

BLOOMBERG NEW ENERGY FINANCE SUMMIT

NEW YORK

23 APRIL 2013

Michael Liebreich, Chief Executive
Bloomberg New Energy Finance

Twitter: @miebreich

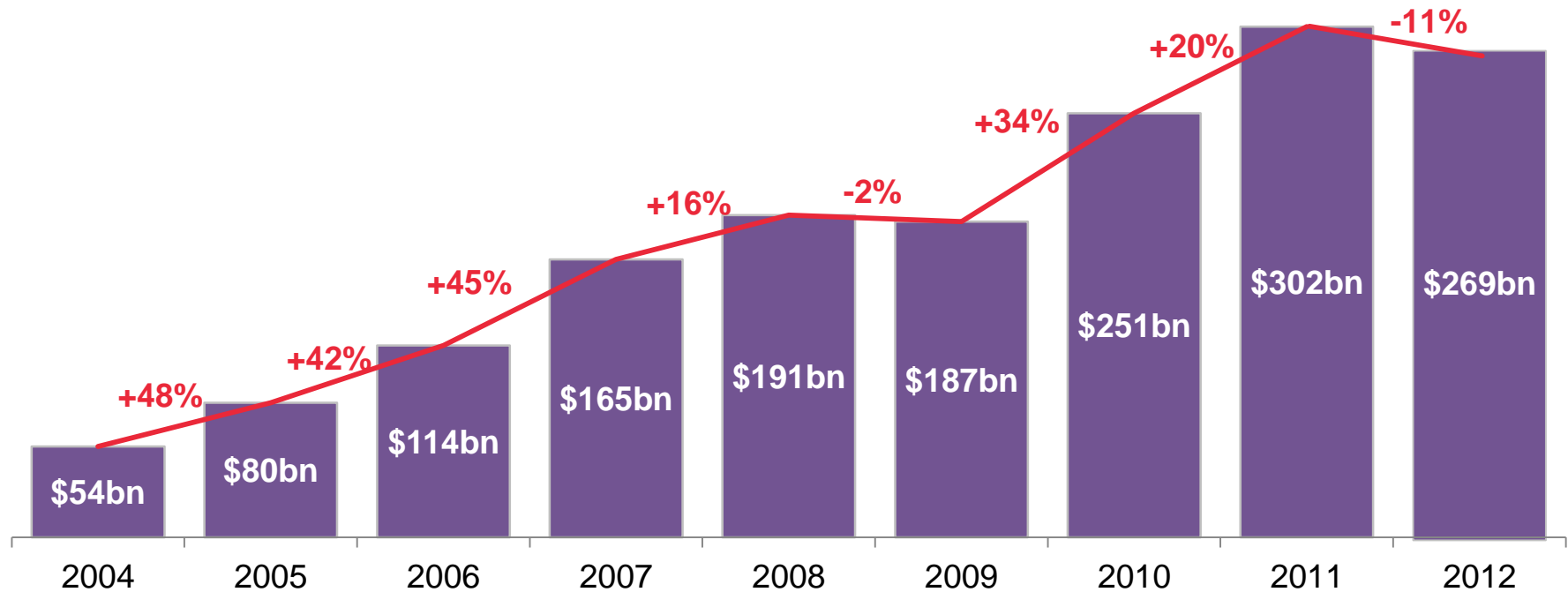


Bloomberg
NEW ENERGY FINANCE

AGENDA

1. Clean energy investment update
2. Four energy realities
3. New Energy ROI

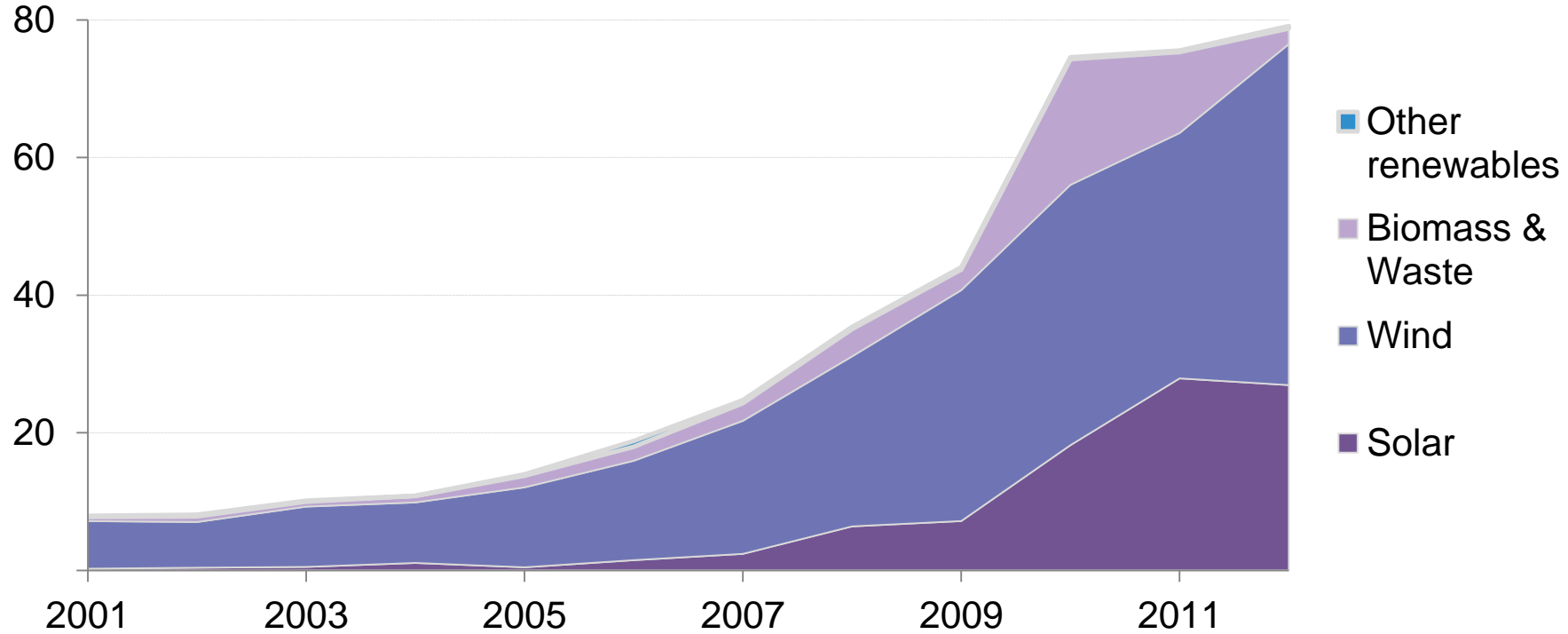
GLOBAL TOTAL NEW INVESTMENT IN CLEAN ENERGY, 2004-2012 (\$BN)



Note: Includes corporate and government R&D, and small distributed capacity. Adjusted for re-invested equity. Does not include proceeds from acquisition transactions

Source: Bloomberg New Energy Finance

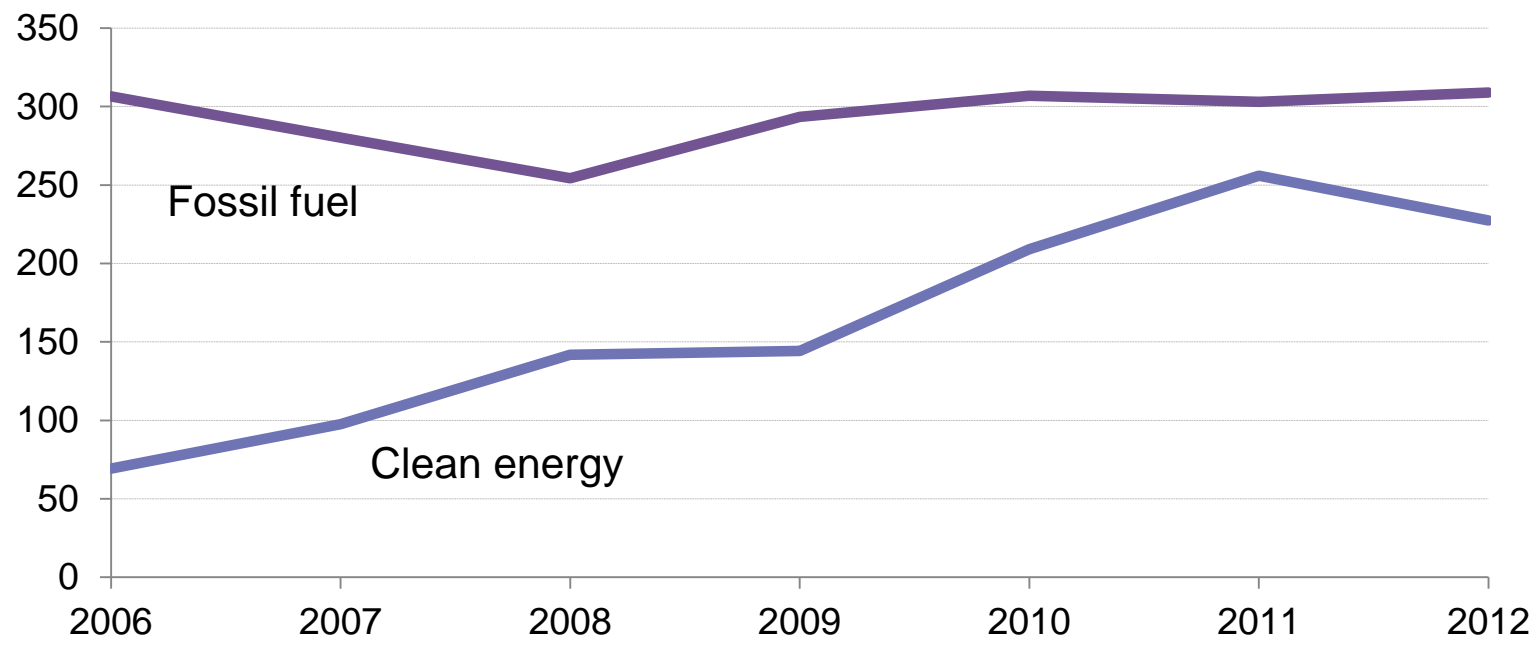
GLOBAL RENEWABLE CAPACITY ADDITIONS (GW)



Note: "Other renewables" includes marine and geothermal power only.

Source: Bloomberg New Energy Finance

CLEAN VS FOSSIL-BASED GENERATING CAPACITY INVESTMENT, 2006–12 (\$BN)



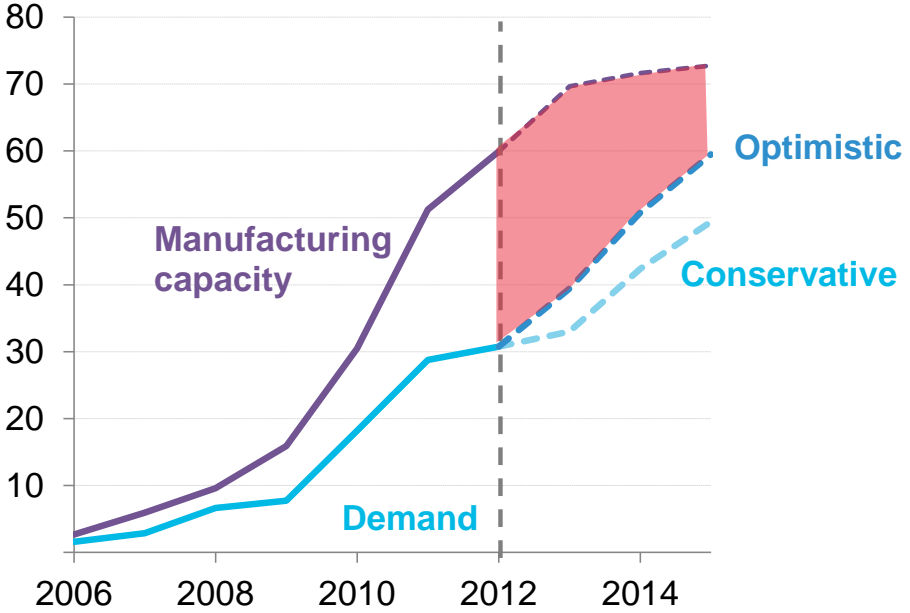
Note: Clean energy total excludes large hydro. Fossil fuel is investment on coal and gas capacity. We assume capacity retirement of 3.3%/yr for coal and 4%/yr for gas.

Source: Bloomberg New Energy Finance

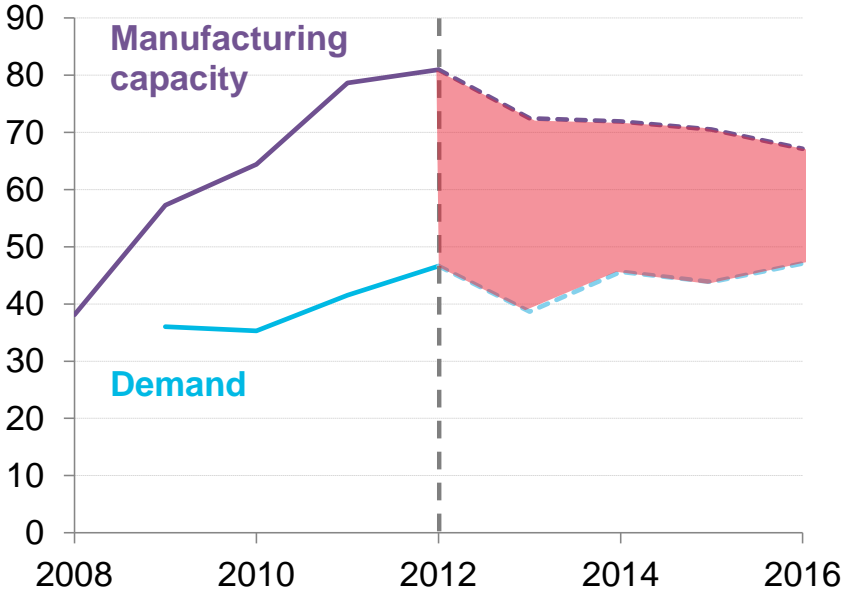


EQUIPMENT SUPPLY AND DEMAND, 2006-2015 (GW)

SOLAR



WIND

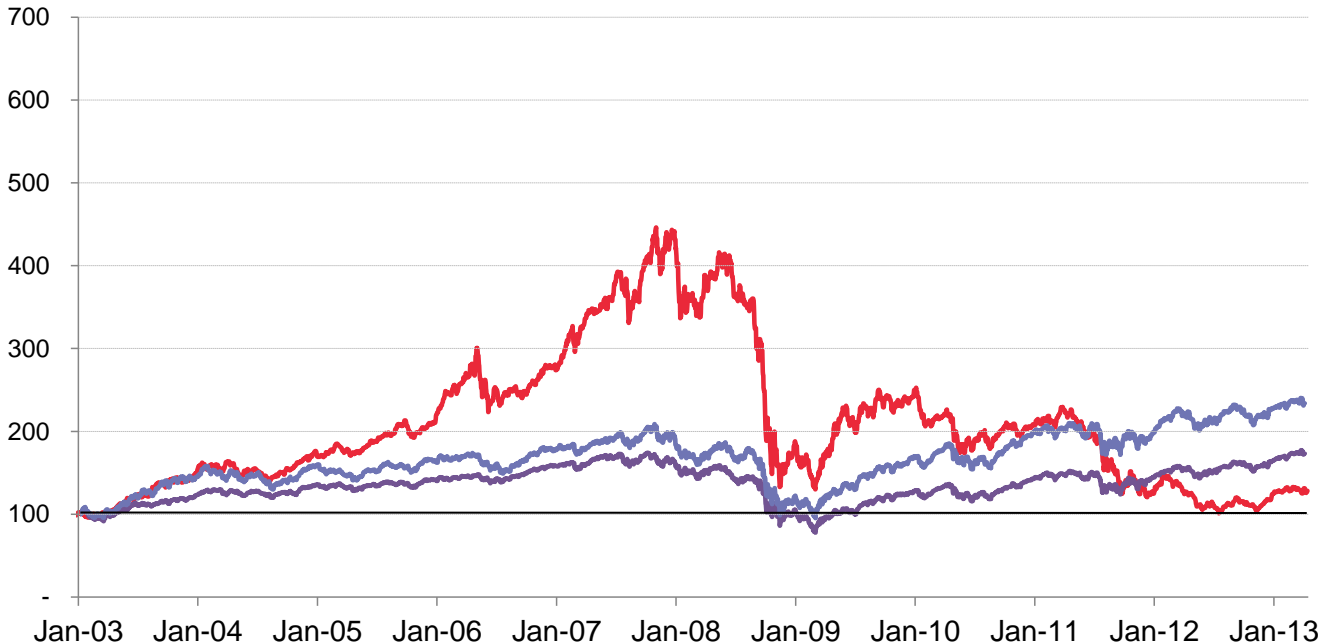


Note: Supply scenarios based on continued 2012 utilisation rates.

Source: Bloomberg New Energy Finance

NEX CLEAN ENERGY INDEX 2003 – 2013 YTD

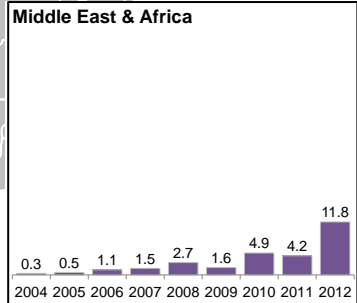
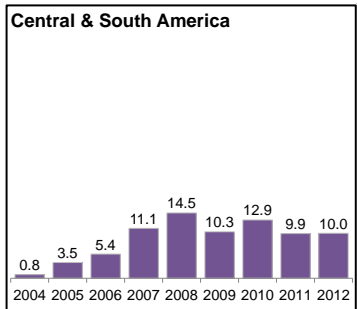
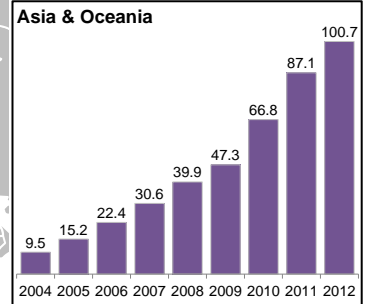
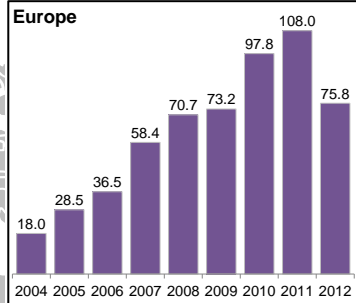
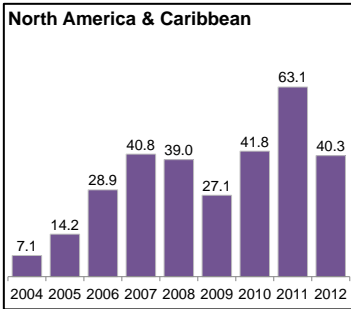
- █ NEX
- █ NASDAQ
- █ S&P 500



Note: Values as of 10 April 2013; NASDAQ and S&P 500 rebased to 100 on 01 Jan 2003

Source: Bloomberg New Energy Finance

NEW INVESTMENT IN CLEAN ENERGY BY REGION, 2004-2012 (\$BN)



Note: Excludes corporate and government R&D

Source: Bloomberg New Energy Finance

US 2012 – THE CLEAN ENERGY ELECTION

*Solyndra! Solyndra!
Solyndra!*



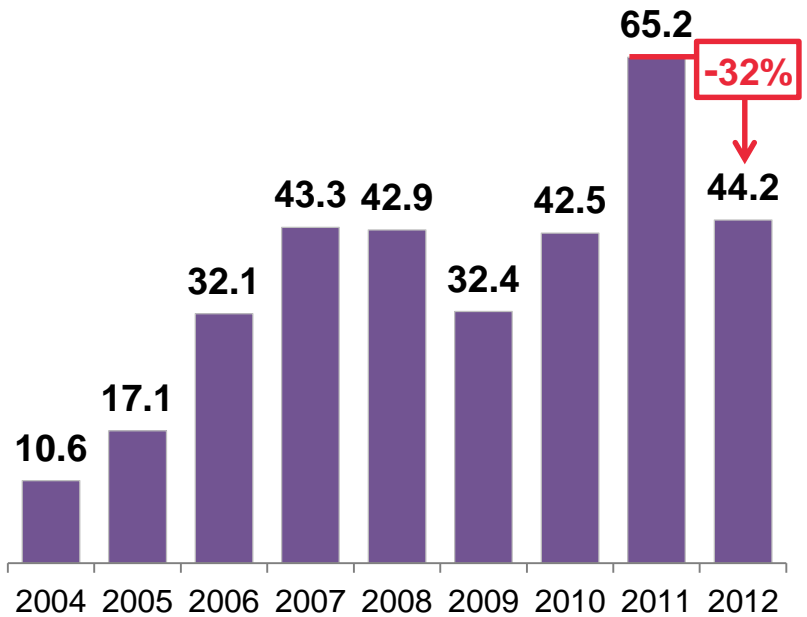
*I'm going to renew the wind
Production Tax Credit!*



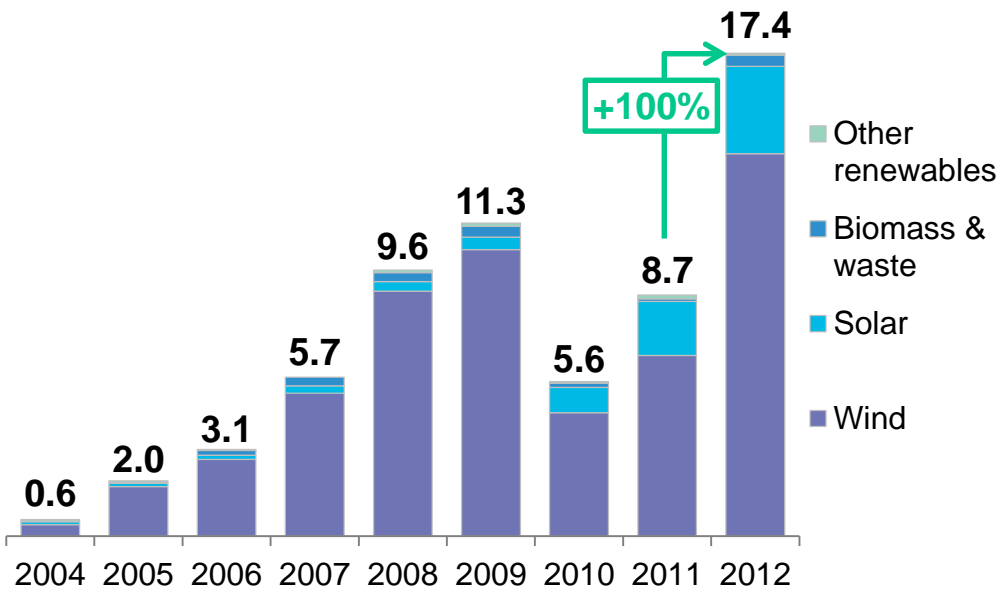
Pictures: Bloomberg

US ANNUAL CLEAN ENERGY INVESTMENT AND CAPACITY ADDITIONS, 2004-2012

TOTAL INVESTMENT, \$BN



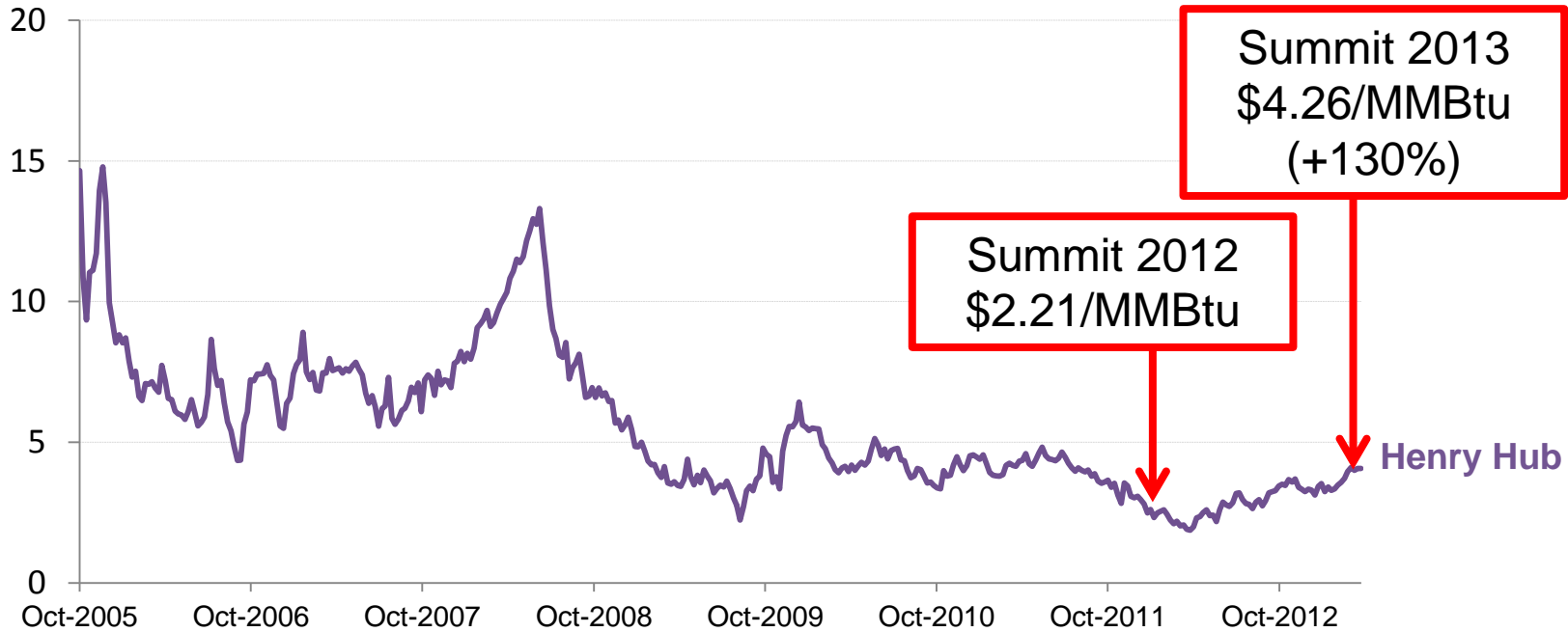
CAPACITY, GW



Source: Bloomberg New Energy Finance

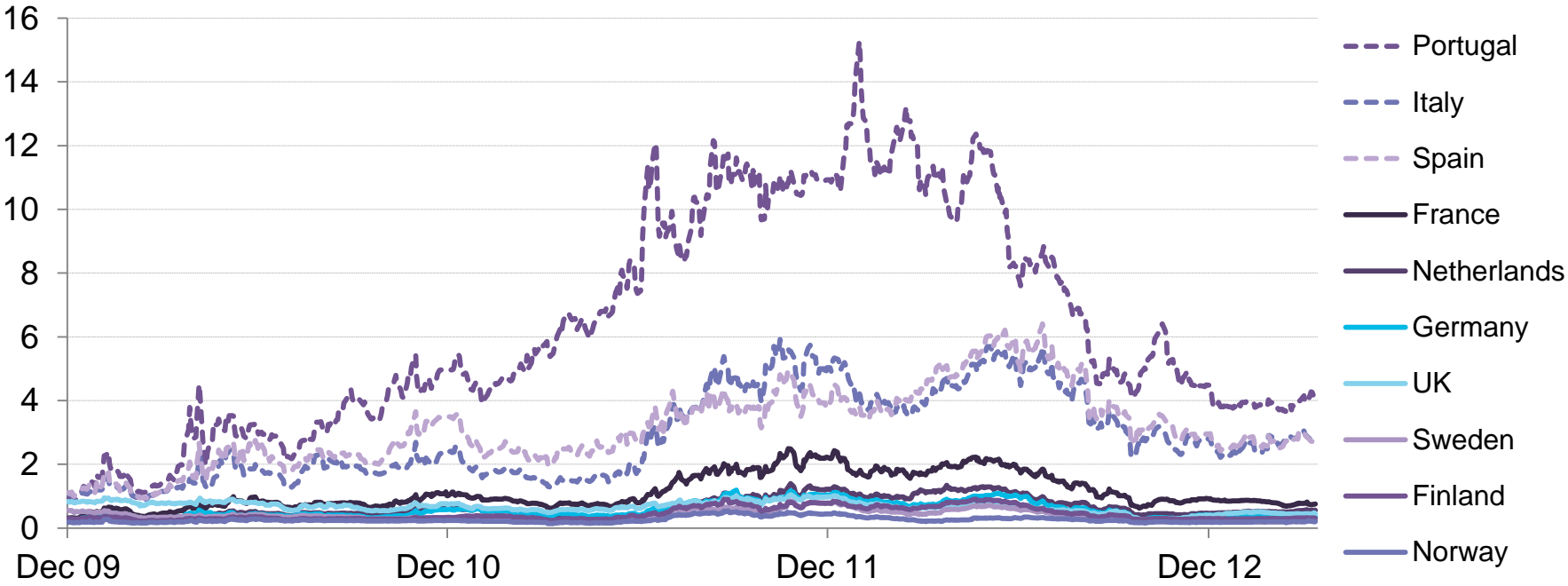
HENRY HUB GAS PRICE

(\$/MMBTU)



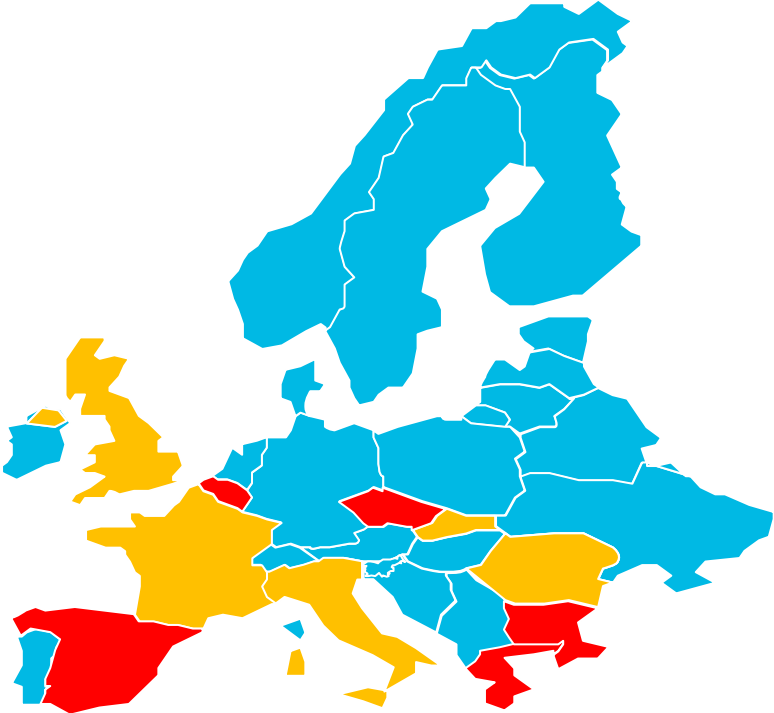
Source: Bloomberg Terminal

EUROPEAN CREDIT DEFAULT SWAP SPREADS, 2009-12



Source: Bloomberg Terminal

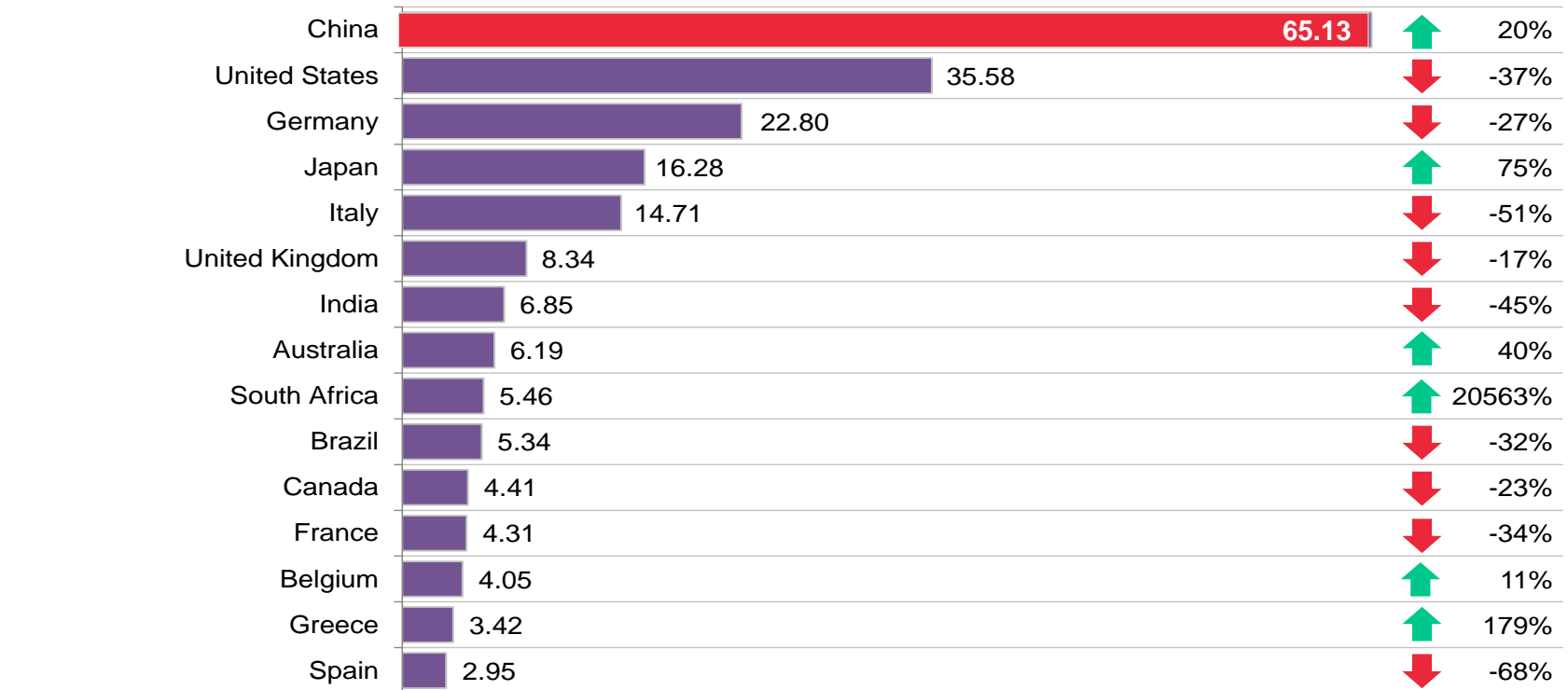
EUROPE - POLICY UNCERTAINTY



- Retroactive changes
- Unplanned reduction

Source: Bloomberg New Energy Finance

TOP 15 COUNTRIES FOR NEW INVESTMENT IN CLEAN ENERGY IN 2012 AND % CHANGE ON 2011 (\$BN)



Note: Excludes corporate and government R&D

Source: Bloomberg New Energy Finance

SUPPLY CHAIN CONSOLIDATION



SUNTECH

NEW ENERGY REALITIES

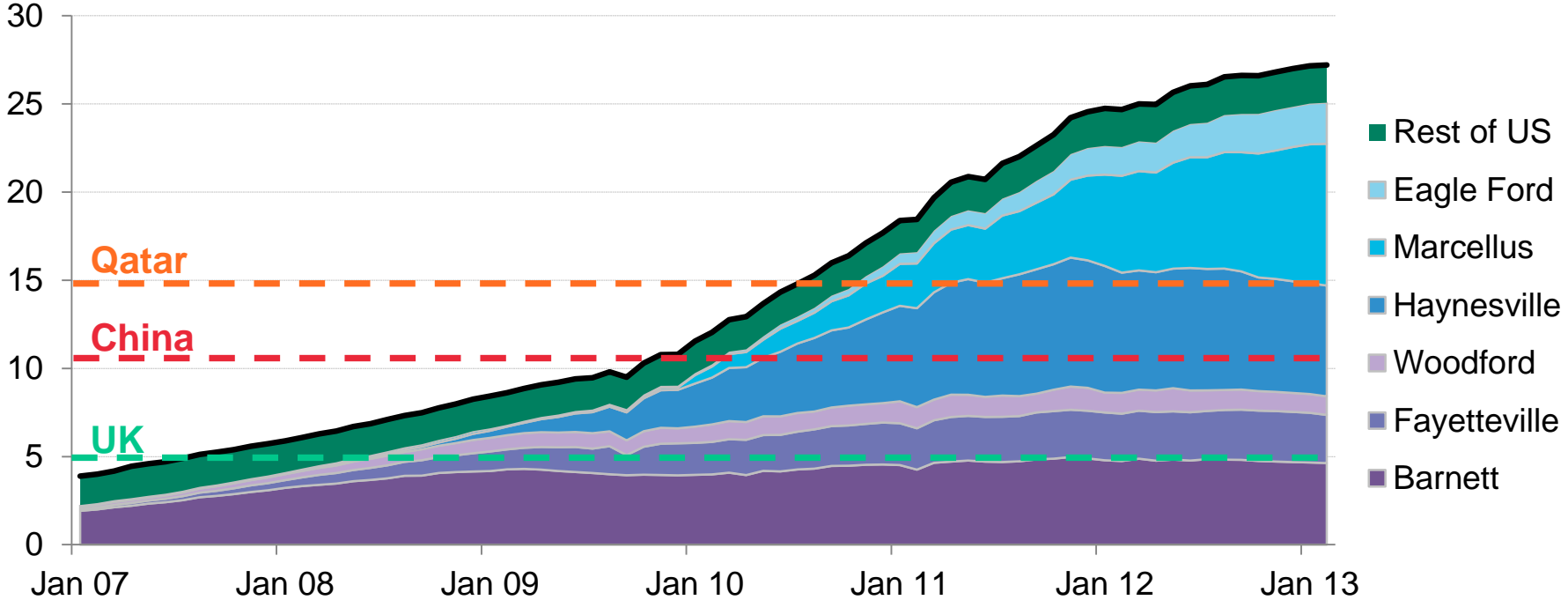
1. Unconventional oil and gas

2. Improving energy intensity

3. Cheap clean energy

4. Unpredictability

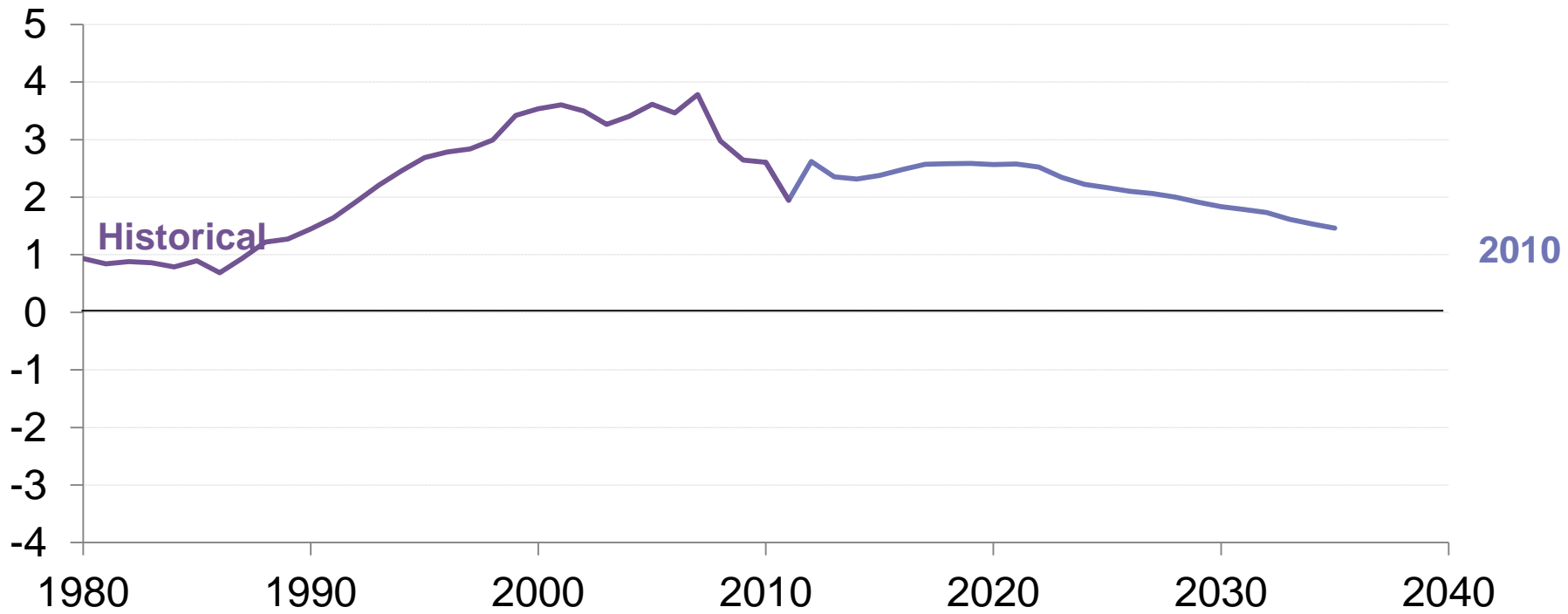
US SHALE GAS PRODUCTION (BCF PER DAY)



Source: Bloomberg New Energy Finance, US EIA, UK DECC, China Customs, BP Statistical Review

US PROJECTED NET IMPORTS OF NATURAL GAS, 2008-20

TRILLION CUBIC FEET

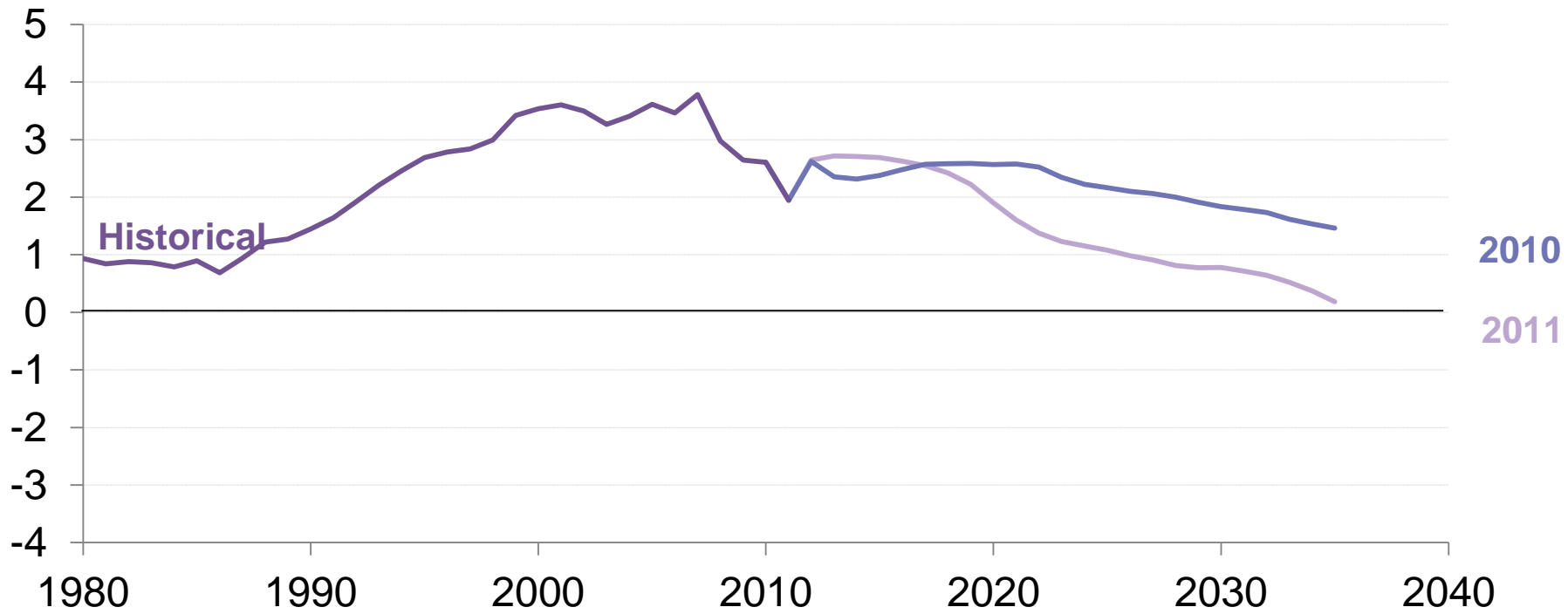


Note: 2013 figures show Early Release

Source: US EIA Annual Energy Outlook, 2010-2013;
Bloomberg New Energy Finance

US PROJECTED NET IMPORTS OF NATURAL GAS, 2008-20

TRILLION CUBIC FEET

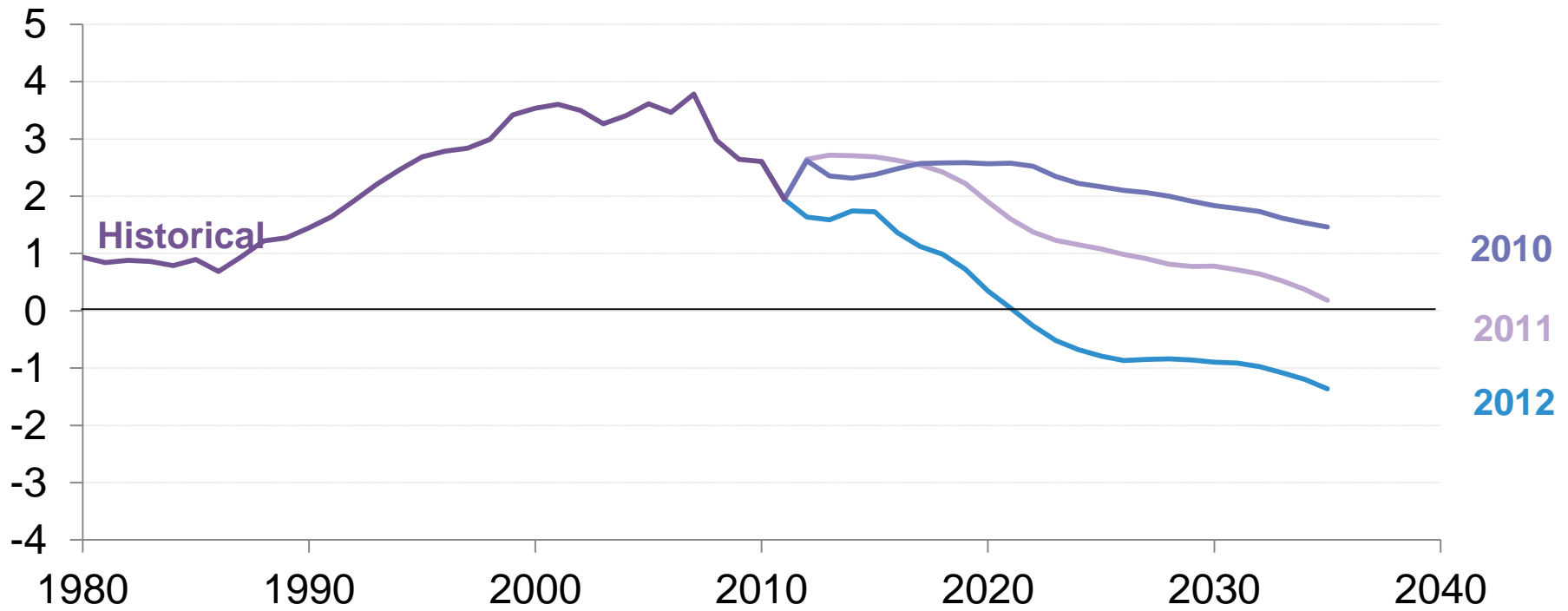


Note: 2013 figures show Early Release

Source: US EIA Annual Energy Outlook, 2010-2013;
Bloomberg New Energy Finance

US PROJECTED NET IMPORTS OF NATURAL GAS, 2008-20

TRILLION CUBIC FEET

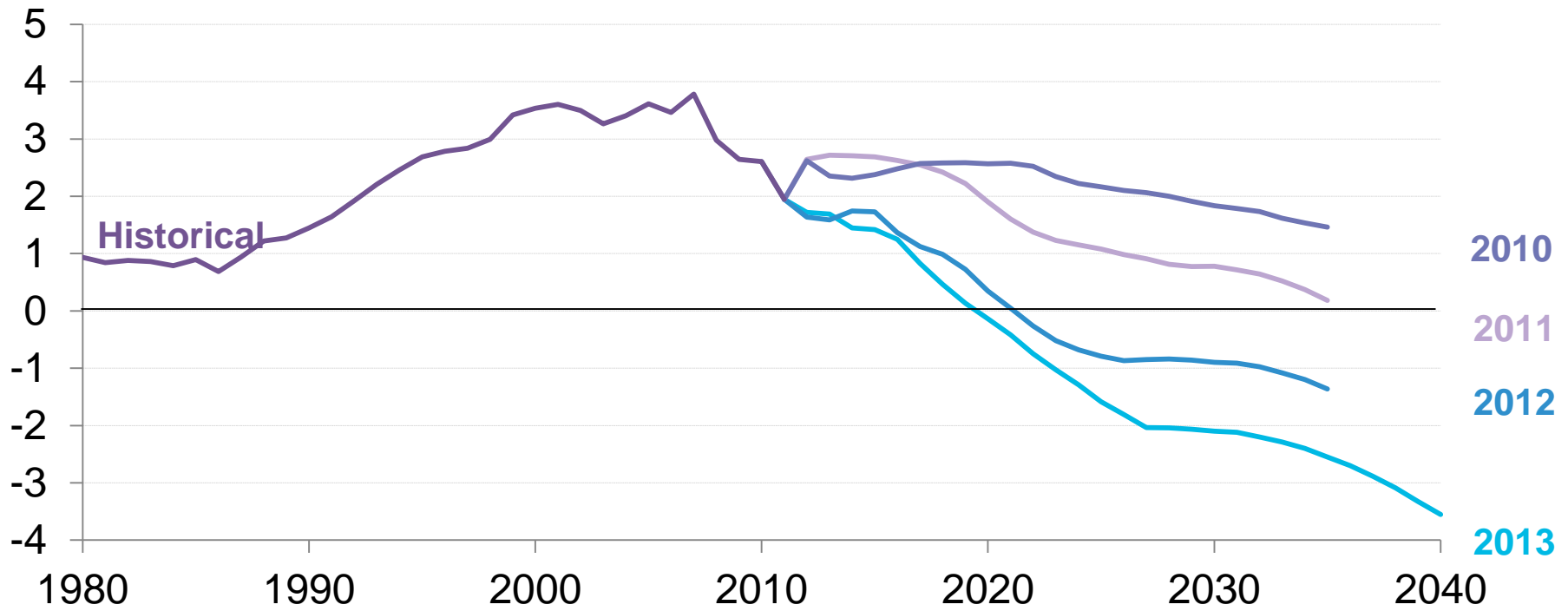


Note: 2013 figures show Early Release

Source: US EIA Annual Energy Outlook, 2010-2013;
Bloomberg New Energy Finance

US PROJECTED NET IMPORTS OF NATURAL GAS, 2008-20

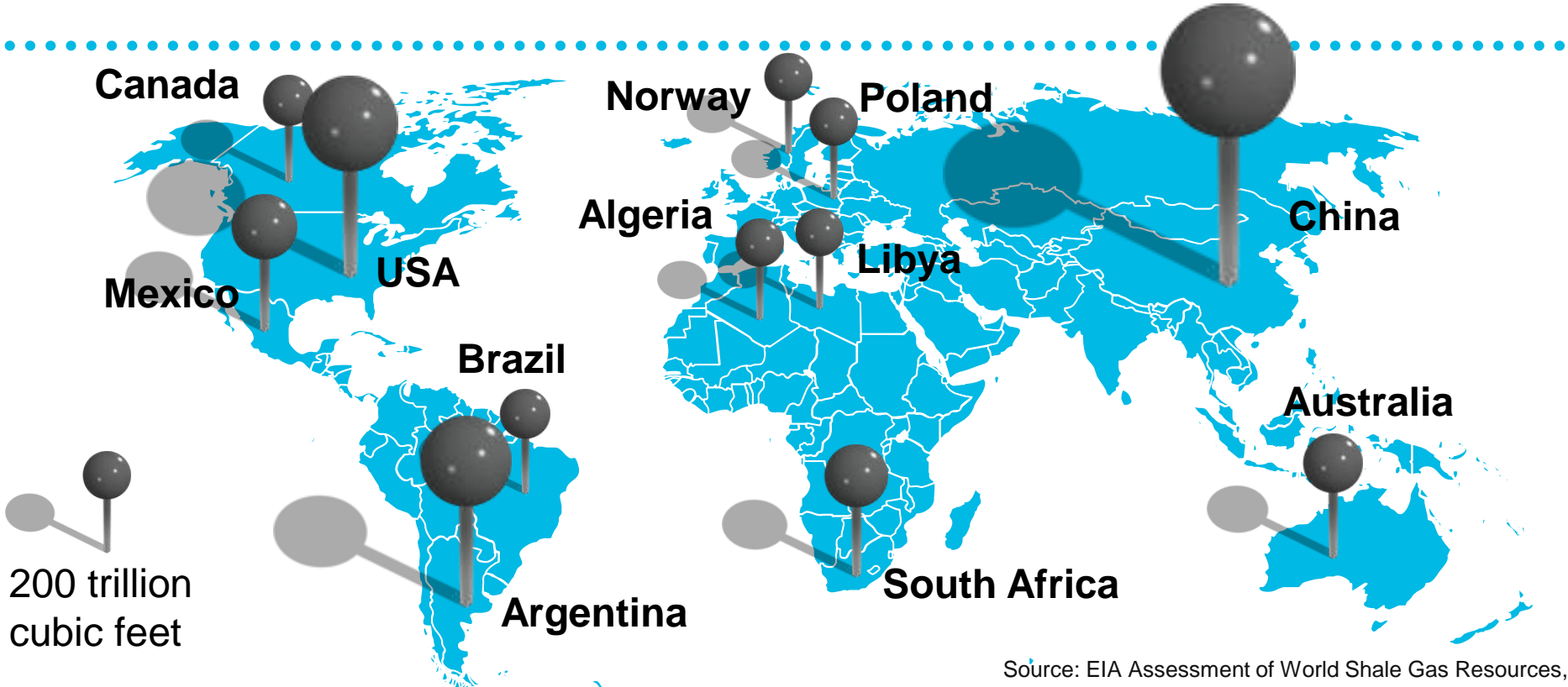
TRILLION CUBIC FEET



Note: 2013 figures show Early Release

Source: US EIA Annual Energy Outlook, 2010-2013;
Bloomberg New Energy Finance

MAJOR GLOBAL SHALE FIELDS



Note: Technically recoverable shale gas resources shown

Source: EIA Assessment of World Shale Gas Resources, April 2011

UK SHALE GAS

“

The extraordinary windfall, which is completely God-given, that this country has got is shale gas.

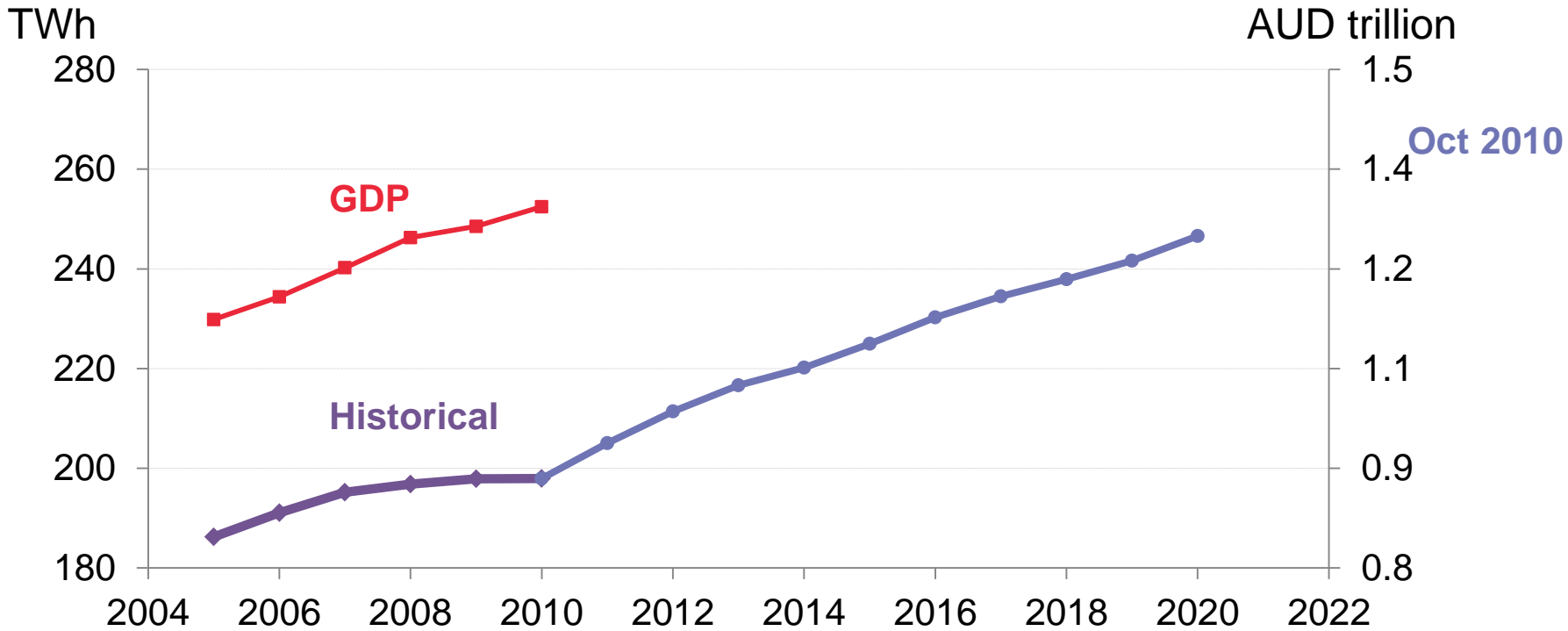
”

Owen Paterson
UK Environment Secretary



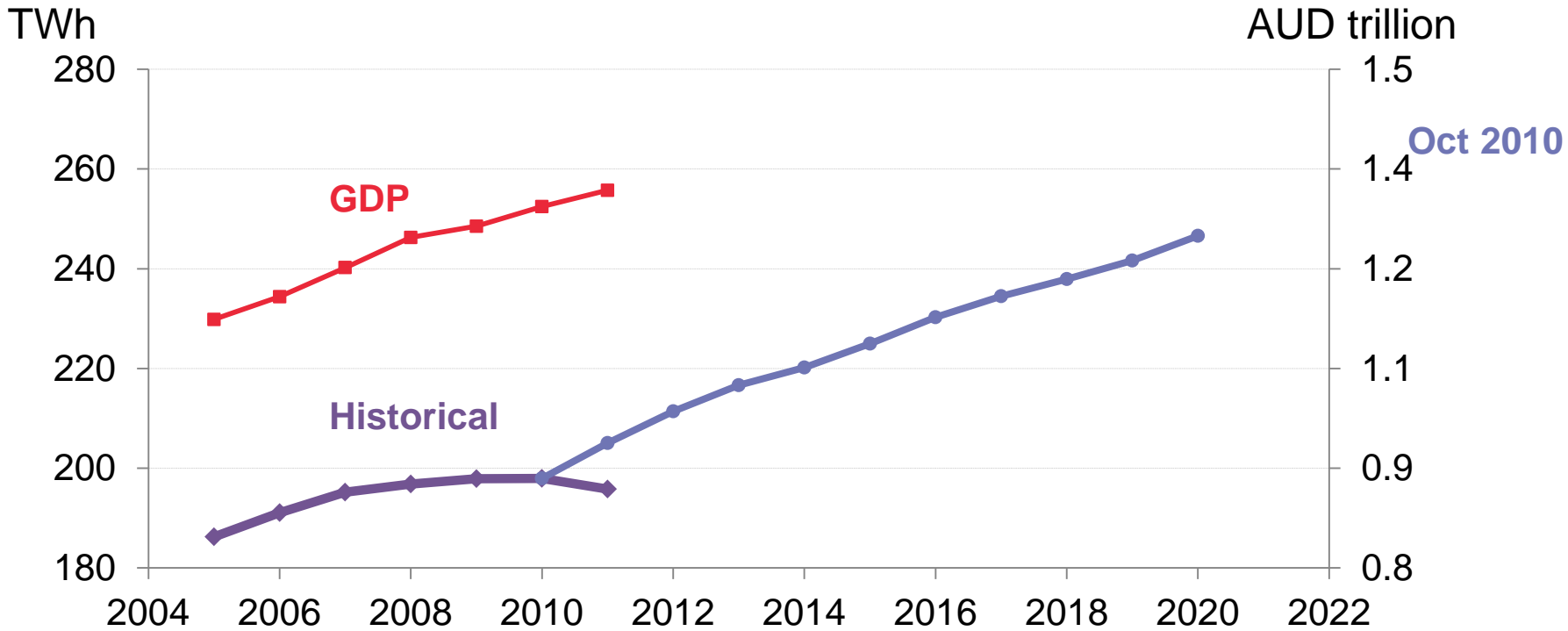
Picture: Getty Images

AUSTRALIA NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 2005–2022



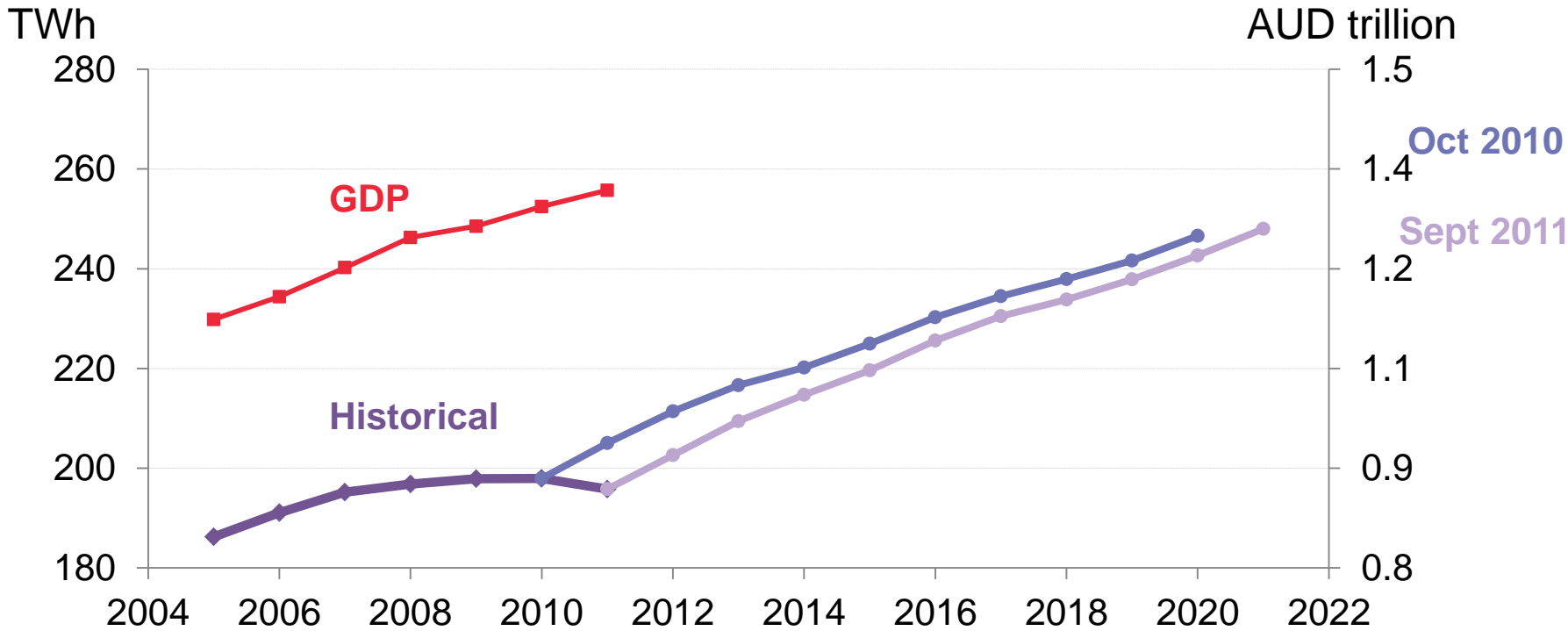
Source: Australian Energy Market Operator, Reserve Bank of Australia, Bloomberg New Energy Finance

AUSTRALIA NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 2005–2022



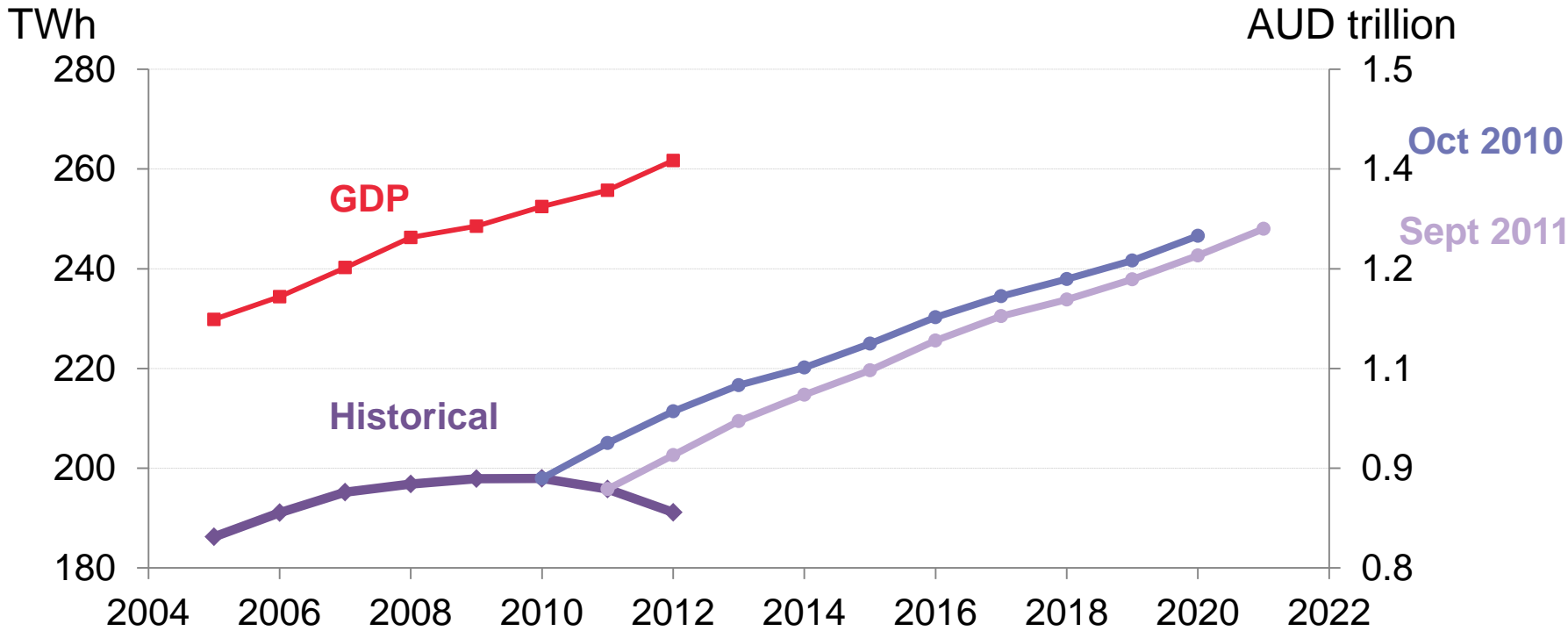
Source: Australian Energy Market Operator, Reserve Bank of Australia, Bloomberg New Energy Finance

AUSTRALIA NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 2005–2022



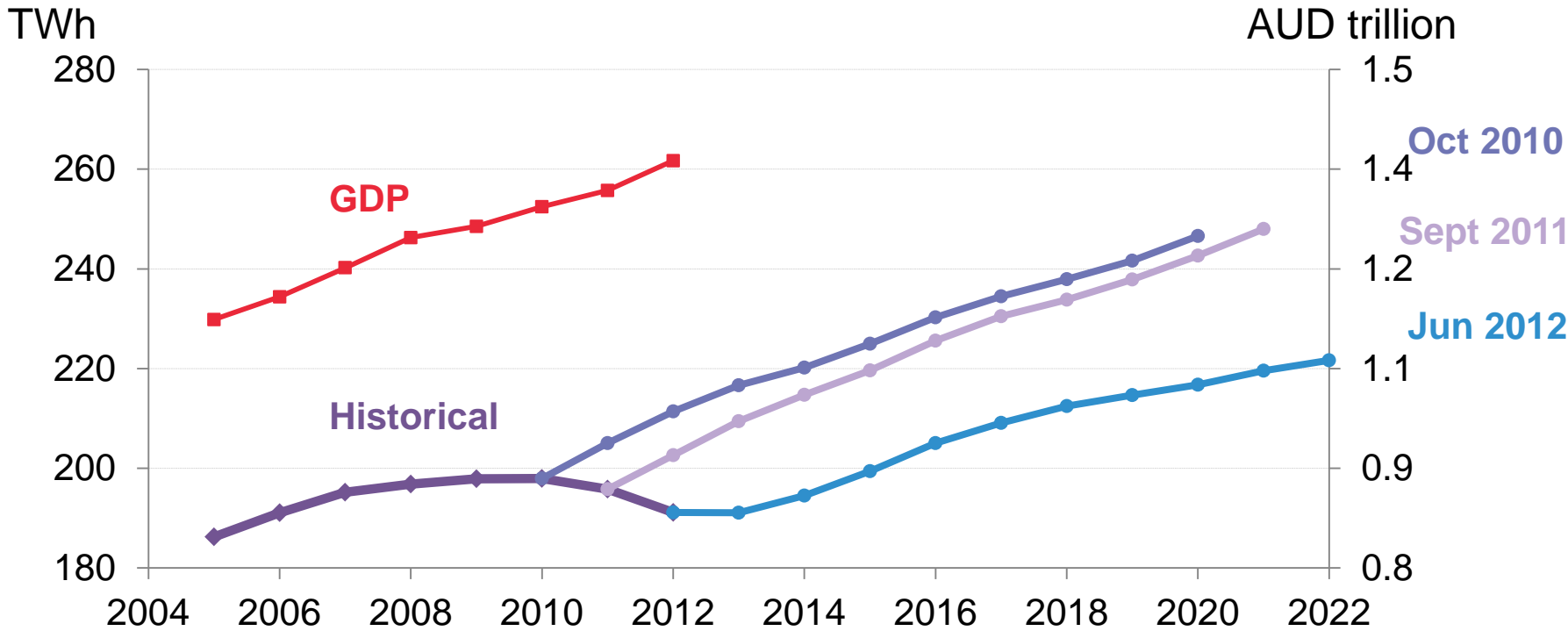
Source: Australian Energy Market Operator, Reserve Bank of Australia, Bloomberg New Energy Finance

AUSTRALIA NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 2005–2022



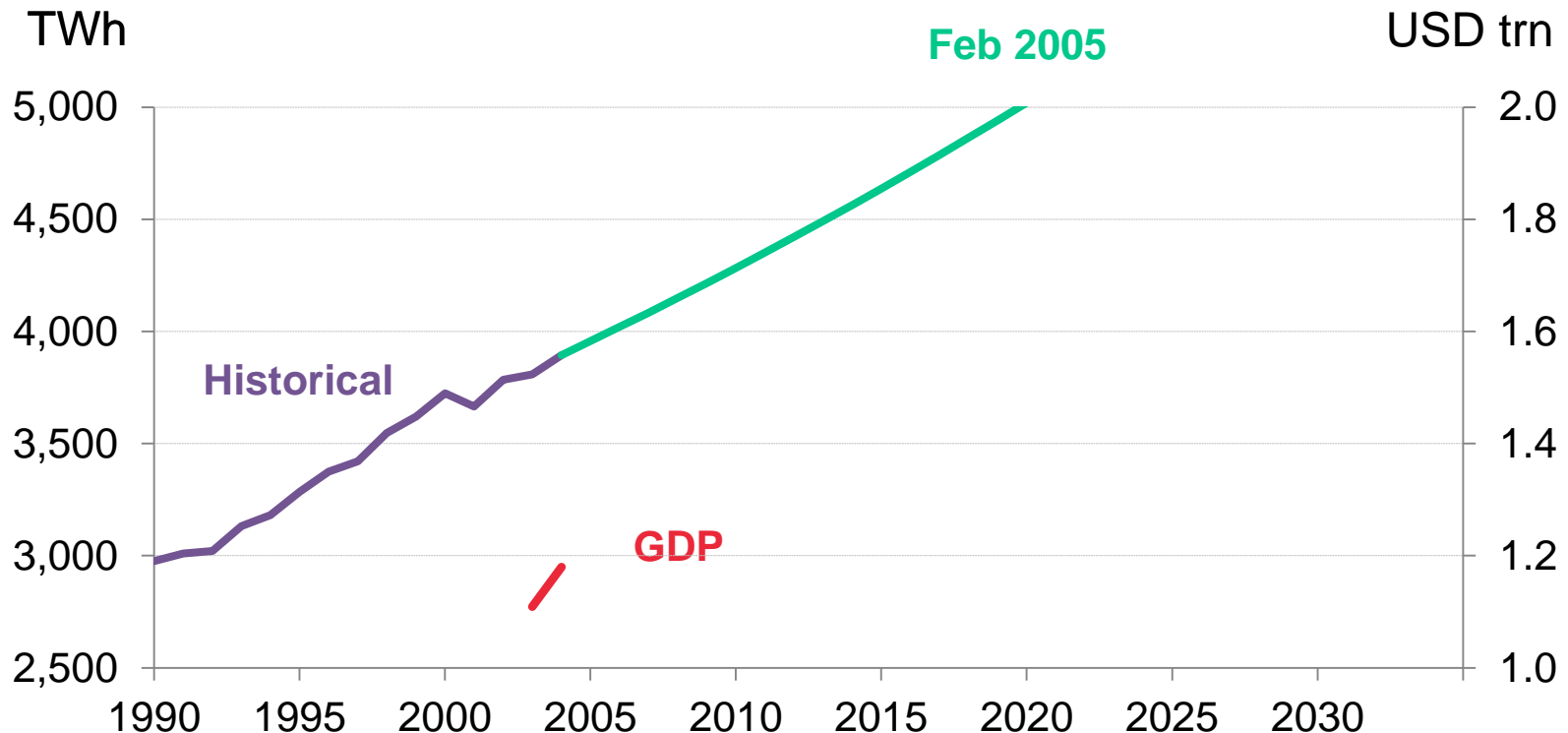
Source: Australian Energy Market Operator, Reserve Bank of Australia, Bloomberg New Energy Finance

AUSTRALIA NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 2005–2022



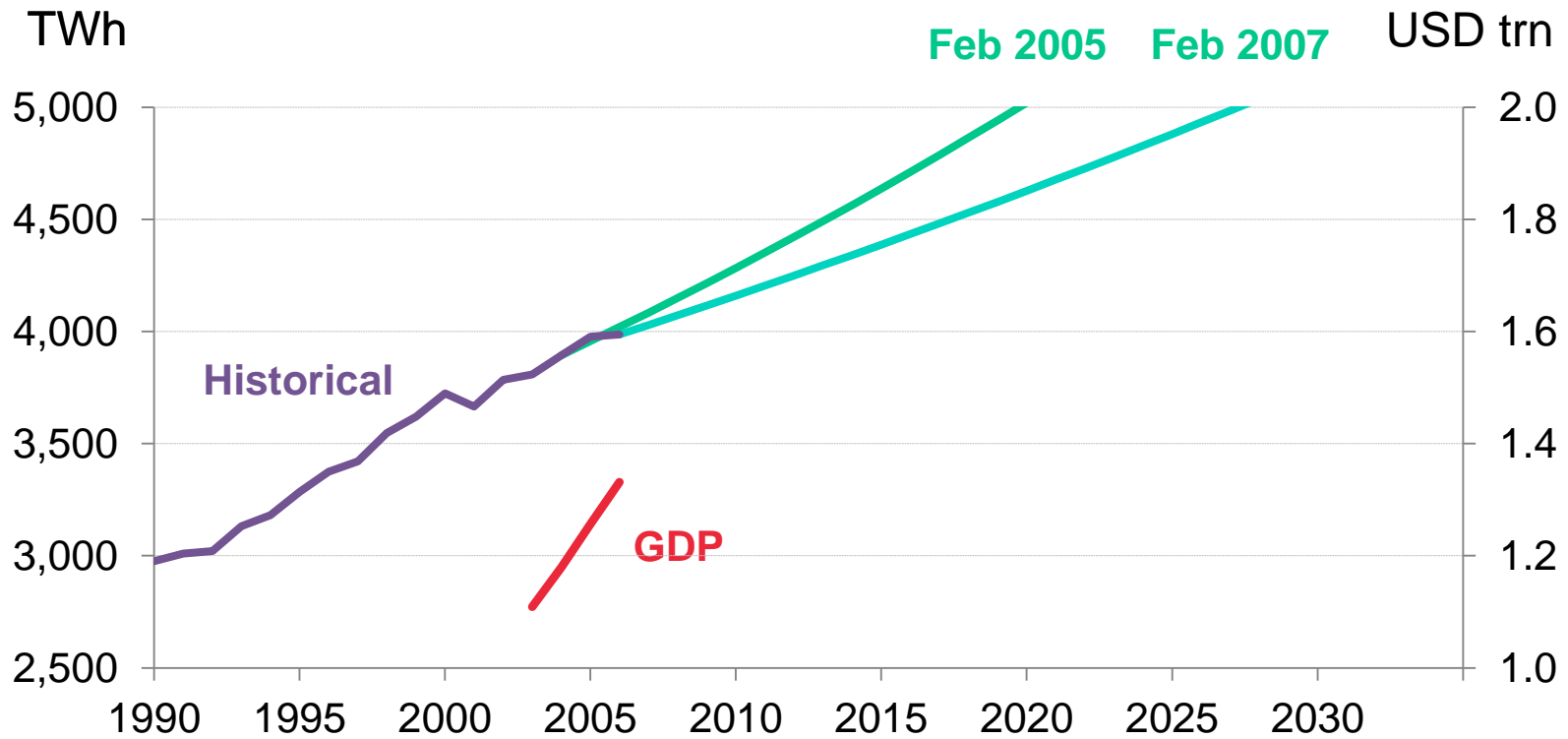
Source: Australian Energy Market Operator, Reserve Bank of Australia, Bloomberg New Energy Finance

US NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 1990–2035



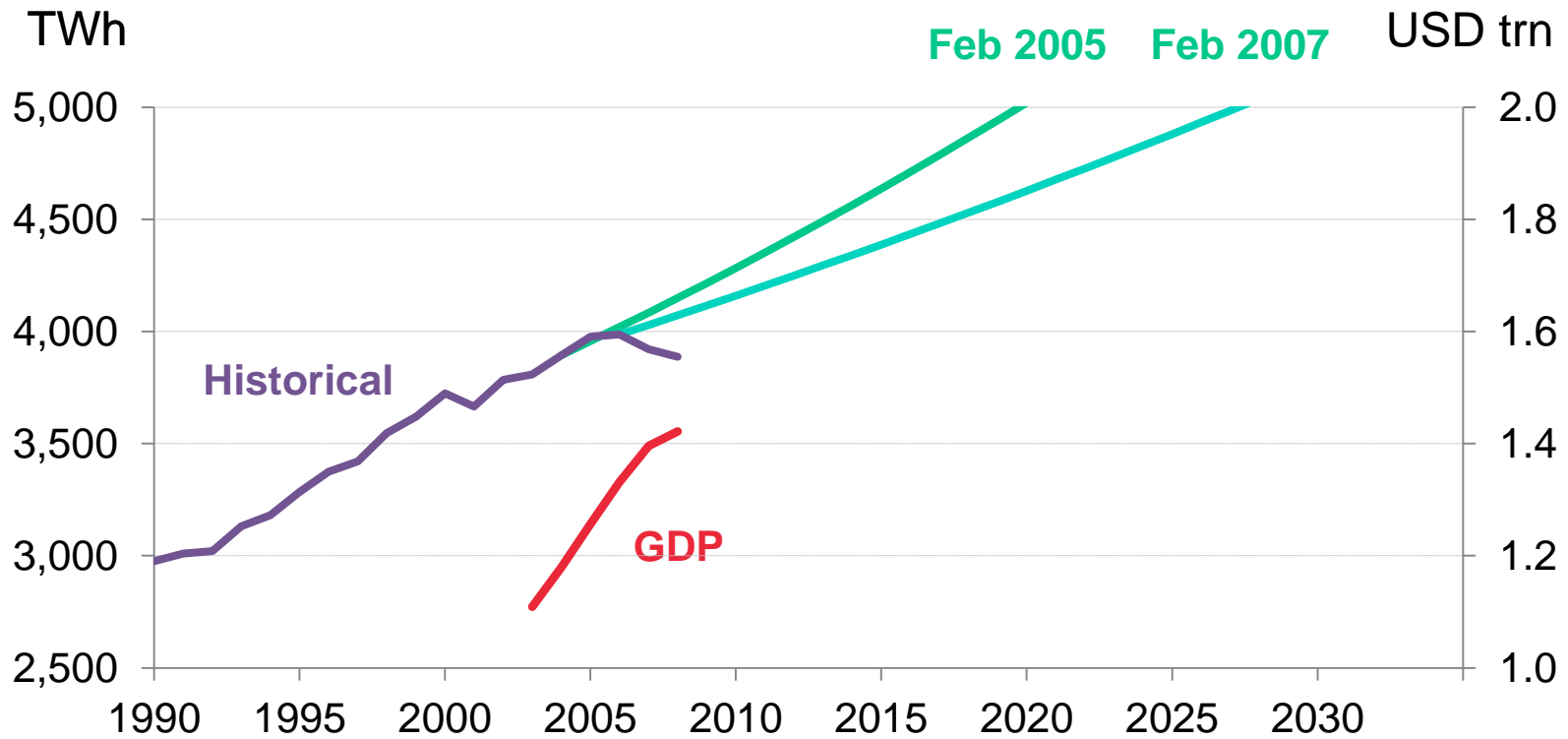
Source: EIA, Bloomberg New Energy Finance

US NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 1990–2035



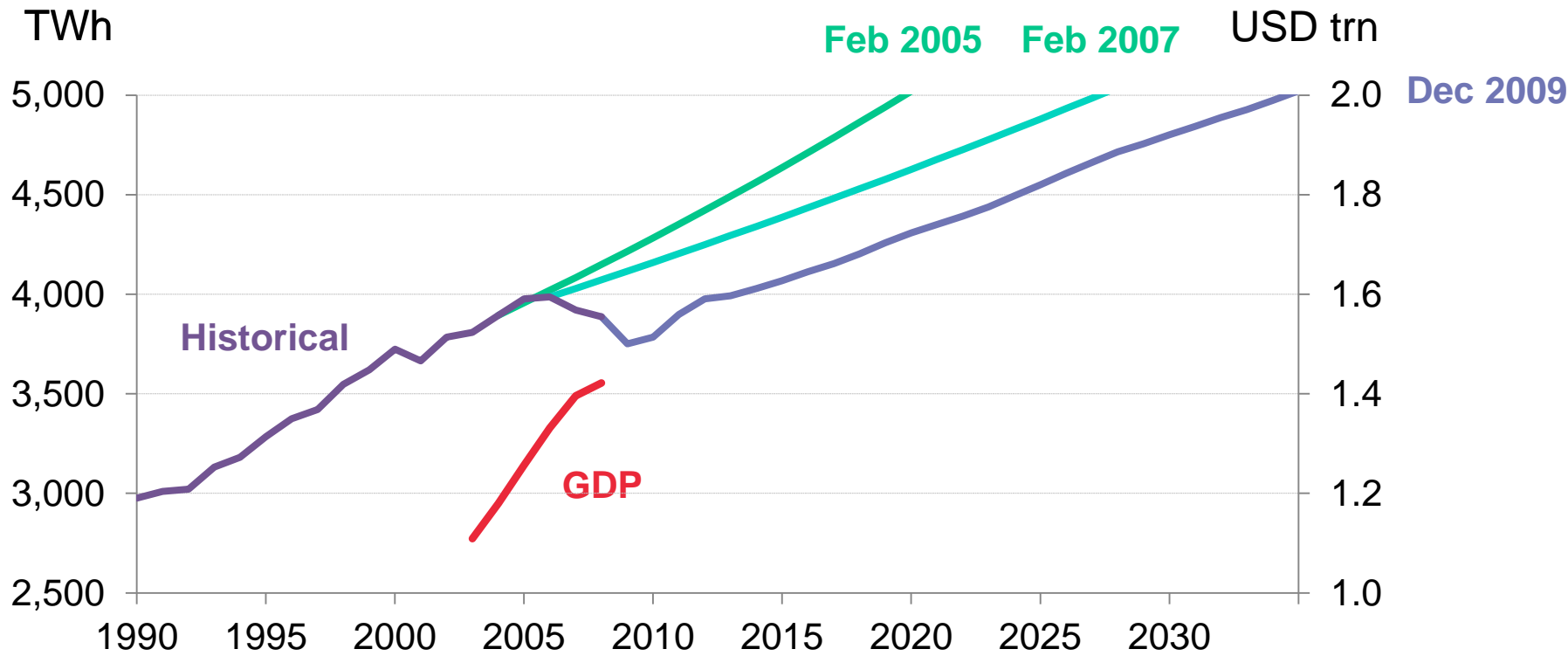
Source: EIA, Bloomberg New Energy Finance

US NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 1990–2035



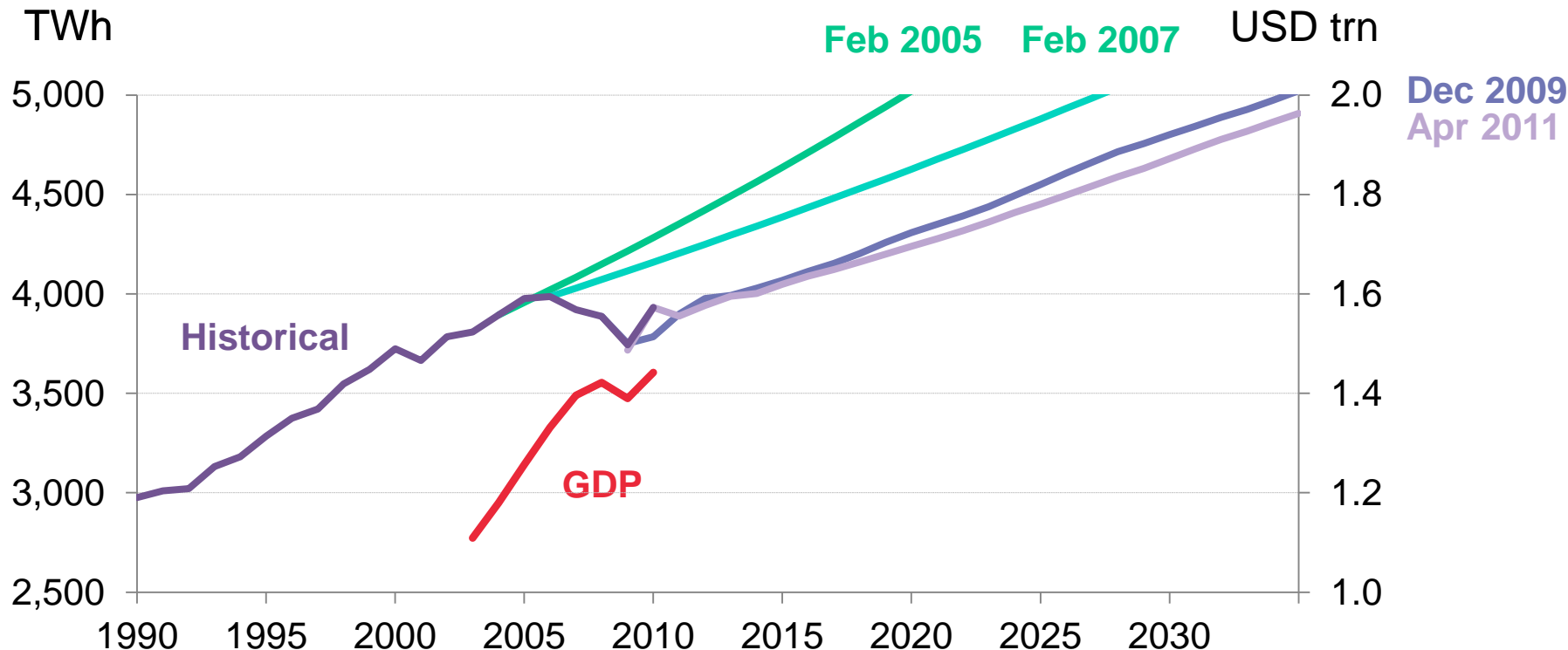
Source: EIA, Bloomberg New Energy Finance

US NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 1990–2035



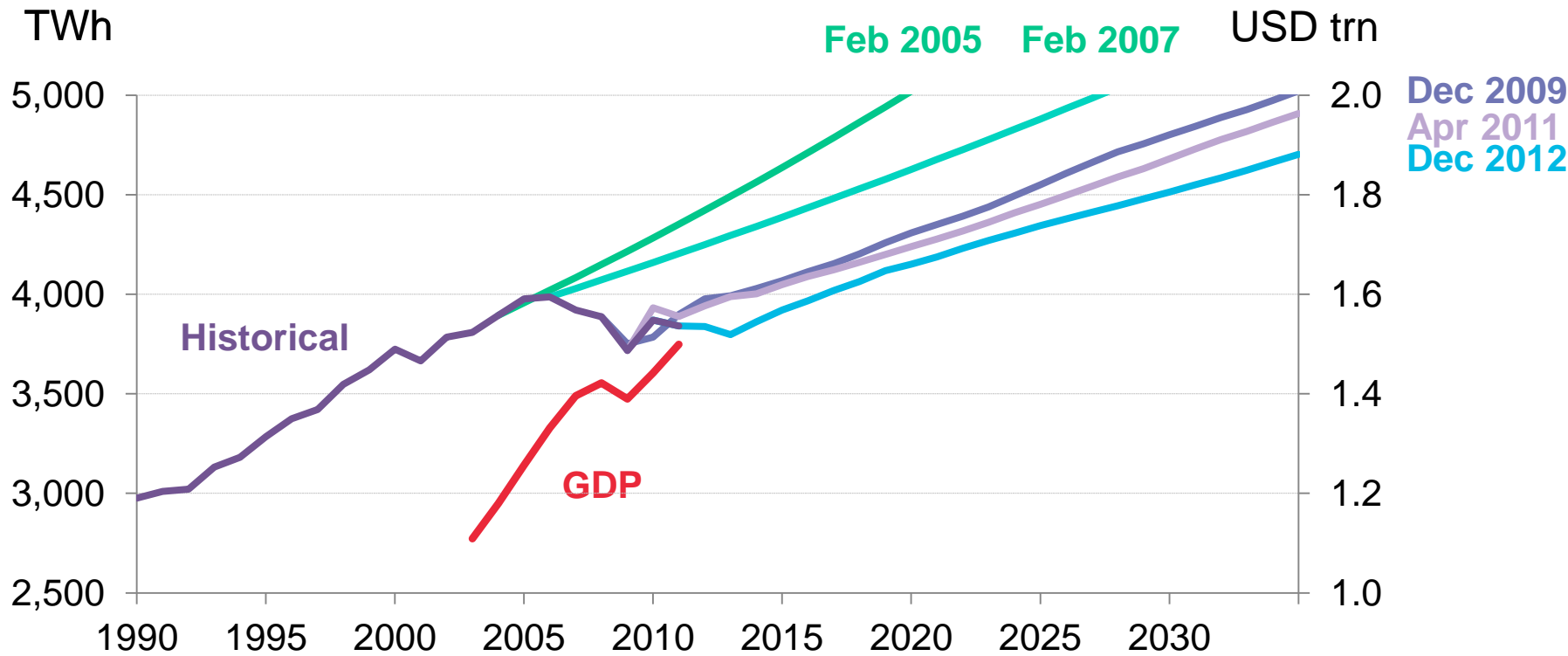
Source: EIA, Bloomberg New Energy Finance

US NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 1990–2035



Source: EIA, Bloomberg New Energy Finance

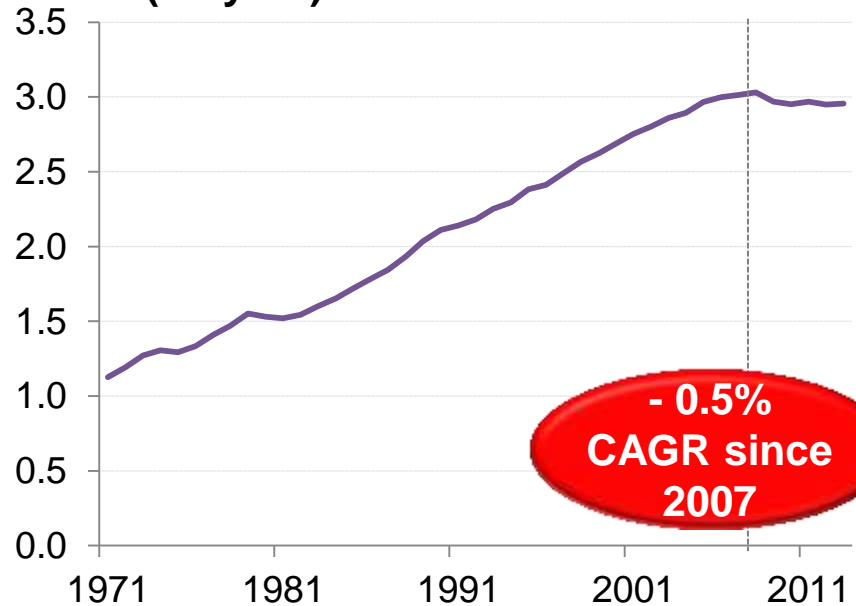
US NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND, 1990–2035



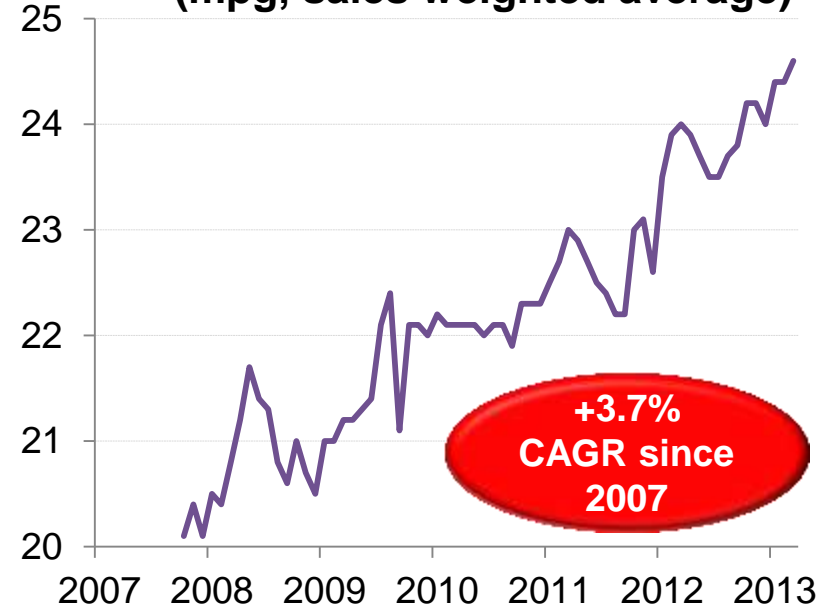
Source: EIA, Bloomberg New Energy Finance

US CAR USE AND FUEL EFFICIENCY

Total vehicle miles travelled (tm/year)



Fuel efficiency of new cars (mpg, sales weighted average)

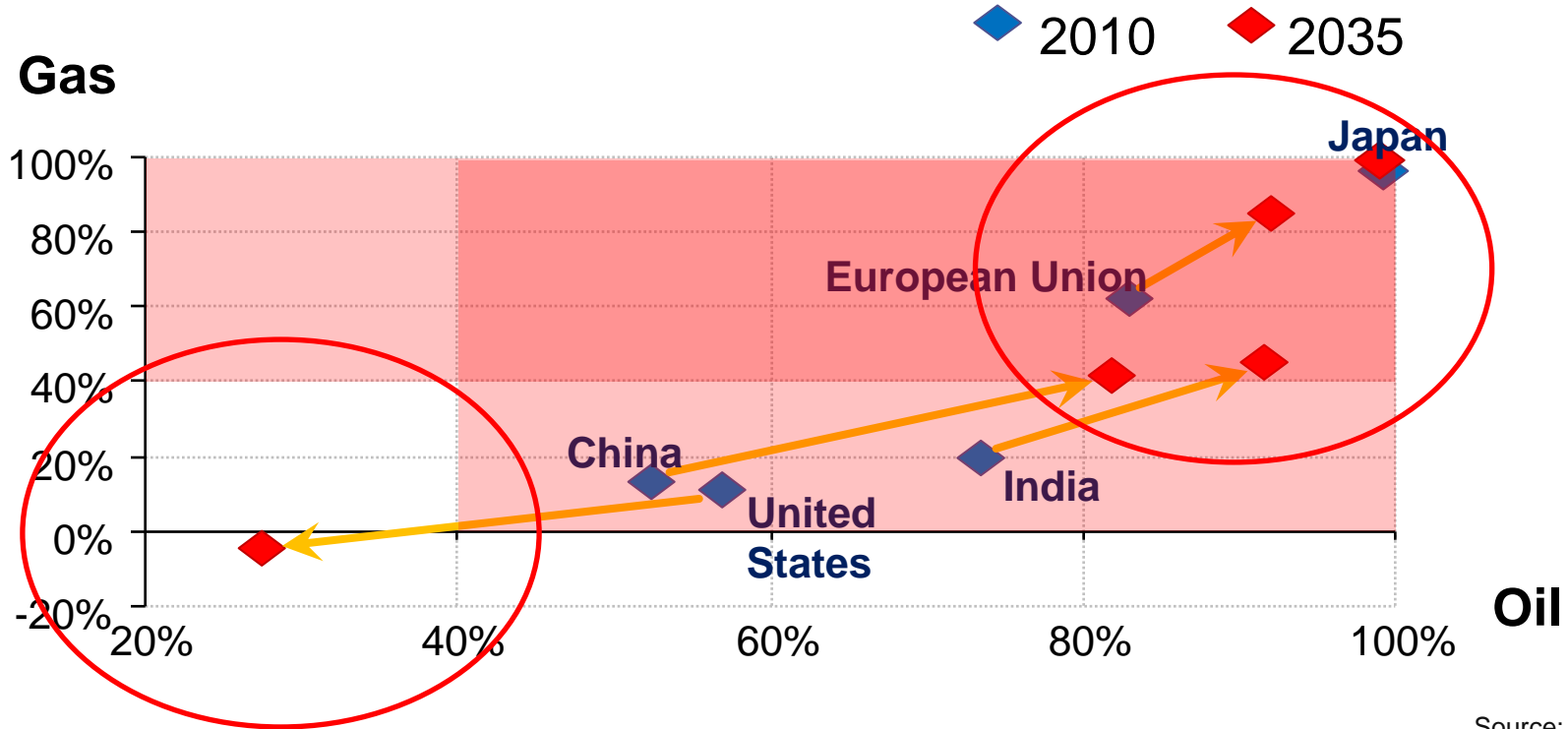


Source: US Department of Transportation Federal Highway Administration; University of Michigan Transportation Research Institute; Bloomberg New Energy Finance

Note: Total vehicle miles grew at 2.7% CAGR between 1971 and 2007

NET OIL AND GAS IMPORT DEPENDENCY, 2010 - 2035

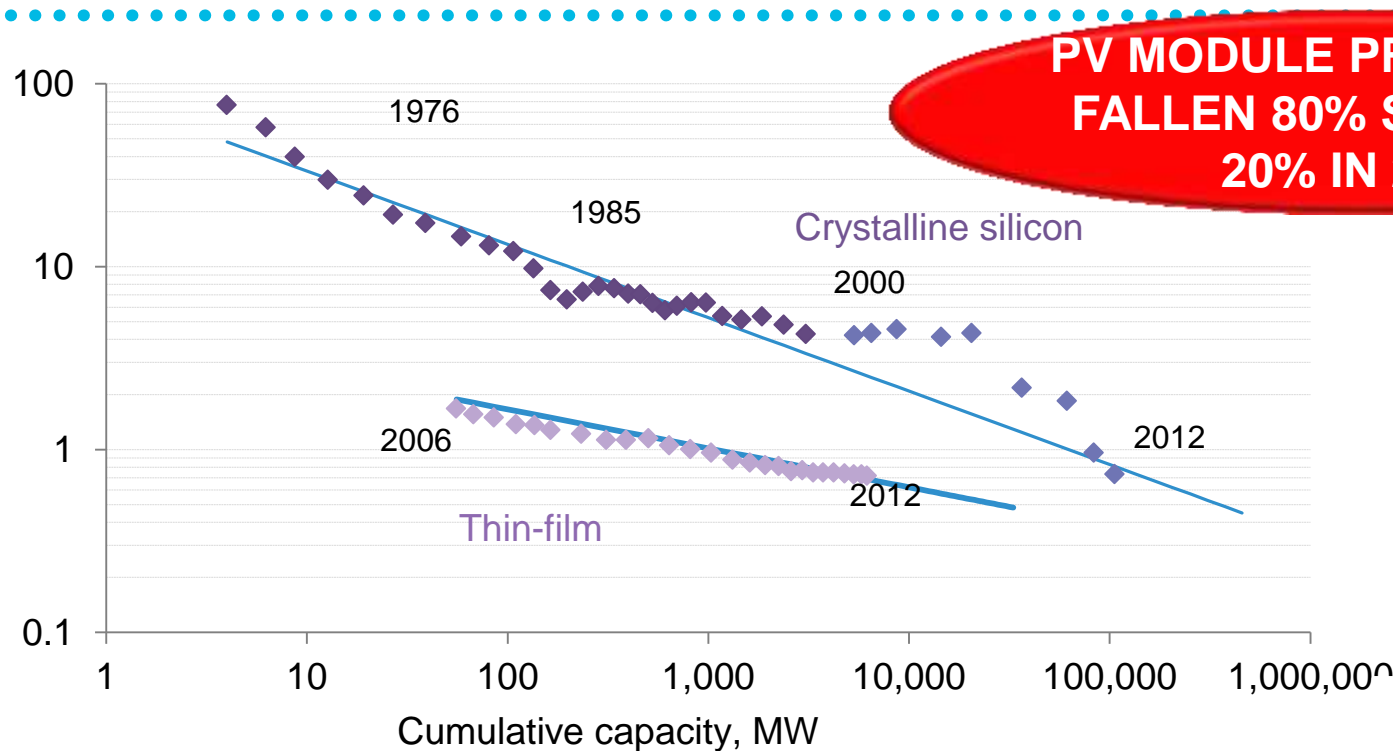
(% of consumption)



Source: IEA

PV EXPERIENCE CURVE, 1976-2012

2012 (\$/W)

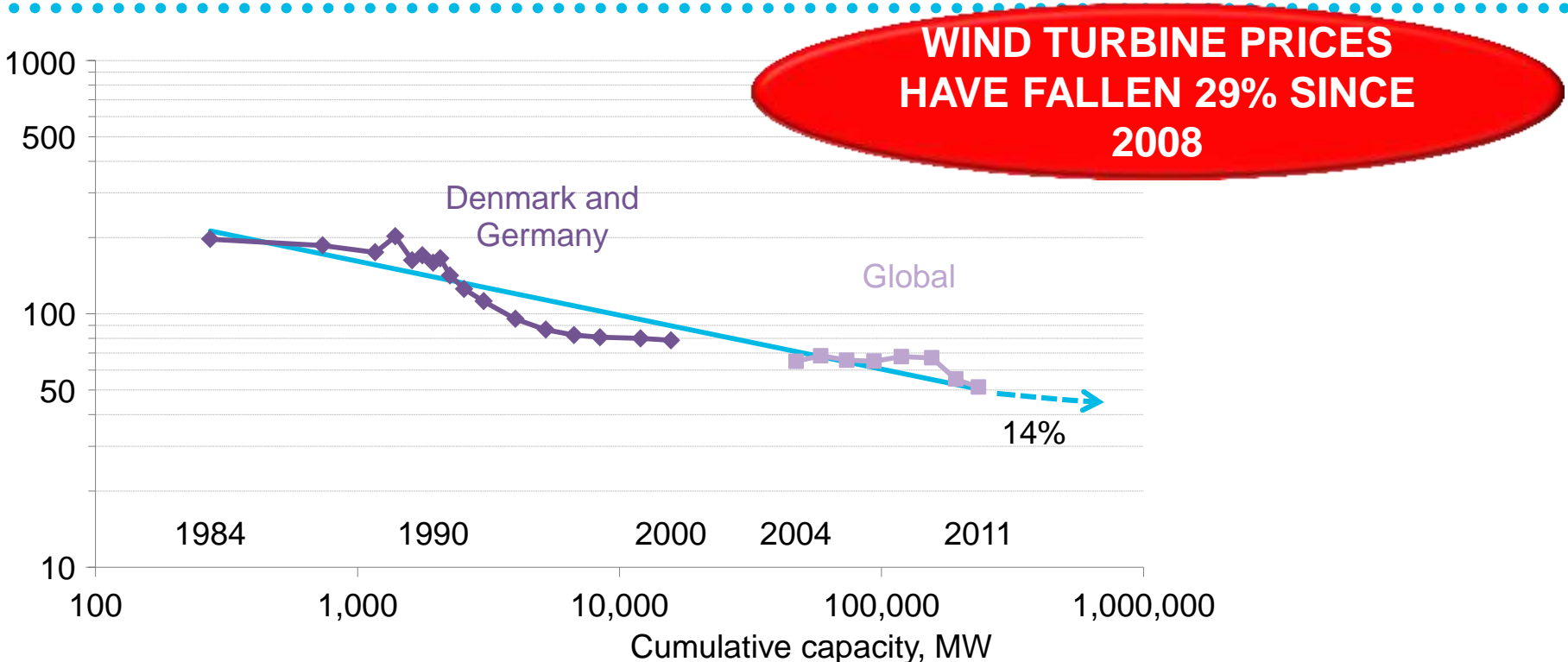


**PV MODULE PRICES HAVE
FALLEN 80% SINCE 2008
20% IN 2012**

Note: Prices inflation indexed to US PPI.

Source: Paul Maycock, Bloomberg New Energy Finance

AVERAGE LEVELISED COST OF ONSHORE WIND, 1984-2012 (€/MWH)

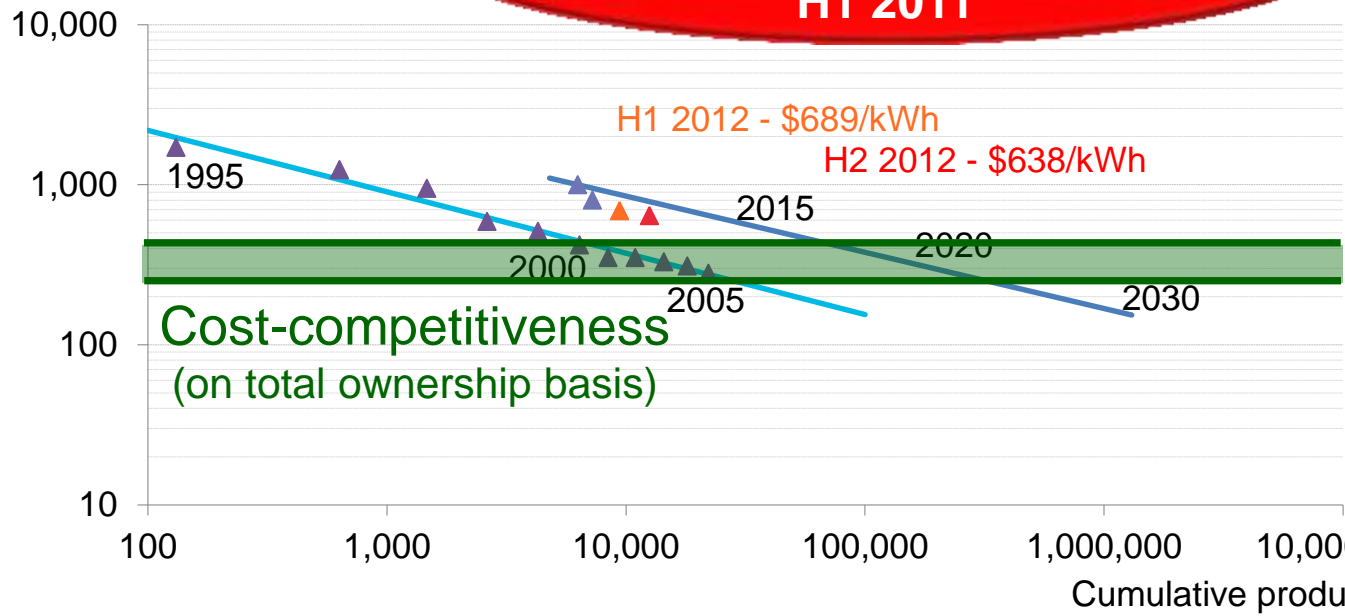


Note: Learning curve (blue line) is least square regression: $R^2 = 0.88$ and 14% learning rate. Source: Bloomberg New Energy Finance, ExTool

LITHIUM-ION BATTERY EXPERIENCE CURVE

**EV BATTERY PRICES
HAVE FALLEN 37% SINCE
H1 2011**

Battery cost
(\$/kWh)

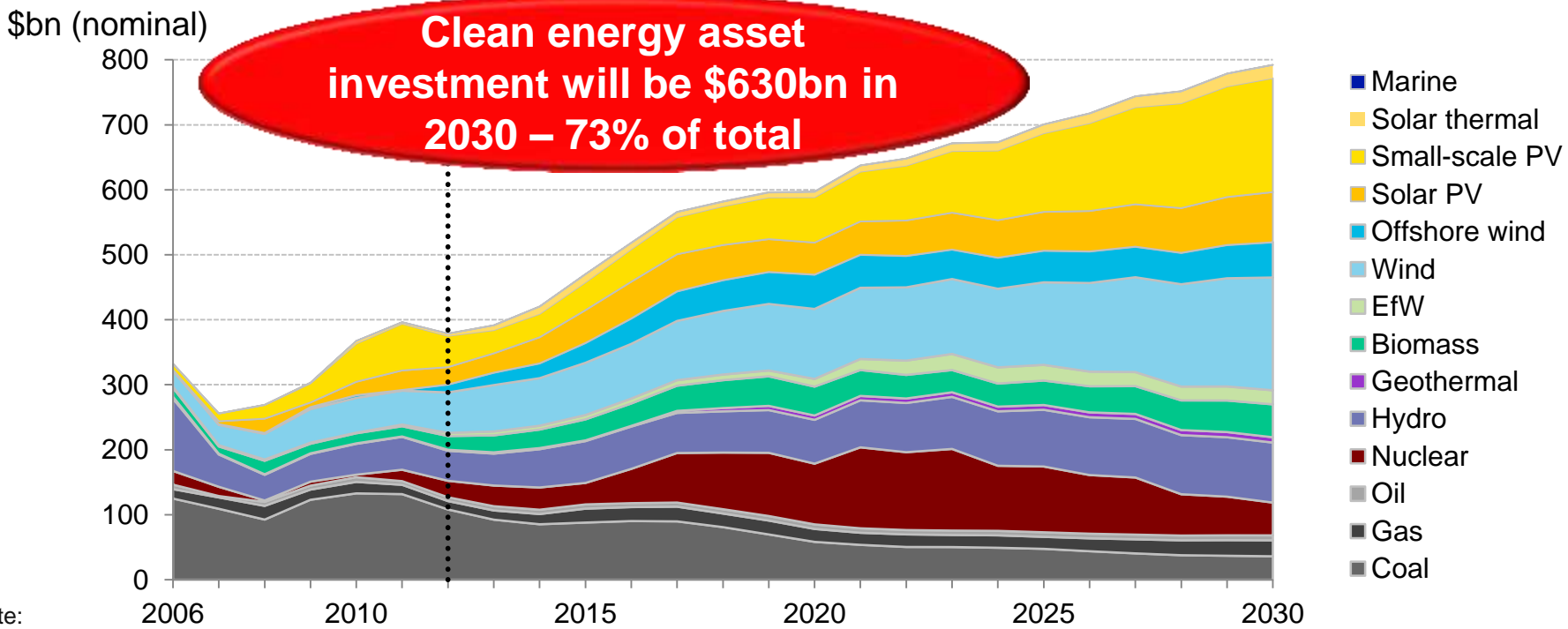


- EV Li-ion battery cost forecast (BNEF)
- Consumer Li-ion battery experience curve
- ▲ EV Li-ion battery prices, historical
- ▲ Consumer Li-ion battery prices, historical

**Cost-competitiveness
(on total ownership basis)**

Source: Battery University, MIIT, IIT, Bloomberg New Energy Finance

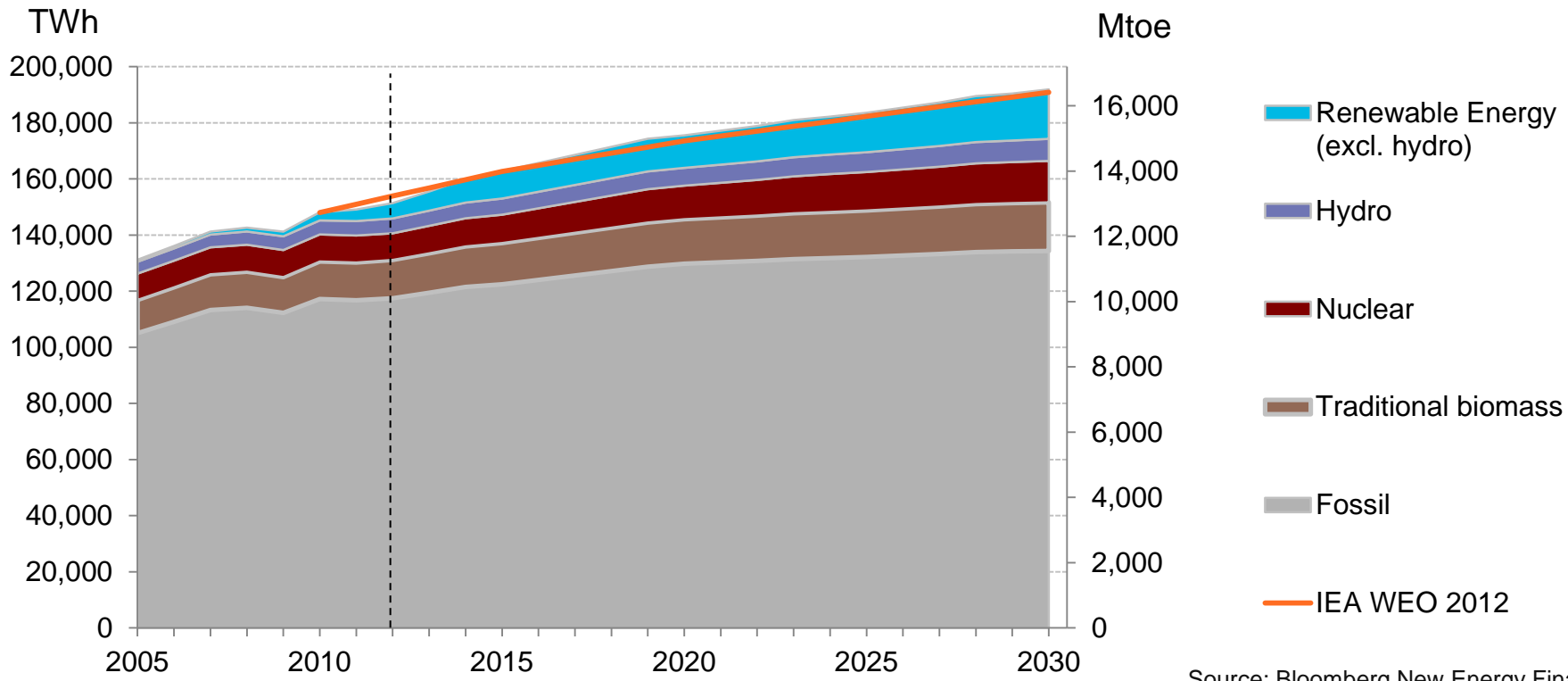
POWER GENERATION CAPACITY ASSET FINANCE (GREMO – NEW NORMAL)



Note:
 1. All \$bn figures are nominal assuming a 2% annual rate of inflation
 2. EfW is energy from waste Small-scale PV includes commercial and residential scale rooftop PV.

Source: Bloomberg New Energy Finance

TOTAL PRIMARY ENERGY DEMAND



Source: Bloomberg New Energy Finance

PREDICTION

“ If we look at things like renewable wind, solar, biofuels, we have those sources over the next 30 years growing 700 to 800 percent. But in the year 2040, they’ll supply just 1 percent.”

Rex Tillerson
CEO, ExxonMobil
March 2013

”



UNCERTAINTY

“

The world of energy
is facing a period of
unprecedented
uncertainty

”

Fatih Birol
Chief Economist, IEA



Picture: Mikhail Evstafiev, Wikimedia

NEW ENERGY ROI

RESILIENCE
OPTIONALITY
INTELLIGENCE

NEW ENERGY ROI – RESILIENCE

Don't ask:

“What is the expected outcome?”

Ask:

“What is the worst that can happen?”

Source: Bloomberg New Energy Finance

“TRADITIONAL” THREATS

ACCIDENTS



NATURAL DISASTERS



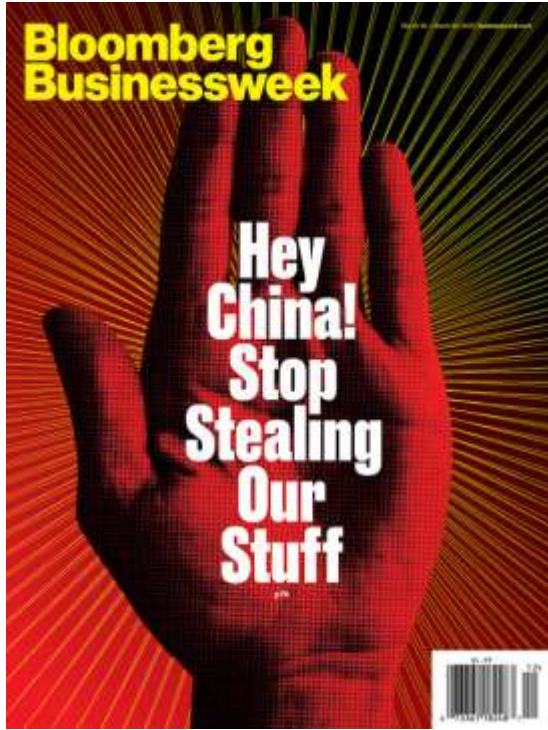
GEOPOLITICS



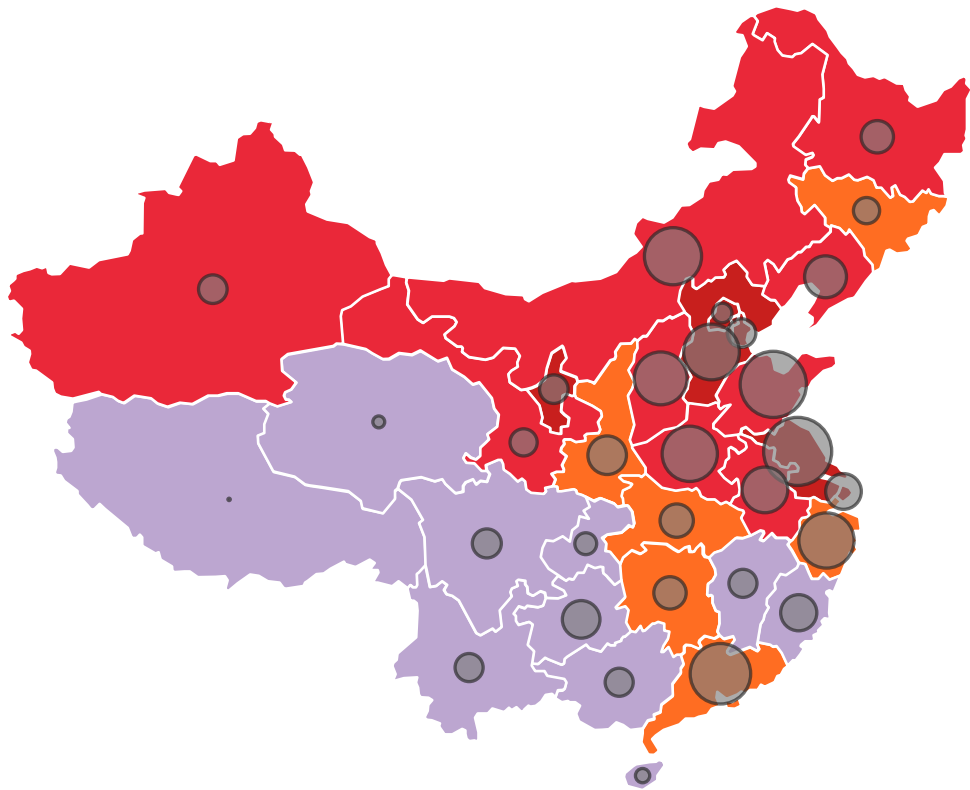
SECURITY



NEW THREATS – CYBERSECURITY



CHINA THERMAL POWER GENERATION VERSUS WATER SCARCITY BY PROVINCE, 2010

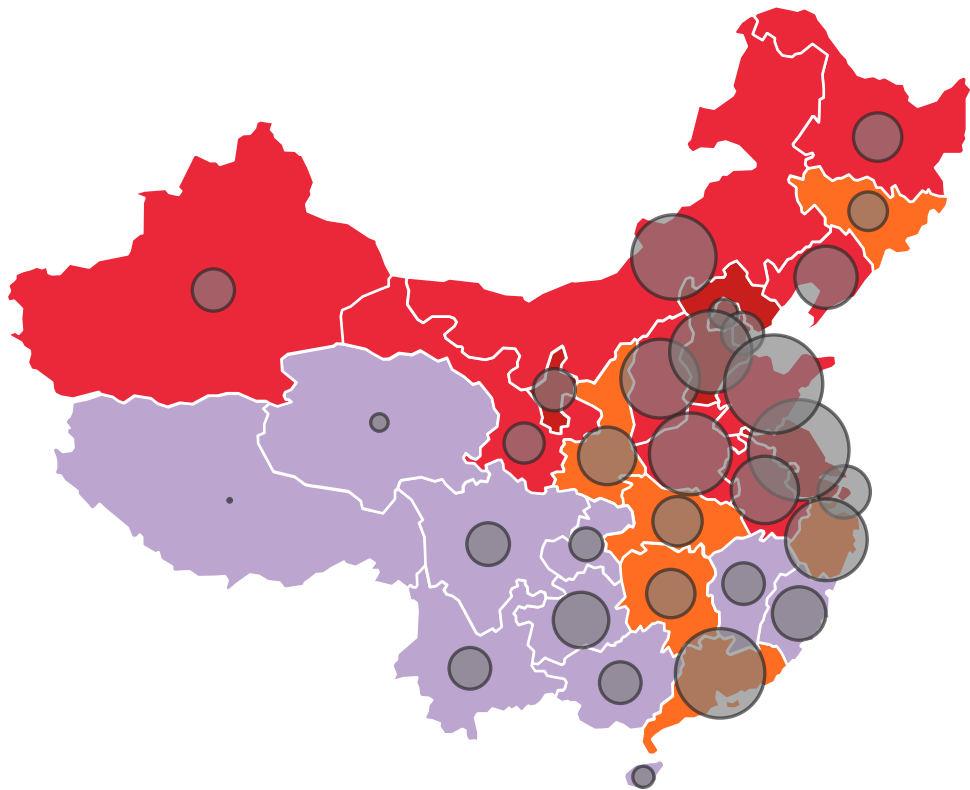


Freshwater scarcity rating:

- Water deficit
- Severe scarcity
- Moderate scarcity
- No scarcity

100TWh

CHINA THERMAL POWER GENERATION VERSUS WATER SCARCITY BY PROVINCE, 2030

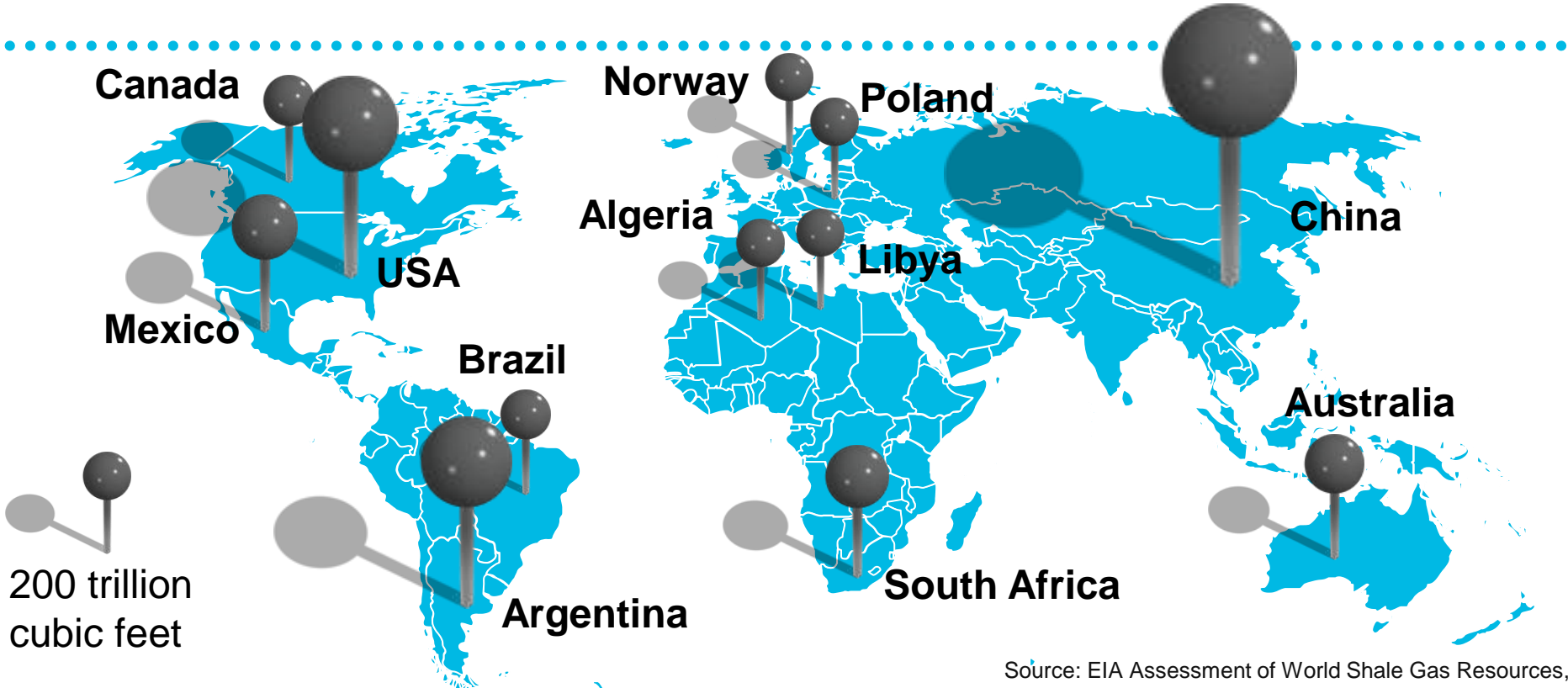


Freshwater scarcity rating:

- Water deficit
- Severe scarcity
- Moderate scarcity
- No scarcity

100TWh

MAJOR GLOBAL SHALE FIELDS

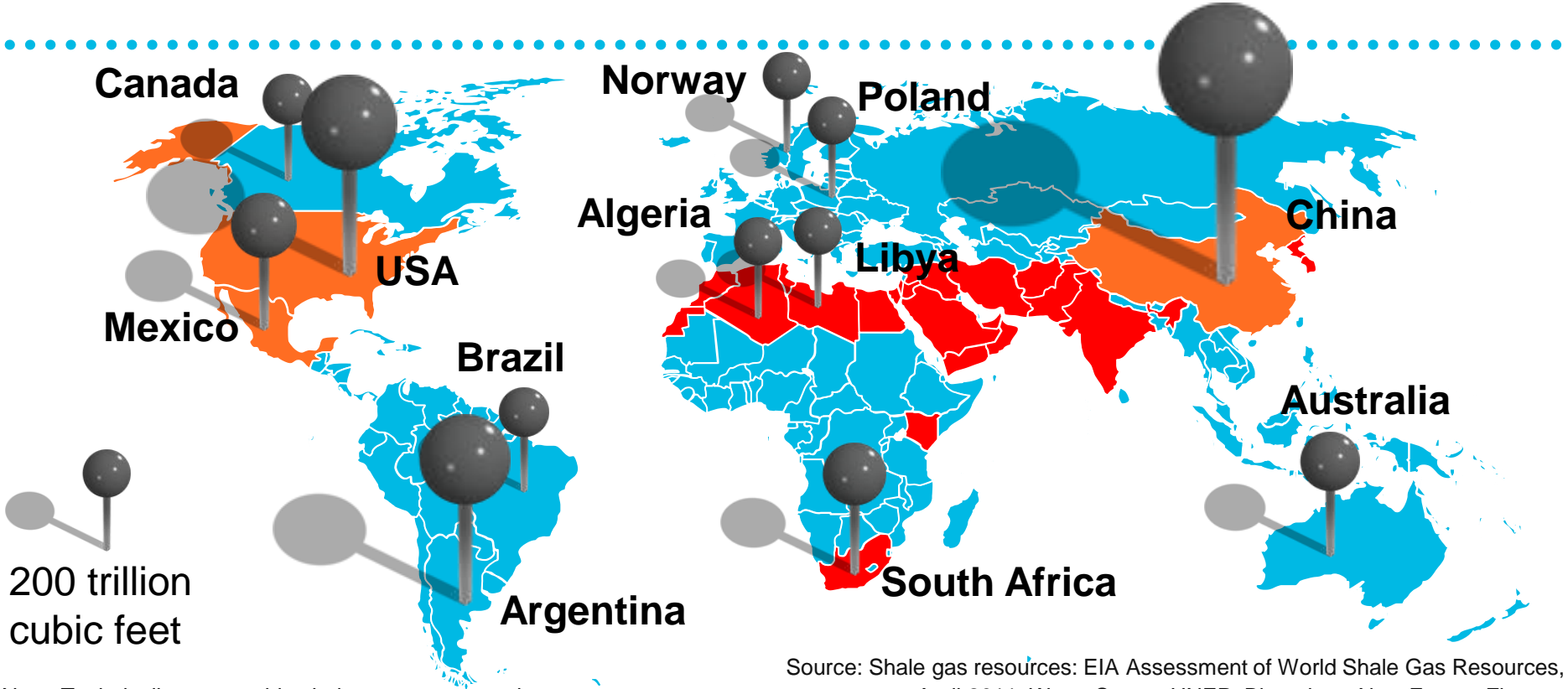


200 trillion cubic feet

Note: Technically recoverable shale gas resources shown

Source: EIA Assessment of World Shale Gas Resources, April 2011

MAJOR GLOBAL SHALE FIELDS – WATER STRESS



200 trillion cubic feet

Note: Technically recoverable shale gas resources shown

Source: Shale gas resources: EIA Assessment of World Shale Gas Resources, April 2011; Water Stress: UNEP, Bloomberg New Energy Finance

SOCIAL ACCEPTABILITY – FRACKING, TAR SANDS



Source: Wikimedia commons

STUDENT FOSSIL FUEL DIVESTMENT MOVEMENT



Picture: gofossilfree.org, US Navy

CLIMATE CHANGE

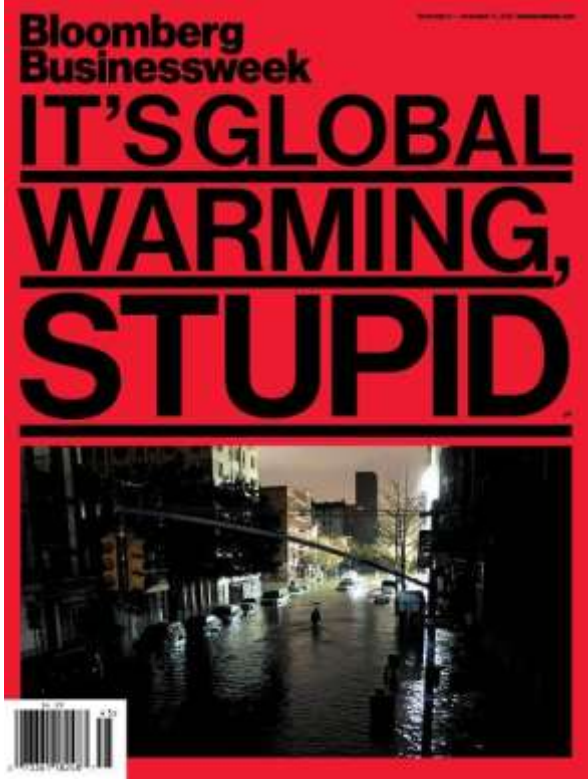


Image: Bloomberg Businessweek

NEW ENERGY ROI – OPTIONALITY



Source: Bloomberg New Energy Finance

OPTIONALITY – SO WHERE ARE THESE OPTIONS?

TECHNOLOGY OPTIONS

- Energy efficiency
- Power storage
- Demand management
- Interconnection
- Fuel flexibility
- Mini-grids
- CCS readiness

OPERATIONAL OPTIONS

- Natural hedges
- Dual sourcing
- Market diversification
- Sector diversification
- Value chain diversification
- R&D
- Coalitions

FINANCIAL OPTIONS

- Capital light
- Low leverage
- Structured finance
- Conditional commitments
- Hedging
- Guarantees
- Option pricing

Source: Bloomberg New Energy Finance

OPTIONALITY – INVESTOR EXAMPLE



TXU
Energy

\$48 billion



SOLYNDRA

\$1.5 billion



A tsunami of information –
Are you surfing or drowning?

Source: Bloomberg New Energy Finance

INTELLIGENCE

MACHINE INTELLIGENCE

- Smart grid
- Internet of things
- Pervasive sensors
- Automated optimisation
- Big data

HUMAN INTELLIGENCE

- Consumer behaviour
- Market intelligence
- Talent management

NEW ENERGY ROI

DINOSAUR HEURISTICS

- Scale
- Centralisation
- Baseload-plus-peak
- Dispatch management
- Vertical integration
- Confidentiality
- Defence budget



MAMMAL HEURISTICS

- Efficiency
- Network
- Responsiveness
- Demand management
- Coalitions
- Data sharing
- R&D budget



Photos: Wikimedia Commons

THANK YOU!

RESILIENCE

OPTIONALITY

INTELLIGENCE