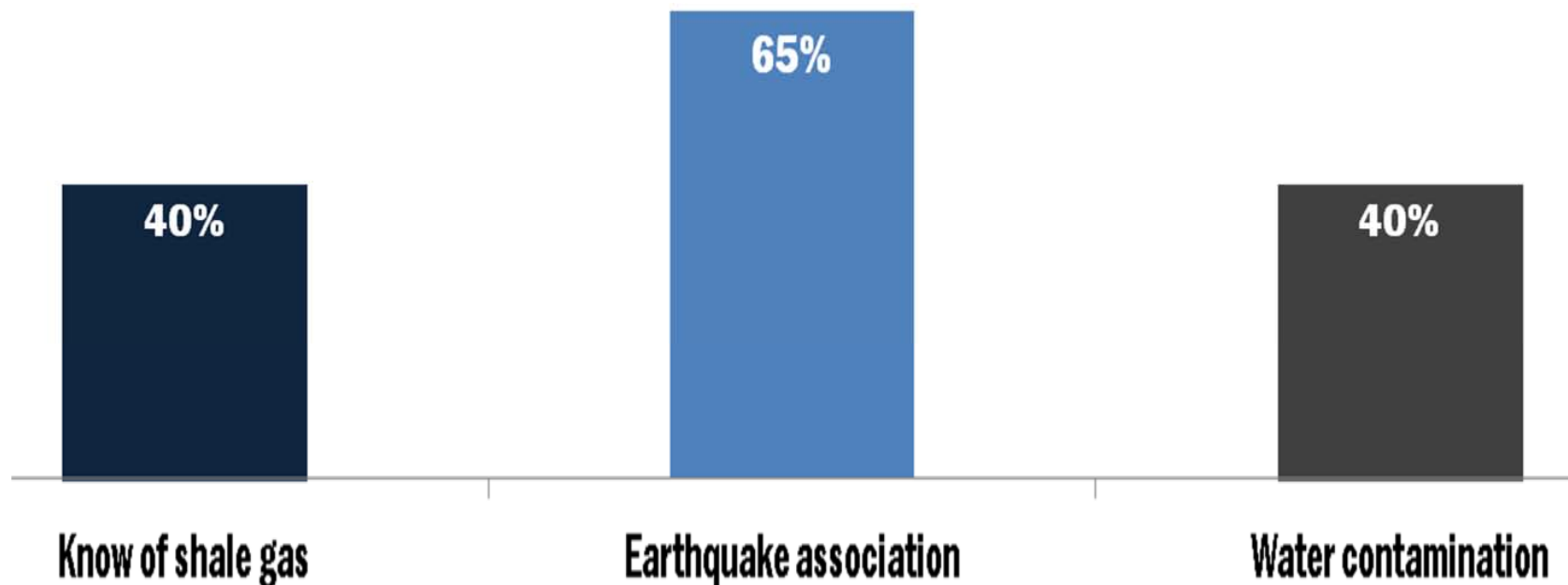
EU SHALE CHALLENGES: METHANE



FUGITIVE METHANE OFTEN OVERLOOKED

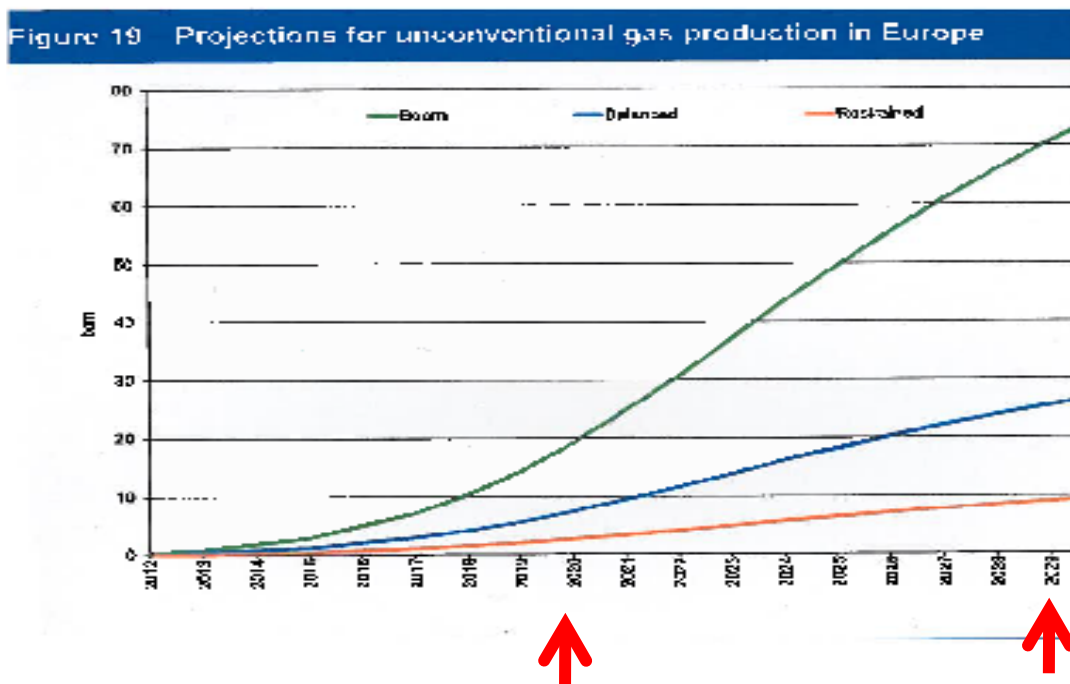
EU SHALE CHALLENGES: POLITICAL

YouGov/ University of Nottingham poll on shale gas
(17-19 June 2012, 2687 respondents)



BIG JOB OF MARKETING FOR SHALE PR

EU SHALE VOLUME OUTLOOK 2030 AND 2030



Source: Poyry/Ofgem

Green = Boom
Red = Restricted Growth

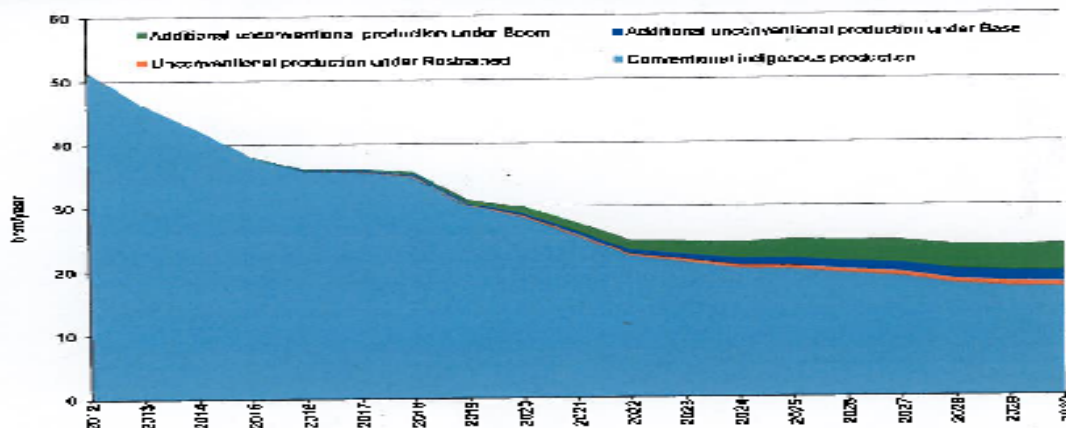
WITH POLAND DELAYED BOOM IS HIGHLY UNLIKELY

GB SHALE: VOLUME IMPACT – 2030 AND 2030

POYRY

THE IMPACT OF UNCONVENTIONAL GAS ON EUROPE

Figure 6: Declining conventional reserves and projected increased production from unconventional gas

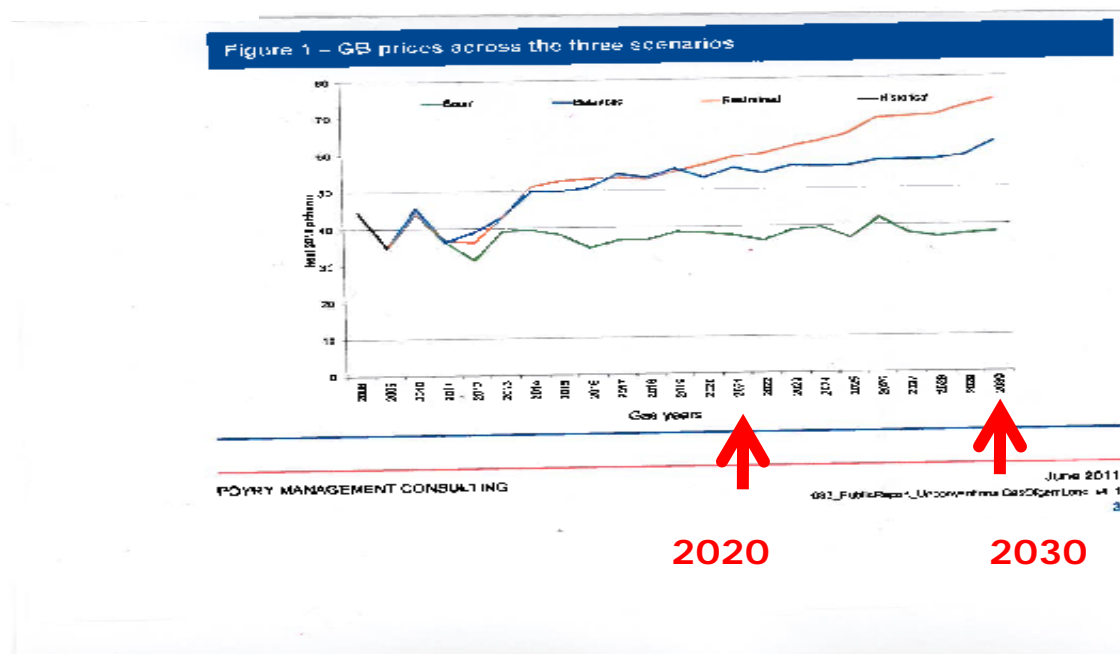


Green = Boom
Red = Restricted Growth

Source: Poyry/Ofgem

ONLY BOOM SCENARIO SUGGESTS MUCH IMPACT

GB SHALE: WHAT ABOUT THE PRICE?



2020

2030

Green = Boom
Red = Restricted Growth

Source: Poyry/Ofgem

PRICE ONLY DENTED IF SHALE BOOM

IF AMERICA CAN DO IT – WE CAN? (1)

<u>USA</u>	<u>GB</u>
(1) Industry got tax breaks and financial assistance.	Support focused on renewables. Brussels watches subsidies closely.
(2) Geography benefits: - Well head spread apart. - Pipe infrastructure very good.	Density and land issues are key factors. GB does have network unlike Poland.
(3) Ownership sits with landowner!	Ownership sits with Crown Estates.
(4) Federal and local regulation has been supportive.	GB has to be cognisant of: - New Water Directive. - REACH Directive. - New EIA rules.
(5) "Reliable supply at reasonable prices" (FERC).	"Economically recoverable potential" (EU).

DIFFERENT STARTING POINTS

BUT IF AMERICA CAN DO IT – WE CAN? (2)

- Win at court of public opinion.
- “Needs must”.
- Front up on real cost of local shale.
- Osborne on 7/10/2012 promises tax breaks.

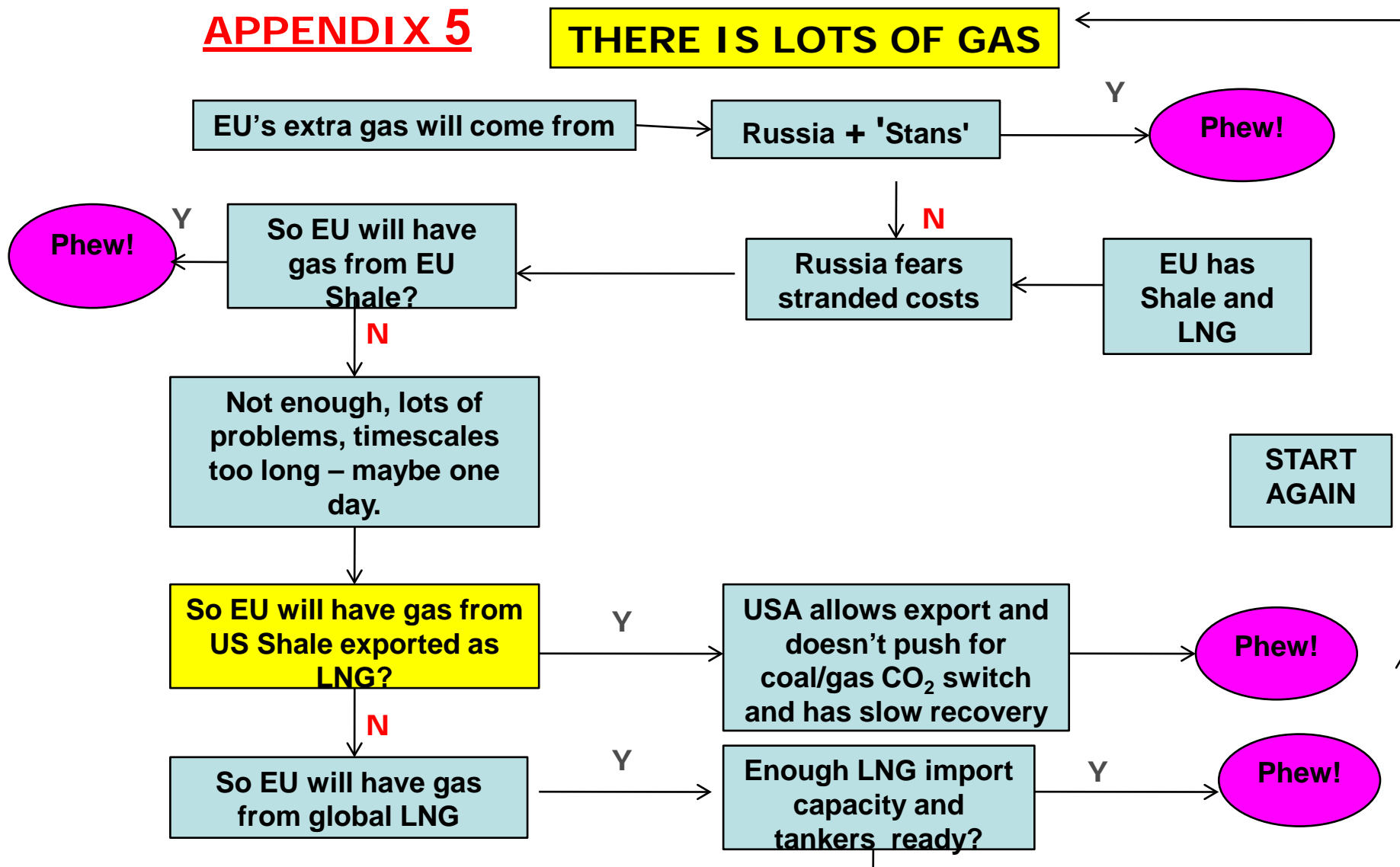
REMEMBER

- It took 10 years for US revolution.
- With “land rush” potential.
- And pioneering spirit.

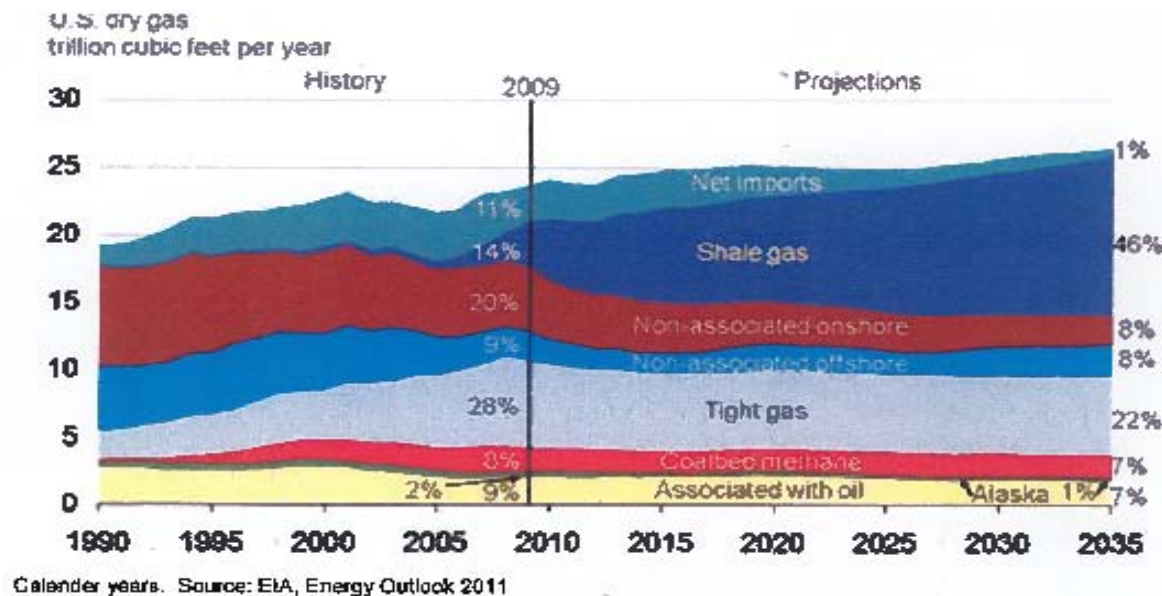
LOTS OF HURDLES – BY 2020??

APPENDIX 5

THERE IS LOTS OF GAS



US GAS SHALE GROWTH A DOMINANT TREND



Source: Poyry/Ofgem

14% TO 46% BY 2035 WILL BE FROM SHALE!

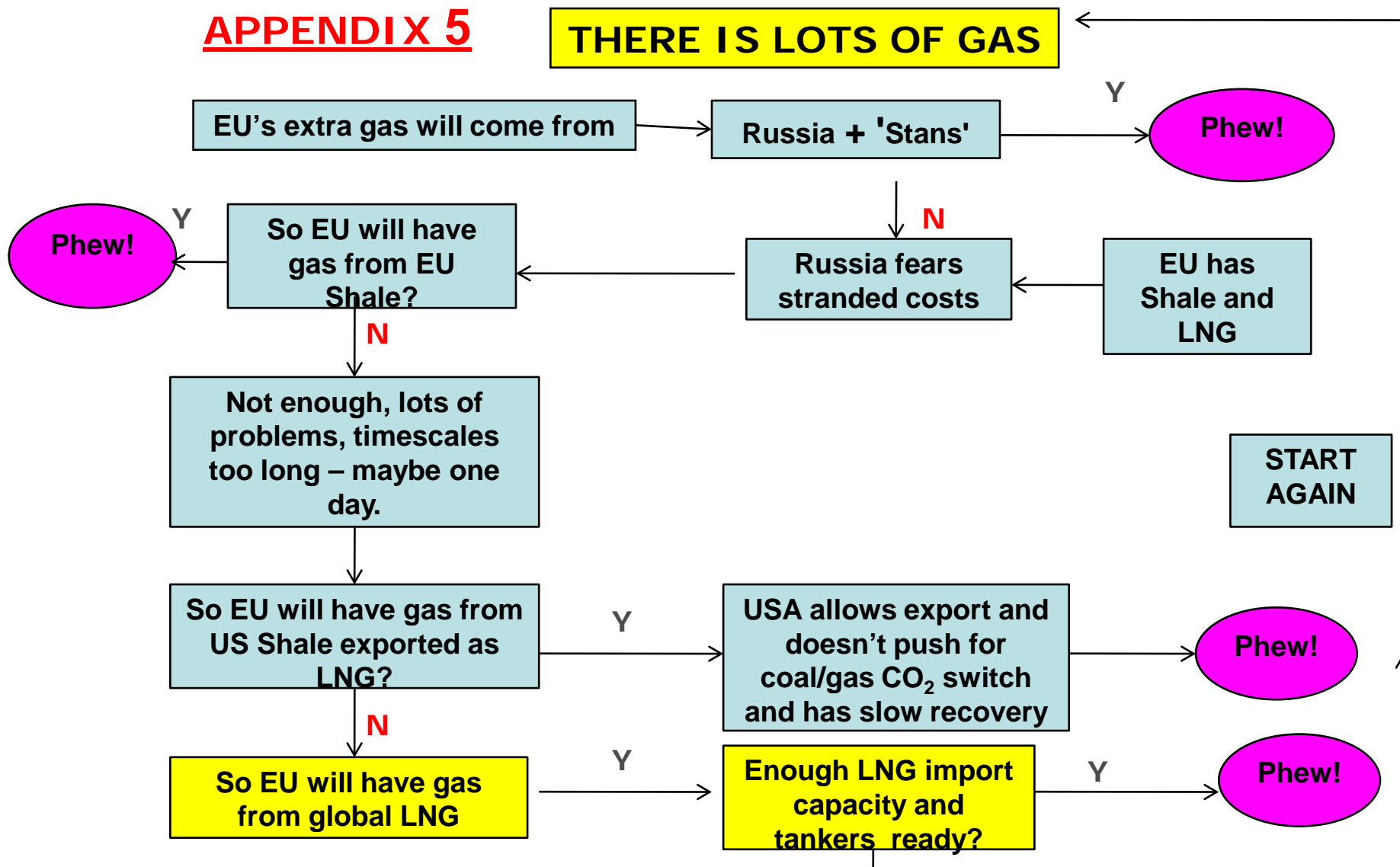
WILL US SHALE EVEN COME TO GB AND COST?

- Asian v GB/European price will determine destination.
- Political questions within USA: can it leave America at all.
- Industry supply profile within USA: pushing prices up now.
- GB pricing: .
 - GB – today gas 60p/th.
 - USA – today gas \$2.50 mmbtn.
 - All time low US gas price converts to delivered to GB at 60-70 p/th?
 - If medium term \$3-5 mmbtn are correct for USA this has implications ... 100p/th for GB?

WOULD USA DELIVERED SHALE GAS BE AFFORDABLE?

APPENDIX 5

THERE IS LOTS OF GAS

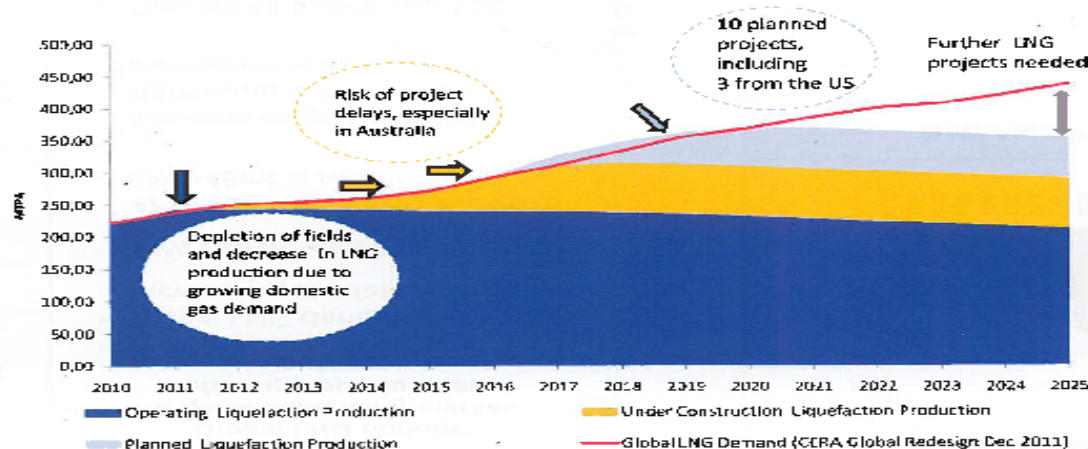


OUTLOOK FOR LNG TO 2020

Mid-term LNG outlook a market tightening beyond 2013

GDF SUEZ

Global LNG Supply and demand to 2025



- 2009-2011: Major increase in LNG production from Qatar and impact of 2008 crisis
- The global LNG market is expected to tighten around 2013-14, as Asian demand continues to increase
- Beyond 2016, new projects will need to come on stream

Source: CERA Global Redesign, Fall 2011, GDF SUEZ LNG

SOCIETE GENERALE LNG CONFERENCE - April 3, 2012

Source: GDF Suez

LNG DEMAND CONCERNS BY 2015?

OUTLOOK FOR LNG TO 2030



What about LNG supply ?



Source: Total

LNG DEMAND CONCERNS 2020-2030?

BOTTLENECK: AUSTRALIA – FIELDS DELAYED

Australian LNG estimate: 100 Mtpa in 2020



AUSTRALIA – LOOKS EXCITING

BOTTLENECK: AUSTRALIA – COSTS UP

Relative Est: Qatari \$3-6 mm btu.
Australia \$8-14 mm btu.

Absolute Est (A\$0'000 per tonne)

NW Shelf 2008	0.5
Pluto 2012	3.5
Gorgon 2014	2.8
Prelude 2017	3.2
Ichthys 2017	3.8

Sources: Berustein/Fitch/FT

DOES AUSTRALIA HOLD THE KEY TO 2015-20?

BOTTLENECK: REST OF WORLD

- East Africa – development stage.
- Southern Core South American – indigenous in decline.
- Qatar – North Field Moratorium.

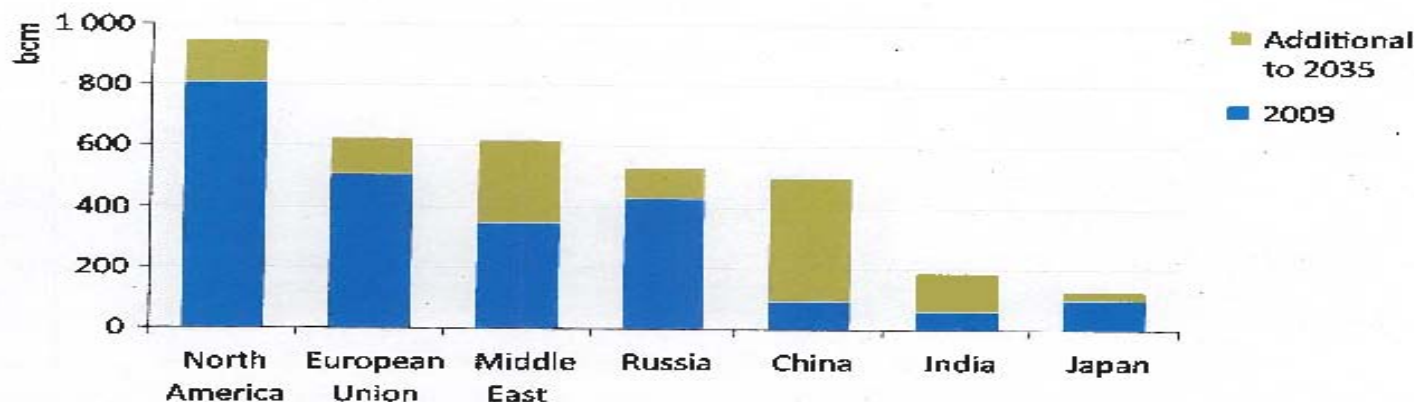
LOTS OF GAS – JUST TAKES TIME

GLOBAL DEMANDS FOR GAS IMPRESSIVE: COUNTRY

*Gas demand growth comes from
China, Middle East, India.....*

**WORLD 2
ENERGY 0
OUTLOOK 1**

Natural gas demand by selected region, 2009 and 2035



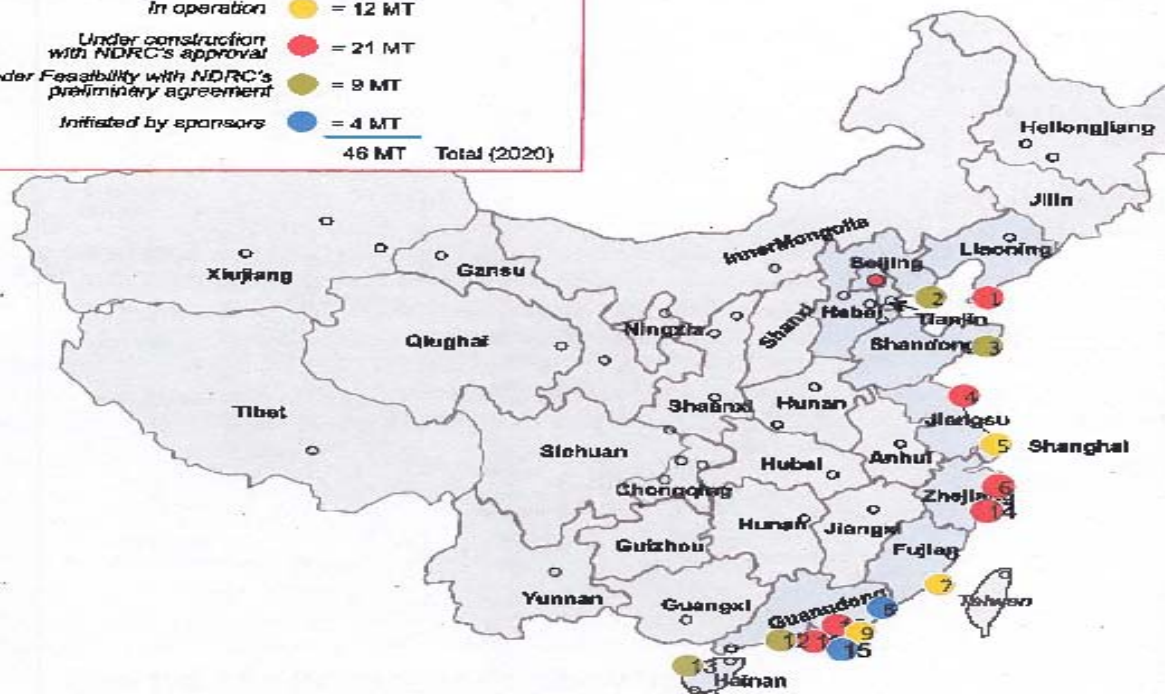
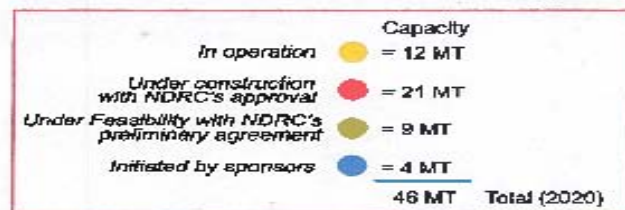
Gas demand grows fastest in the non-OECD regions, led by China, which accounts for more than a quarter of the worldwide increase in demand between 2009 & 2035

© OGD/IEA 2011

SOME KEY COUNTRIES ANNUAL GROWTH RATES +10%

APPETITE IN CHINA ALONE IS HUGE FOR LNG

China: LNG receiving Terminal Projects

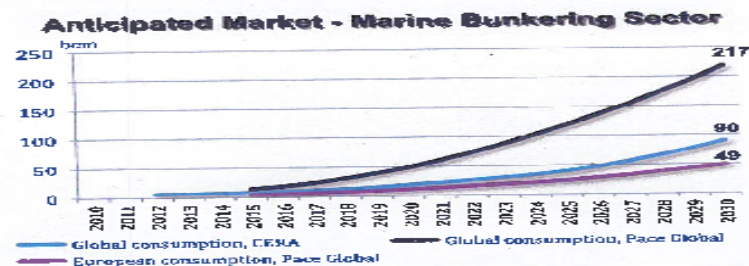


Location	Main owner
1. Dalian	PetroChina
2. Caofeidian	PetroChina
3. Qingdao	Sinopac
4. Rudong	PetroChina
5. Shanghai	CNOOC
6. Zhejiang Ningbo	CNOOC
7. Fujian	CNOOC
8. Shantou	CNOOC
9. Guangdong Dapeng	CNOOC
10. Shenzhen	CNOOC
11. Shenzhen Qichan Island	PetroChina
12. Zhuhai	CNOOC
13. Hainan LNG	CNOOC
14. Zhejiang Wenzhou	CNOOC
15. Shenzhen	PetroChina

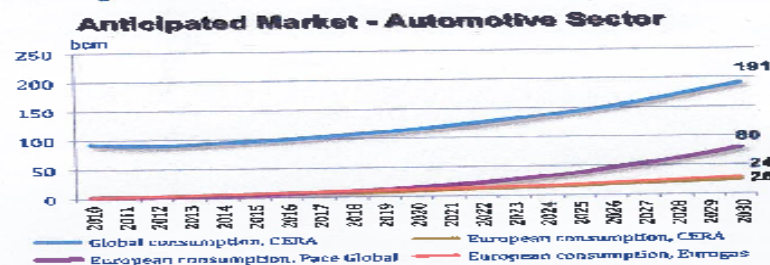
INFRASTRUCTURE NOT IN PLACE FOR CHINESE SHALE (YET)

NEW SECTORS USING LNG: NEW DEMAND

Natural Gas Demand Growth Potential by Sector



BUNKERING

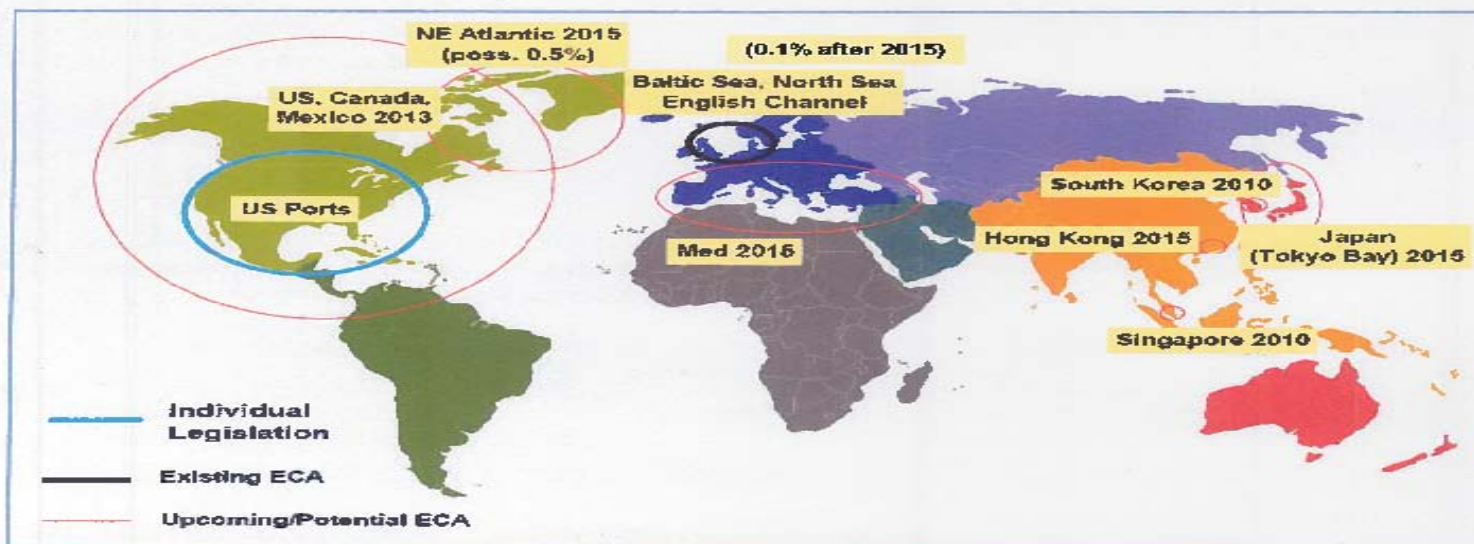


AUTOMOTIVE

DEMAND FOR LNG NOT JUST FROM POWER SECTOR

LNG BUNKERING WILL AFFECT DELIVERY

LNG Bunkering Will be Viable in Regions Implementing Strict Ship Emissions Standards



Source: Gazprom

HOW FAST WILL LNG BUNKERING MARKET DEVELOP?

LET'S DO A RE-CAP!

Britain needs Gas for generation 2012-2022 (40% rising to 60-70%).

SO:

Gas will come from:

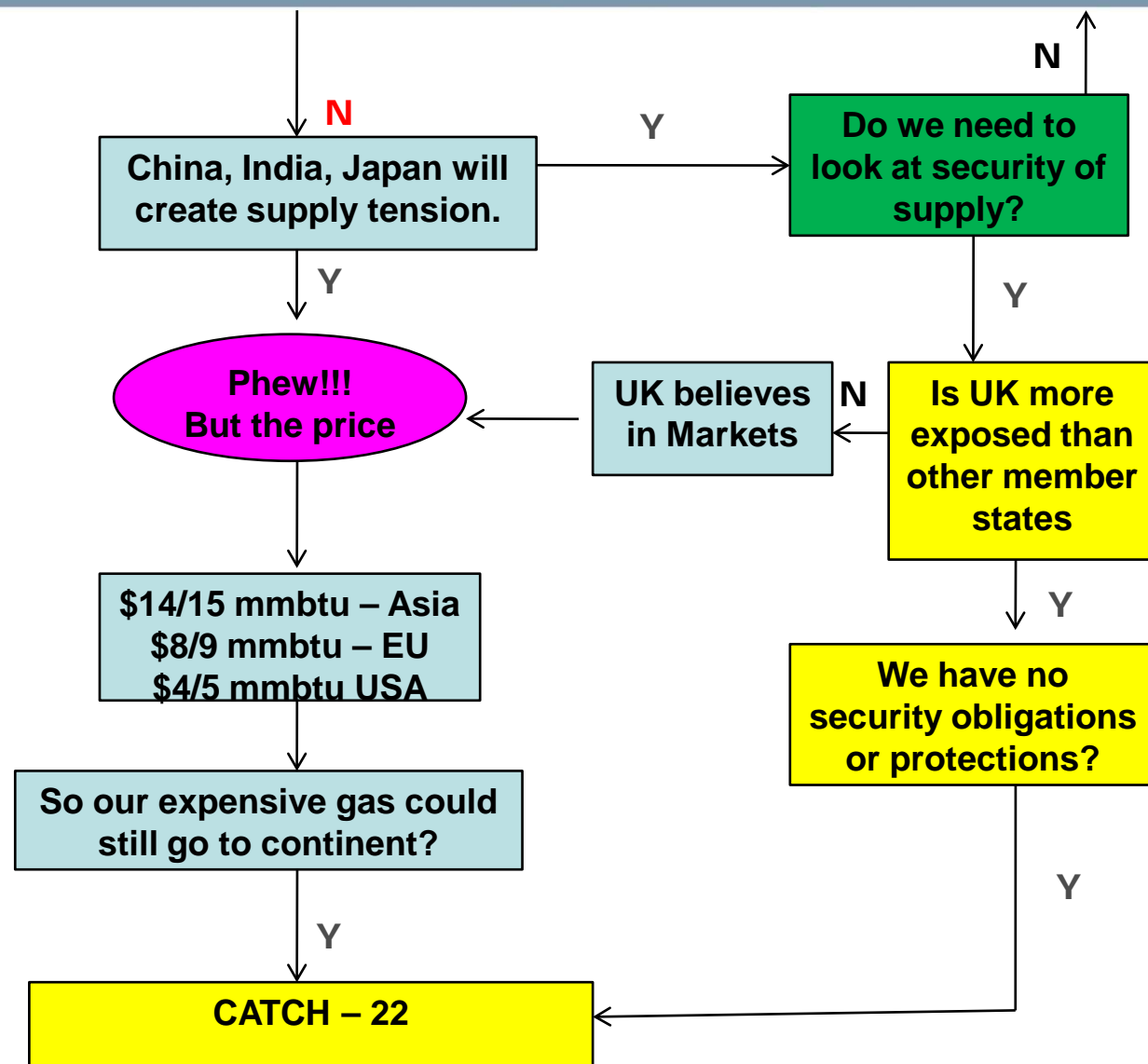
- Norway Yes.
- Russia/Stans Not as much as expected.
- EU Shale Minimal.
- GB Shale Minimal.
- US Shale Minimal.
- LNG
 - Bottleneck supply.
 - Lots of demand.
 - Transport demand.
 - Lorries demand.
 - Shipping shortages.
 - New LNG rules.

FORTUNATELY GB HAS BUILT LNG HUB

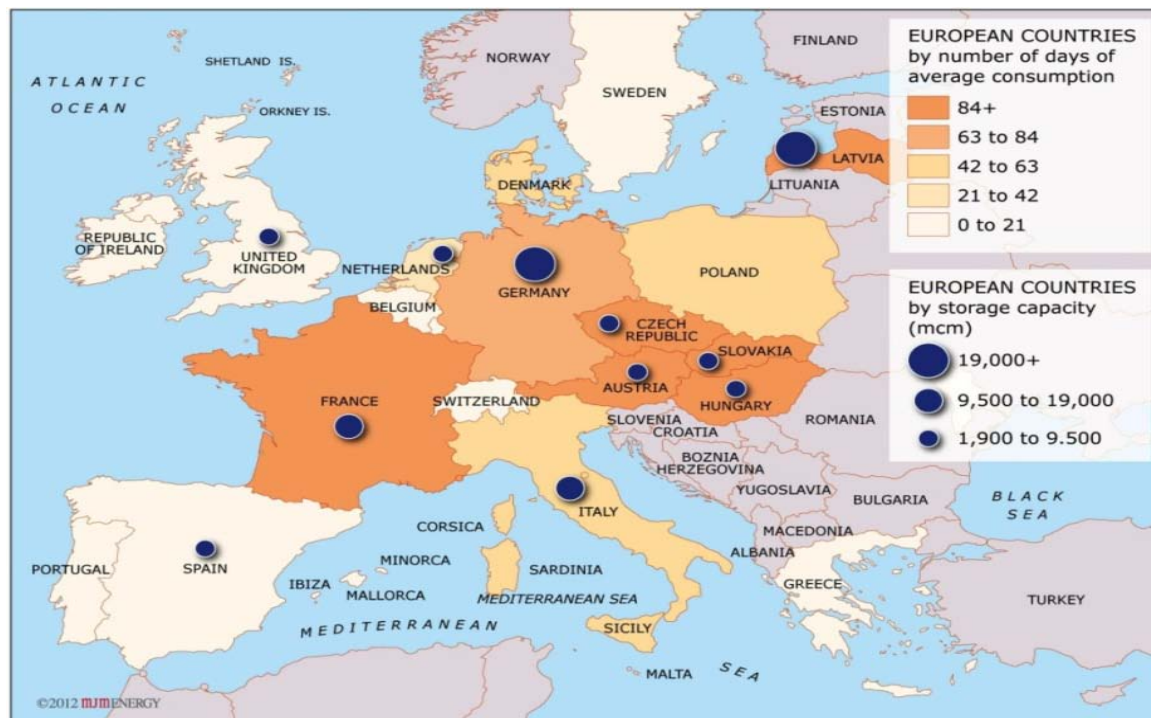
THE LNG WE NEED?

- GB is a gas hub.
- In 2012/13 NG estimated 80/439 mcm/d LNG.
- Exported 16bcm in 2011.

OPTIONALITY ON GAS LANDED IN GB



CAN WE STORE GAS? (1)



Source: MJM Energy Research

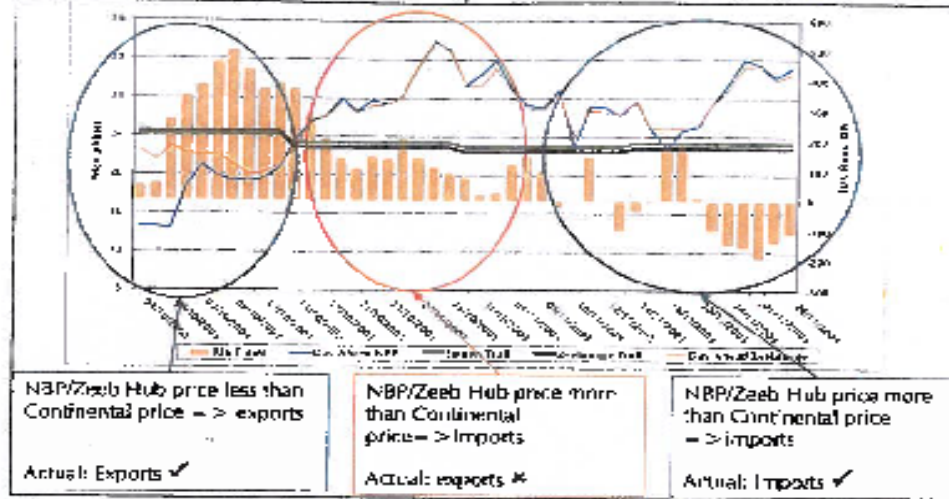
OF 100BCM IN GB – ONLY 4BCM STORAGE!

WHAT ARE THE “MUST WINS” FOR STORAGE?

- (1) Speed of delivery.
- (2) Cost/Subsidy.
- (3) Planning/Access/Feasibility.
- (4) Passing the rules:
 - EU Environmental.
 - REMIT impact.
 - New guidelines.

STORAGE IS NOT STRAIGHTFORWARD

WILL EUROPE /MARKETS HELP US OUT? (1)

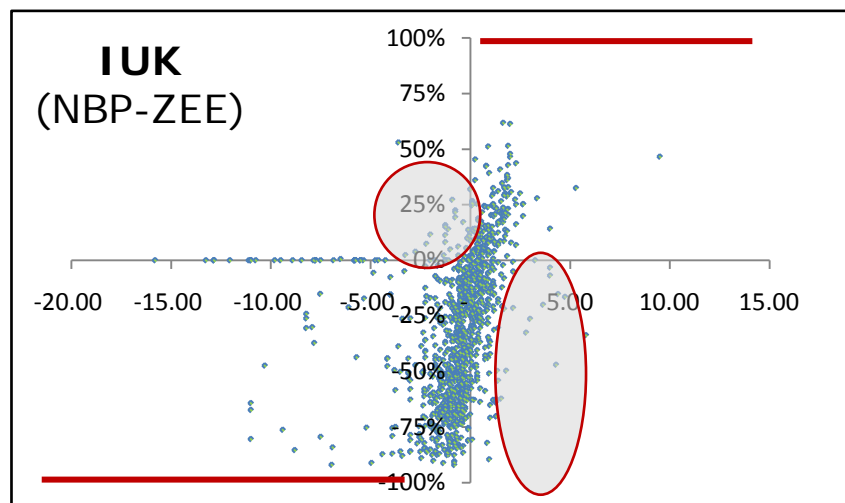


Source: Ofgem

LANDMARK ENQUIRY BY OFGEM IN 2005

ARBITRAGE FAILED IN 2004/05

WILL EUROPEAN /MARKETS HELP US OUT? (2)



- Between 2009-2011 **gas flowed into the right direction during 71% of days**
- **Average utilisation over this period: 38%**

Source: Ofgem

WERE FLOWS OF GAS WRONG 30% OF TIME?

WILL EUROPEAN MARKETS HELP US OUT? (3)

IUK and BBL interactions

- BBL transported gas from NL to GB on 362 days in 2011
- IUK exported gas from GB to Belgium on 302 of these days
- **Question: what happened between NL and Belgium on those days?**
Are we observing loop flows?



Source: Ofgem

LOOP FLOWS BETWEEN COUNTRIES – NEED ANSWERS

RECAP ON KEY EU MARKET FEATURES (1)

- Incumbants dominate.
- LTC's dominate (oil/gas index).
- Key outside supply parties dominate.
- Barely any spare capacity on key routes i.e. non-contracted.

Source: Ofgem

RELYING ON MARKETS BEING FLEXIBLE IS HARD

RECAP ON KEY EU MARKET FEATURES (2)

- Art 194: member states have self-determination in energy.
- Art 193: member states can set tougher local environmental laws.
- Virtually every member state – except GB – has a form of override in form of PSO: 4 forms of PSO being used by EU Governments.

GB HAS NO PSO (PUBLIC SERVICE OBLIGATION)

CONCLUSION (1) GOOD NEWS

"ADVISORS' ADVISE"

- Ofgem:
- Project Discovery (Oct '09, Feb '10)
 - Poyry Gas Shale (June '11)
 - Capacity Report (Electricity of Supply with NG) (Oct '12)
 - Gas Market Report (Gas Security of Supply) (End 2012)
 - Gas Interconnector enquiry (starts Sept 2012)

MINISTERS DECIDE

- DECC:
- Energy Bill (end 2012)
 - Gas Generation Strategy (end 2012)

COALITION GOVERNMENT HAS ACTED ON INFO

CONCLUSION (2) GOOD NEWS

- Do you think anything needs to be done to promote power station capacity in period 2012-22?
- Do you think anything needs to be done to ensure gas security of supply?
- If yes to both/either of above – what?

FOR POLICY OPTIONS – NEXT PAGE

OPTIONS

<u>ELECTRICITY</u>	<u>GAS</u>
(1) Capacity credit?	(1) Public service supply obligation?
(2) Long term contracts (CFD's)?	(2) Storage (Assisted Market, Regulated or Straight?)
(3) Carbon taxes (CT, EUETS, EPS)?	(3) Sharper market signals (DSR, cash-out)?
(4) Renewables subsidies?	(4) Strategic solutions?
(5) Review international agreements (LCPD, IED, Durban)?	(5) Interconnector flow management?
(6) Keep coal – refuse gas (some of climate change lobby)?	(6) Support new sources urgently? Subsidies? -Norway? (Statoil Hydro: Oct 2012) - Shale? (Osborne: Oct 2012)
(7) Demand.	

BIG DECISIONS FOR HMG