BLOOMBERG NEW ENERGY FINANCE SUMMIT 2015

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Michael Liebreich, Chairman of the Advisory Board
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NEW INVESTMENT IN CLEAN ENERGY
2004-14 ($BN)

Note: Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy and energy storage projects (not reported in quarterly statistics), as well as a BNEF estimate for large hydro investment.

Source: Bloomberg New Energy Finance
NEW INVESTMENT IN CLEAN ENERGY
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Source: Bloomberg New Energy Finance
WTI CRUDE OIL PRICES, 2010-14
($2014 / BARREL)

Note: WTI crude oil prices adjusted to inflation

Source: Bloomberg New Energy Finance, World Bank
WTI CRUDE OIL PRICES, 2000–14
($2014 / BARREL)

Note: WTI crude oil prices adjusted to inflation

Source: Bloomberg New Energy Finance, World Bank
OIL PRICE CRASH – V OR L?

Abdalla El-Badri, Secretary General, OPEC

“If you don’t invest in oil and gas, you will see more than $200”

Bob Dudley CEO, BP

You won’t see $100 oil again “for a long time”

Images: Bloomberg
(BARRELS PER DAY)

Source: EIA

Production

Consumption
US VEHICLE MILES TRAVELLED
(MILLION MILES)

Gap to trend: 17% in 10 years

Note: Moving 12-month total of vehicle miles travelled in the US. Created from monthly data, and not seasonally adjusted

Source: US Federal Highways Administration
(AVERAGE MILES PER GALLON)

Improvement
60% in 13 years

Source: US Department of Transportation NHTSA
Prices on electric cars will continue to drop until they're within reach of the average family.

The Washington Post 1915

Images: BMW, Detroit Electric, 2015, courtesy of EVASD
ELECTRIC VEHICLES IN USE WORLDWIDE, 2014
0.75 million (to scale)

Source: International Organization of Motor Vehicle Manufacturers, Bloomberg New Energy Finance
LITHIUM-ION EV BATTERY EXPERIENCE CURVE

Historical price (USD/Wh)

Cumulative production (MWh)

Note: Prices are in real (2014) USD.

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

Michael Liebreich, New York, 14 April 2015

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LITHIUM-ION EV BATTERY EXPERIENCE CURVE COMPARED WITH SOLAR PV EXPERIENCE CURVE

Note: Prices are in real (2014) USD.

Source: Bloomberg New Energy Finance, Maycock, Battery University, MIIT
MEXICO CITY, MEXICO
LOS ANGELES, USA

Photo: UCLA
PARIS, FRANCE

Photo: DENNIS/Creative Commons

Note: Japan-Korea Marker is based on broker assessments of the spot price of un-contracted LNG cargoes delivered into the Northeast Asia market.

Source: Bloomberg New Energy Finance, ICAP, Platts
US SHALE GAS PRODUCTION BY FIELD, 2000–14

Source: EIA, Bloomberg New Energy Finance
LNG EXPORT CAPACITY BY COUNTRY/REGION (MMTPA)

0 100 200 300 400 500 600 700 800

Other
North America
Russia
East Africa
West Africa
Australia
Qatar
Demand
Pre-FID
Operational, under construction or post-FID

Note: For the underlying data to this chart, go to BI LNGGG<GO>

Source: Bloomberg New Energy Finance
RENEWABLE ENERGY PROPORTION OF POWER GENERATION, 2013 (%)

- Canada 76%
- Spain 43%
- UK 19%
- Germany 28%
- Japan 11%
- China 22%
- US 13%
- Brazil 71%
- S. Africa 2%
- India 6%
- Australia 16%
- Belgium 31%
- China 22%
- Spain 43%
- UK 19%
- Germany 28%
- Japan 11%
- China 22%
- US 13%
- Brazil 71%
- S. Africa 2%
- India 6%
- Australia 16%
- No data

Source: Oxford Energy, China Electricity Council, BDEW, UK Govt, REE, NRCAN, EIA, USEA, Bloomberg New Energy Finance
Name: Usain Bolt  
Event: 100m  
Record: 9.58 seconds

Name: Paddy Padmanathan  
Event: Solar PV  
Record: US$5.84c

Source: Bloomberg New Energy Finance
GLOBAL GROSS POWER GENERATION CAPACITY ADDITIONS, 2010–30 (GW)

**FOSSIL FUEL**

Forecast

- 2010: 105
- 2013: 141
- 2015: 110
- 2020: 91
- 2025: 62
- 2030: 64

**CLEAN ENERGY**

Forecast

- 2010: 93
- 2013: 143
- 2015: 164
- 2020: 208
- 2025: 242
- 2030: 279

- **Hydro**
- **Nuclear**
- **Solar**
- **Wind**
- **Biomass & waste**
- **Geotherm.**

Note: Underlying data is from GREMO 2014

Source: Bloomberg New Energy Finance

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US & CHINA CAPACITY BUILD OUT (GW)

**China’s low-carbon additions 2015-2030 ~ 90% of US 2015 capacity**

**US**

- **2014**
  - 1,094 GW
  - Low-carbon: 302 GW
  - Fossil fuels: 792 GW

- **2030**
  - 1,384 GW
  - Low-carbon: 273 GW
  - Fossil fuels: 810 GW

**China**

- **2014**
  - 920 GW
  - Low-carbon: 442 GW
  - Fossil fuels: 478 GW

- **2030**
  - 2,601 GW
  - Low-carbon: 996 GW
  - Fossil fuels: 1,605 GW

**Source:** Bloomberg New Energy Finance
RENEWABLES IN INDIA, 2006–22

(GW)

Source: Bloomberg New Energy Finance

Solar 0.6 GW/year
Wind 4.7 GW/year
RENEWABLES IN INDIA, 2006–22

(GW)

Solar 0.6 GW/year
Wind 4.7 GW/year

Solar 6 GW/year
Wind 3 GW/year

Source: Bloomberg New Energy Finance
RENEWABLES IN INDIA, 2006–22 (GW)

Solar 0.6 GW/year
Wind 4.7 GW/year

Solar 6 GW/year
Wind 3 GW/year

Modi target:
Solar 12 GW/year
Wind 8 GW/year

Source: Bloomberg New Energy Finance
NUCLEAR POWER PLANTS – HISTORIC CONSTRUCTION

Source: Bloomberg New Energy Finance; IAEA, World Nuclear Association

566 nuclear power stations ever built
NUCLEAR POWER PLANTS – CURRENT CONSTRUCTION

Source: Bloomberg New Energy Finance; IAEA, World Nuclear Association

66 nuclear power stations under construction

Chart Title
Note: Nominal dollars. Includes residential, commercial and industrial spending. For more details, see our H1 2014 Global Energy Efficiency Market Outlook.

AUSTRALIA NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND FY2004–FY2025

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AUSTRALIA NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND FY2004–FY2025


GDP

Historical

FY04 FY06 FY08 FY10 FY12 FY14 FY16 FY18 FY20 FY22 FY24

TWh AUD trillion

0.8
1.0
1.2
1.4
1.6
1.8
160
180
200
220
240
260

2011
2010

Historical

AUSTRALIA NATIONAL ELECTRICITY MARKET ACTUAL VS FORECAST ELECTRICITY DEMAND FY2004–FY2025

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THE AGE OF PLENTY...

...THE AGE OF COMPETITION
IMPACT OF LOWER OIL AND GAS PRICES ($BN/YR)

Note: Calculation based on $5 drop in natural gas price and $50 drop in oil price; based on import/export volumes 2011-2013, excluding impact of changes in volumes since then

Source: Bloomberg New Energy Finance; CIA Fact Book; IEA; EIA; World Bank; IMF

- **Canada**: - $40 billion
- **USA**: + 180 billion
- **Latin America**: - $60 billion
- **North Africa**: - $62 billion
- **Sub-Saharan Africa**: - $89 billion
- **Middle East**: - $357 billion
- **Europe**: + 300 billion
- **Russia & C. Asia**: - $218 billion
- **Asia**: + 393 billion
- **Canada**: - $40 billion
- **Norway**: - $53 billion
- **Norway**: + 300 billion
- **Russia & C. Asia**: - $218 billion
- **Asia**: + 393 billion

Canada

Norway

Europe

Russia & C. Asia

Asia

USA

Latin America

North Africa

Sub-Saharan Africa

Middle East

Note: Calculation based on $5 drop in natural gas price and $50 drop in oil price; based on import/export volumes 2011-2013, excluding impact of changes in volumes since then

Source: Bloomberg New Energy Finance; CIA Fact Book; IEA; EIA; World Bank; IMF
COAL DEPENDENCY, G20, 2013
(% OF PRIMARY ENERGY)

Note: Data comes from the IEA Global Statistics database. Where actual 2013 data was unavailable, IEA produced an estimate figure.

Source: IEA, Bloomberg New Energy Finance
Up to 23GW of US coal capacity coming offline in 2015

Notes: Bloomberg New Energy Finance base case build forecasts; historical build from EIA Form 860

Source: Bloomberg New Energy Finance
CHINA COAL CONSUMPTION, 2000-14 (MILLION TONS)

Source: Bloomberg New Energy Finance, Chinese Government
In the old world, I’m selling whale oil.

In the developing world, I’m selling crack cocaine.

Anonymous coal trader
ARA AND NEWCASTLE COAL PRICE 2007–15
(2014 US$/TONNE)

Note: Prices have been adjusted for inflation

Source: Bloomberg New Energy Finance
Note: Values as of 01 April 2015; Stowe and S&P 500 rebased to 100 on 01 Jan 2013

Source: Bloomberg New Energy Finance
Notes: Countries’ inclusion of land-use and forestry in emissions calculations vary. China’s 2020 target estimated from announced emissions intensity target per unit GDP, and no absolute emissions level set for its 2030 pledge.

Source: Bloomberg New Energy Finance, UNFCCC
Defect?

- Distribution charges
- Resilience (black-out)
- Sense of independence

Don’t defect?

- System right-sizing
- Sale of surplus power
- Resilience (back-up)
- System management and maintenance

Source: Bloomberg New Energy Finance
GRID DEFECTION?

“Having a solar panel that isn’t connected to the grid is like having a computer that’s not connected to the Internet.”

Ellen Hayes, PG&E spokeswoman
COMPOSITION OF RESIDENTIAL ELECTRICITY TARIFFS ACROSS THE WORLD, 2008-2014 (EUR/MWh)

New South Wales (Aus)

Germany

Spain

Denmark

Note: Other includes taxes, levies, carbon costs, profits

Source: Australian Energy Regulator, Eurostat Bloomberg New Energy Finance
POWER SYSTEM VALUE CHAIN

Extraction → Generation → Transmission → Distribution → Demand
Old world

Extraction → Generation → Transmission → Distribution → Demand

 $$$
Old world

Extraction → Generation → Transmission → Distribution → Demand

Age of plenty

Extraction → Generation → Transmission → Distribution → Demand

$\$$
Old world

Extraction | Generation | Transmission | Distribution | Demand

Age of plenty

Extraction | Generation | Transmission | Distribution | Demand
POWER SYSTEM VALUE CHAIN

Old world

Extraction ➔ Generation ➔ Transmission ➔ Distribution ➔ Demand

Age of plenty

Extraction ➔ Generation ➔ Transmission ➔ Distribution ➔ Demand

Age of plenty

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EON SPLIT

e.on e.off
ENERGY RETAIL BATTLEFIELD
NEW ENTRANTS - STARTUPS

- SolarCity: Solar PV and energy monitoring
- ONZO: Load disaggregation
- OPower: Behavioural engagement
- bidgely: Load disaggregation
- Tendril: HEM tools
- Netatmo: Connected home / IoT
- Sigfox: Smart thermostats
- PassiSystems: Heating controls
- tado°: Smart thermostats
- Nest: Smart thermostats, home automation

Source: Bloomberg New Energy Finance
ENERGY RETAIL BATTLEFIELD
NEW SERVICES FROM INCUMBENTS

Source: Bloomberg New Energy Finance
ENERGY RETAIL BATTLEFIELD
NEW ENTRANTS - MAJORS

Google
Nest acquisition
Home automation

Verizon
Home automation

Apple
HomeKit

AT&T
Digital Life connected home service

ADT
1m connected home customers

Time Warner
Home automation

Panasonic
Energy supply and services

Rakuten
DR and retail services

NTT
HEMS platform

Deutsche Telekom
Smart home hubs

Orange
Registered energy supplier

Telefonica
Smart home platform (AT&T)

Source: Bloomberg New Energy Finance

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ENERGY RETAIL BATTLEFIELD
NEW SERVICE BUNDLES

Bundled telecoms, energy. Residential energy storage.

Bundled telecoms, electricity supply beginning in 2016.

Bundled telecoms, electricity and gas.

Bundled electricity, entertainment and home automation.

Bundled electricity, telecoms and energy.

Source: Bloomberg New Energy Finance
Michael Liebreich, New York, 14 April 2015

ENERGY RETAIL BATTLEFIELD

- **HIVE home heating controls**
- **RWE Residential energy storage**
- **Deutsche Telekom Smart home hubs**
- **orange™ Registered energy supplier**
- **Panasonic Energy supply and services**
- **SoftBank Bundled telecoms, electricity supply, and retail services**
- **Google Bundled electricity, entertainment, and home automation**
- **TELECOMPLUS PLC Bundled telecoms and energy supply**
- **Fortum**
  - HEM tools and DR

**Bundled electricity, telecoms, and energy**

**Bundled insurance, telecoms and energy**

**Bundled electricity telecoms services**

- **PG&E**
  - IHD and smart thermostat program
  - BEMS for DR and energy efficiency
- **Reliant**
  - Smart thermostats to reduce churn
- **AT&T**
  - Digital Life connected home service
- **Telefónica**
  - VATTENFALL
  - Smart home platform (AT&T)
- **VATTENFALL**
  - Smart lighting / home automation
- **Vattenfall**
  - Virtual mobile operator – 80k customers
- **Eon**
  - Smart home partnerships/investment
- **CEZ GROUP**
  - HEMS platform
- **TransACT**
  - Home energy management
- **Dodo**
  - Bundled electricity telecoms services
- **SoftBank**
  - Bundled telecoms, electricity supply, and retail services
- **Origin**
  - HEMS platform

**Smart home platforms (AT&T)**

1m connected home customers
APPLE’S SOLAR SHOPPING SPREE

$850 billion
Over 25 years
SELECTED COMMERCIAL BUILDERS OR BUYERS OF RENEWABLE ENERGY
CLEAN VS FOSSIL ENERGY INVESTMENT
($BN)

Note: Nominal values. Renewable energy includes large hydro, investment made at financial close. Fossil fuel is gross investment on coal, gas and oil capacity. We assume capacity retirement of 3.3%/yr for coal, 4%/yr for gas and 2.5%/yr for coal in all countries where fossil capacity is net positive. We assume retiring capacity is replaced in countries where fossil fuel capacity additions are net positive and not where additions are zero or negative. We count fossil fuel investment in the year when capacity was commissioned (owing to a lower visibility of data). Q1 2015 figures do not include corporate & government R&D, or EST asset finance estimates which are compiled on an annual basis only.

Source: Bloomberg New Energy Finance
YIELD ON 30-YEAR BONDS, 1977-2015 (%)

Note: This shows the percentage yield of 30 year generic government bond rates downloaded on 09/04/2015 from the Bloomberg Terminal.

Source: Bloomberg New Energy Finance
CAVEAT – GREXIT

Photo: ZDF / Jan Böhmermann?
Note: The size of each circle is proportional to GHG emissions covered. Based off the CA ETS covering 334 million tonnes of CO2 per year as of 2015.

Source: IEA, Bloomberg New Energy Finance
EMISSIONS TRADING SCHEMES, 2015

Note: The size of each circle is proportional to GHG emissions covered. Based off the CA ETS covering 334 million tonnes of CO2 per year as of 2015.

Source: IEA, Bloomberg New Energy Finance
CLEAN VS FOSSIL ENERGY INVESTMENT
($BN)

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Source: Bloomberg New Energy Finance
CLEAN ENERGY CAPITAL REQUIREMENT TO 2030 ($BN)

CLEAN ENERGY CAPITAL REQUIREMENT TO 2030
($BN)

Thanks!

MARKETS
Renewable Energy
Energy Smart Technologies
Advanced Transport
Gas
Carbon and RECs

SERVICES
Americas Service
Asia Pacific Service
EMEA Service
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Unique analysis, tools and data for decision-makers driving change in the energy system

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