GREEN MARKETS, SUSTAINABLE BUSINESS

Centre for Enterprise, Markets and Ethics, 2 March 2017

Michael Liebreich
Chairman of the Advisory Board
Twitter: @mliebreich

Bloomberg NEW ENERGY FINANCE

THE LEGACY ENERGY SYSTEM

Bloomberg NEW ENERGY FINANCE

THE EMERGING ENERGY SYSTEM

GLOBAL CLEAN ENERGY INVESTMENT & CAPACITY ADDITIONS

Bloomberg NEW ENERGY FINANCE

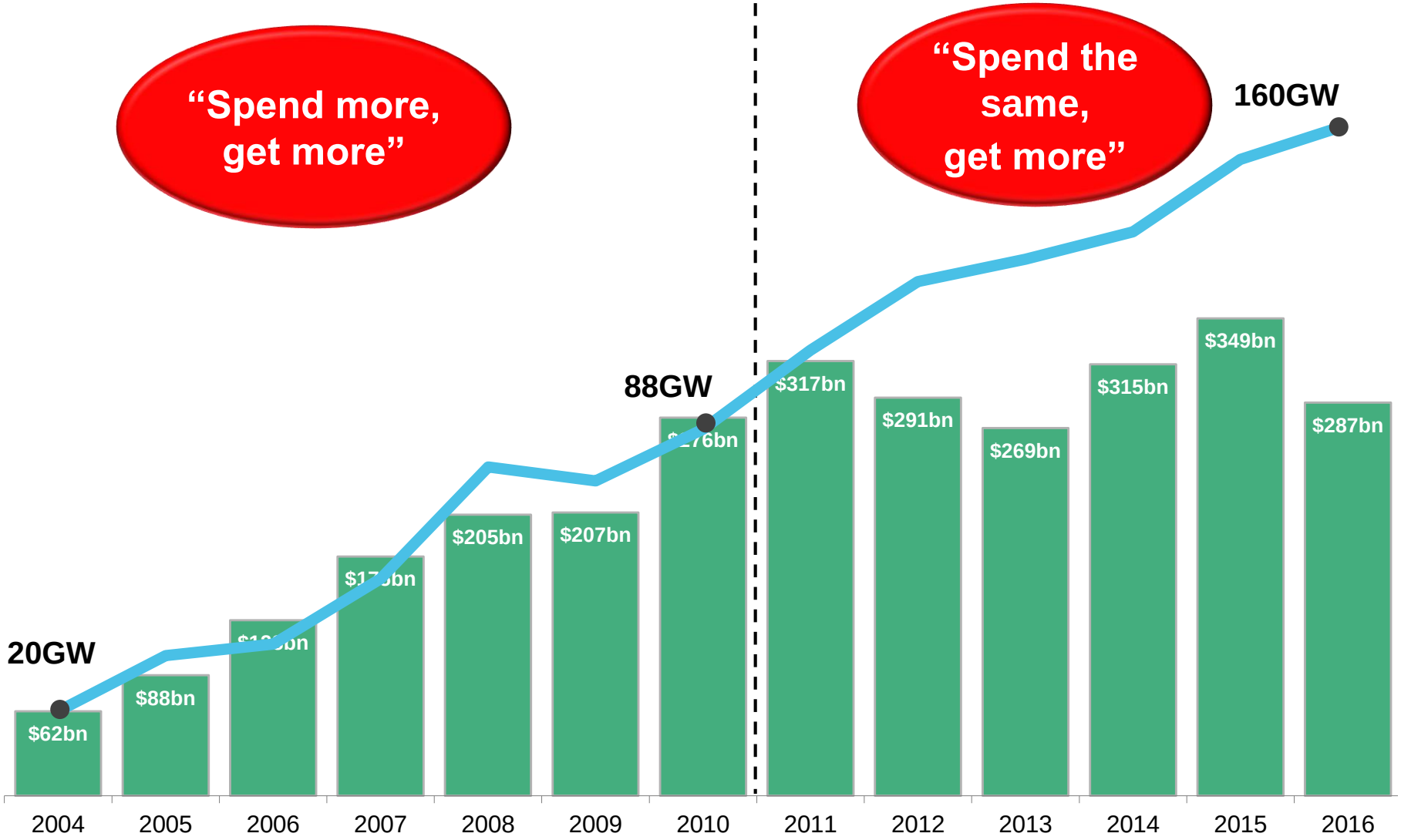
2004

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). Excludes large hydro.

Source: Bloomberg Intelligence, Bloomberg New Energy Finance

GLOBAL CLEAN ENERGY INVESTMENT & CAPACITY ADDITIONS

Bloomberg NEW ENERGY FINANCE

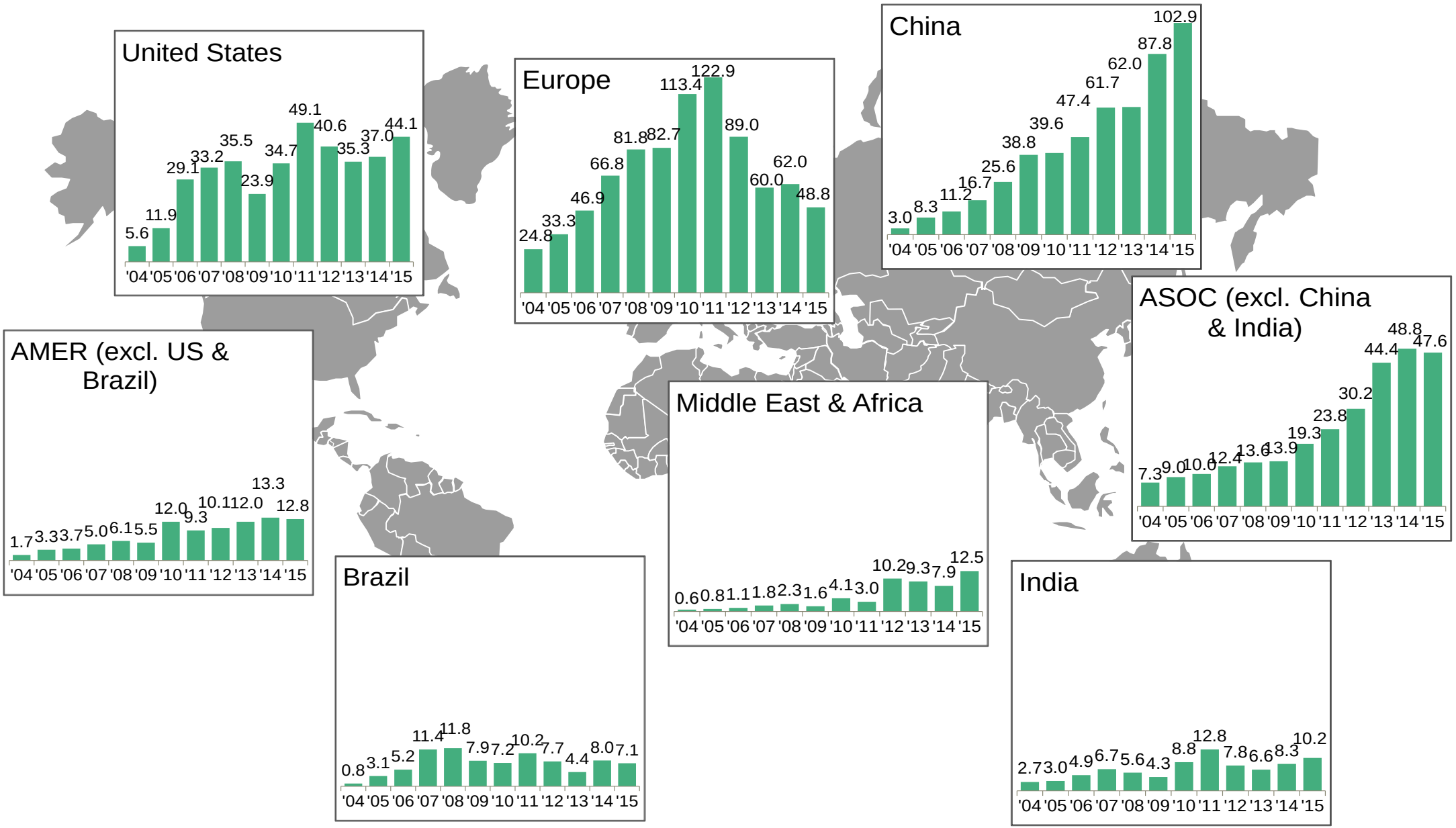


Note: Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy and energy storage projects (not reported in quarterly statistics). Excludes large hydro.

Source: Bloomberg Intelligence, Bloomberg New Energy Finance

RENEWABLE ENERGY INVESTMENT BY REGION 2004-2015 ($BN)

Bloomberg NEW ENERGY FINANCE

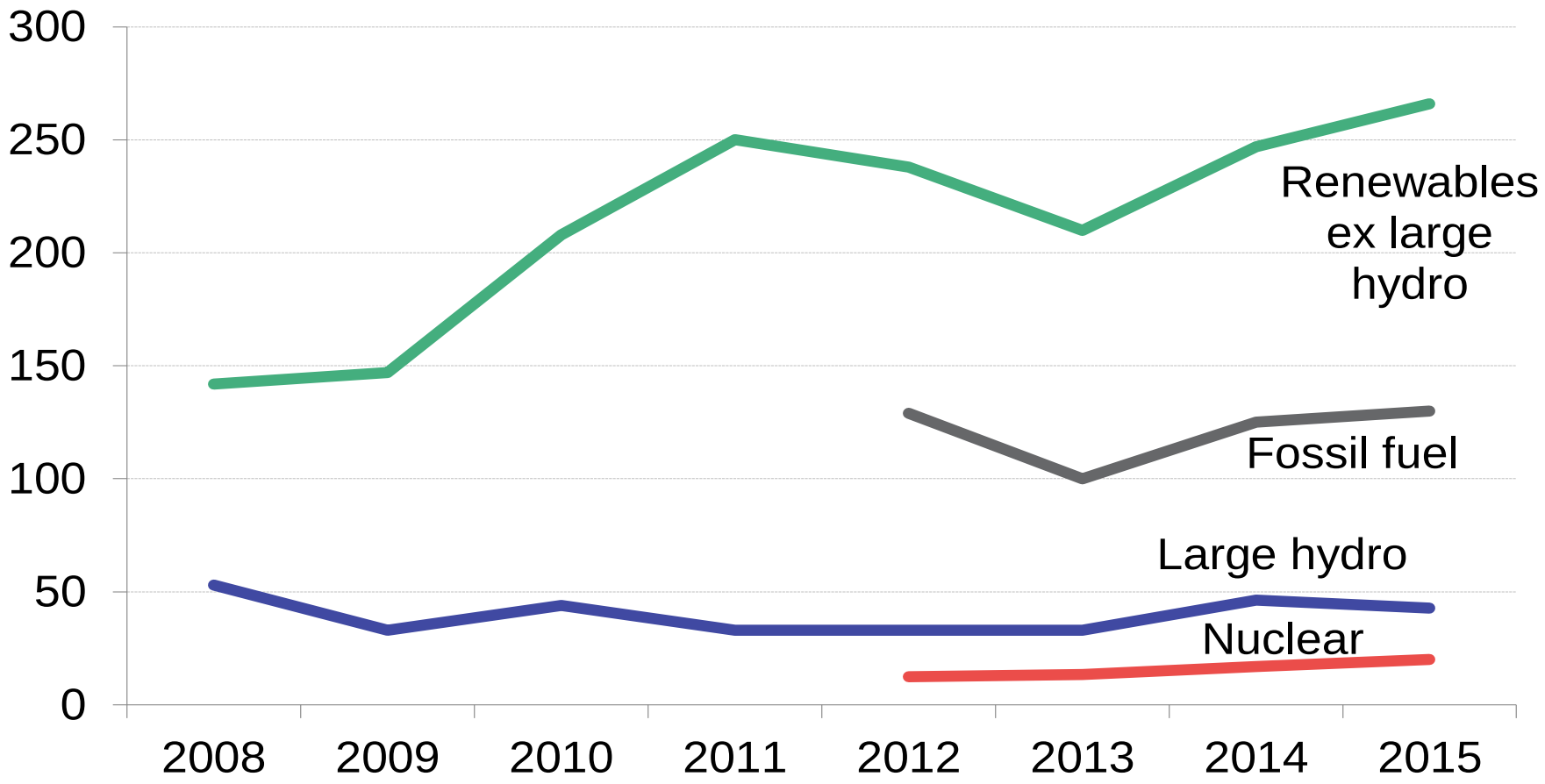


Note: New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals.

Source: Bloomberg New Energy Finance

INVESTMENT IN POWER CAPACITY, 2008–15 ($BN)

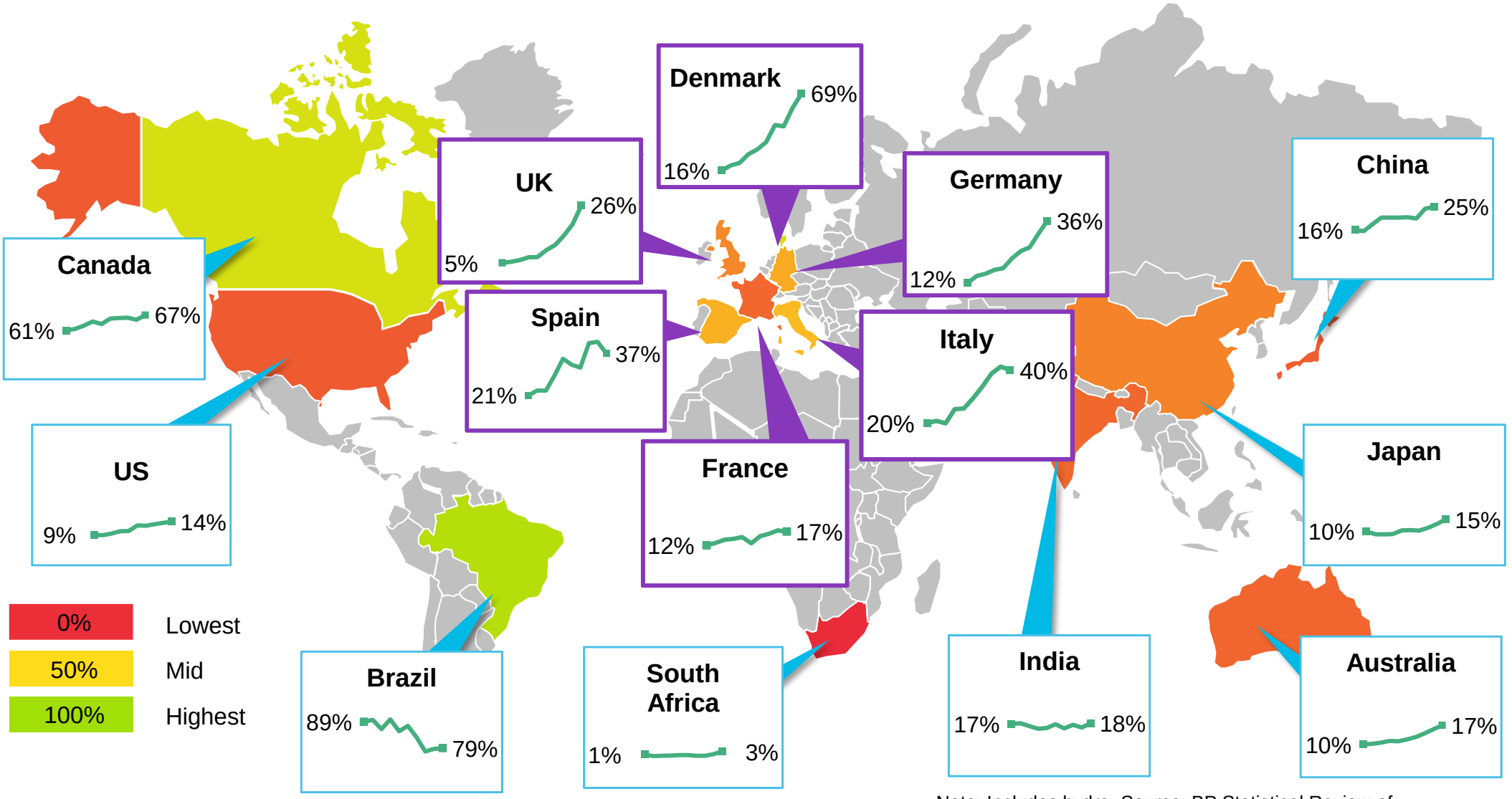
Bloomberg NEW ENERGY FINANCE



Source: UNEP, Bloomberg New Energy Finance

RENEWABLE ENERGY PROPORTION OF POWER GENERATION, 10 YEARS TO 2015 (%)

Bloomberg NEW ENERGY FINANCE



Note: Includes hydro Source: BP Statistical Review of Energy, Bloomberg New Energy Finance

2011 UNSUBSIDISED CLEAN ENERGY WORLD RECORDS

Bloomberg NEW ENERGY FINANCE

ONSHORE WIND

US$ 6.2 cents/kWh

SOLAR PV

US$ 17 cents/kWh

Source: Bloomberg New Energy Finance; ImagesSiemens; Wikimedia Commons

2016 UNSUBSIDISED CLEAN ENERGY WORLD RECORDS

Bloomberg NEW ENERGY FINANCE

ONSHORE WIND

Location:	Morocco
Bidder:	Enel Green Power
Signed:	January 2016
Construction:	2018
Price:	US$ 3.0 c/kWh

SOLAR PV

Location:	Peru
Bidder:	Enel Green Power
Signed:	February 2016
Construction:	2017
Price:	**US$ 4.8 c/kWh**

Source: Bloomberg New Energy Finance; ImagesSiemens; Wikimedia Commons

2016 UNSUBSIDISED CLEAN ENERGY WORLD RECORDS

Bloomberg NEW ENERGY FINANCE

ONSHORE WIND

Location:	Morocco
Bidder:	Enel Green Power
Signed:	January 2016
Construction:	2018
Price:	US$ 3.0 c/kWh

SOLAR PV

Location:	Coahuila, Mexico
Bidder:	Enel Green Power
Signed:	March 2016
Construction:	2018
Price:	**US$ 3.6 c/kWh**

Source: Bloomberg New Energy Finance; ImagesSiemens; Wikimedia Commons

2016 UNSUBSIDISED CLEAN ENERGY WORLD RECORDS

Bloomberg NEW ENERGY FINANCE

ONSHORE WIND

Location:	Morocco
Bidder:	Enel Green Power
Signed:	January 2016
Construction:	2018
Price:	US$ 3.0 c/kWh

SOLAR PV

Location:	Dubai
Bidder:	Masdar Consortium
Signed:	May 2016
Construction:	2019
Price:	**US$ 2.99 c/kWh**

Source: Bloomberg New Energy Finance; ImagesSiemens; Wikimedia Commons

2016 UNSUBSIDISED CLEAN ENERGY WORLD RECORDS

Bloomberg NEW ENERGY FINANCE

ONSHORE WIND

Location:	Morocco
Bidder:	Enel Green Power
Signed:	January 2016
Construction:	2018
Price:	US$ 3.0 c/kWh

SOLAR PV

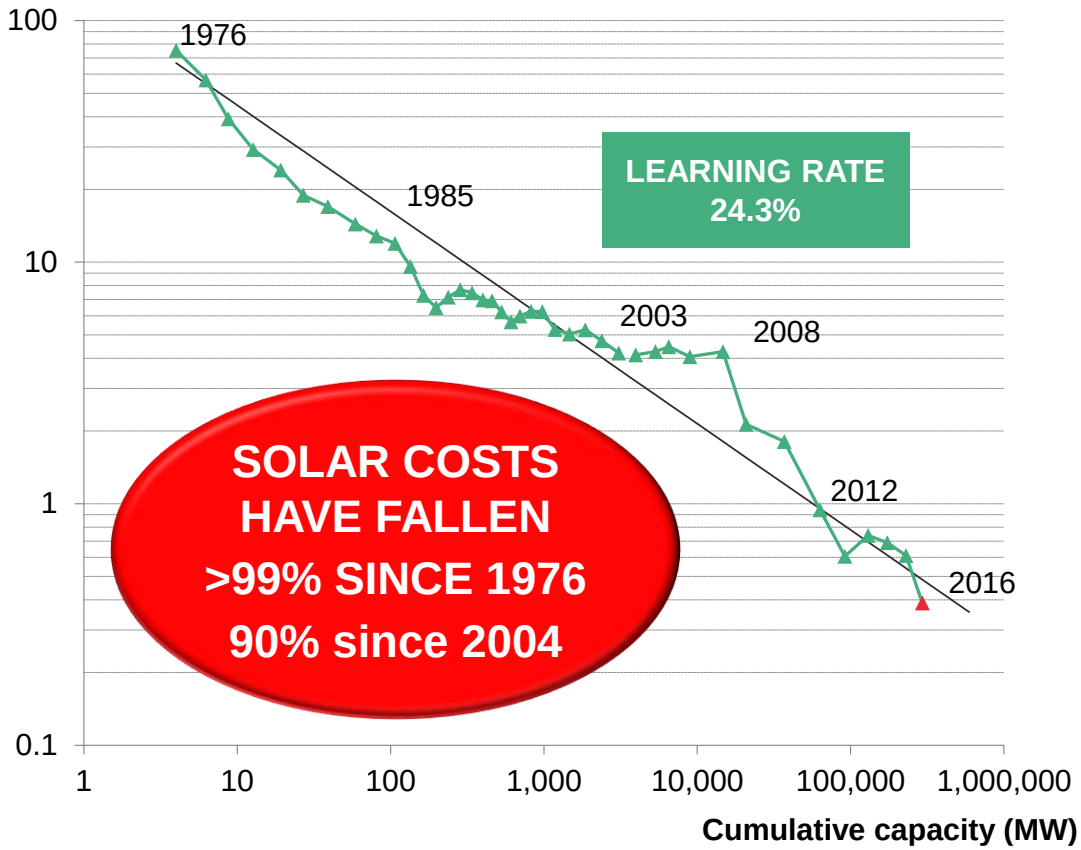
Location:	Chile
Bidder:	Solarpack Corporation
Signed:	August 2016
Construction:	2019
Price:	**US$ 2.91 c/kWh**

Source: Bloomberg New Energy Finance; ImagesSiemens; Wikimedia Commons

WIND AND SOLAR EXPERIENCE CURVES

Bloomberg NEW ENERGY FINANCE

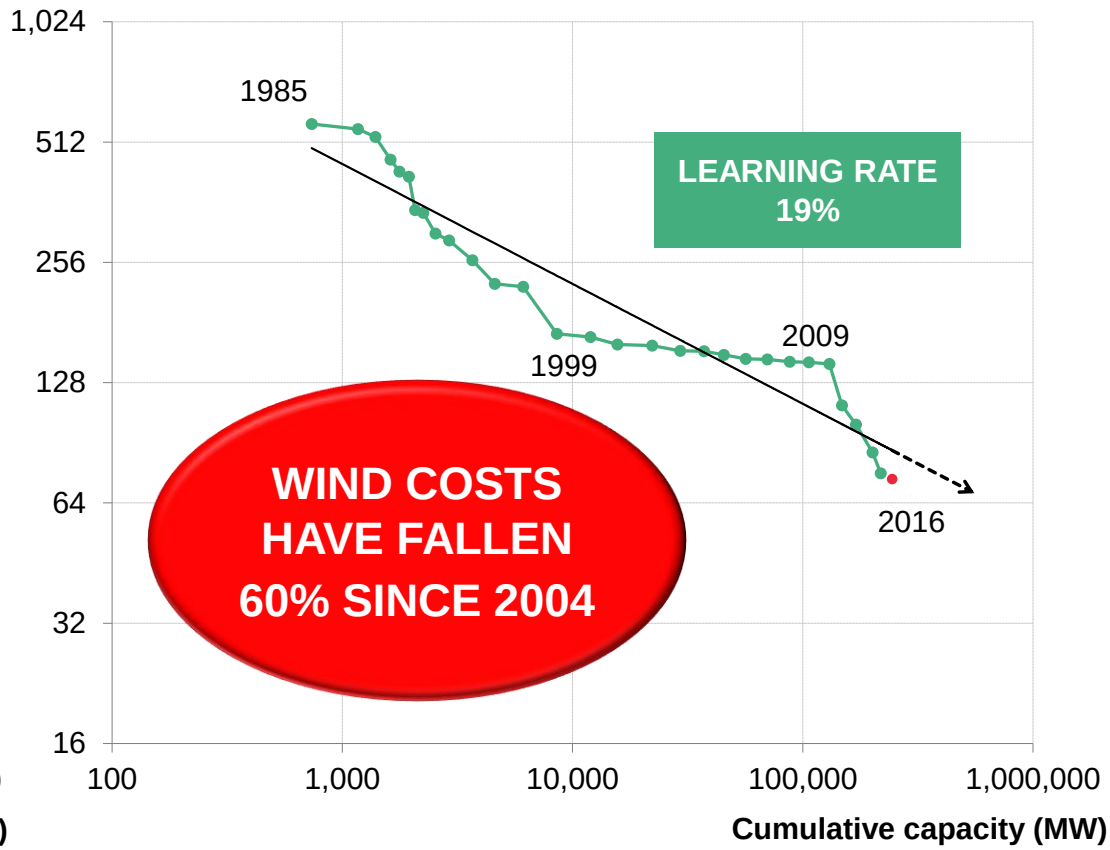
SOLAR PV MODULE COST ($/W)



Note: Prices are in real (2015) USD. 'Current price' is $0.4/W

Source: Bloomberg New Energy Finance, Maycock

ONSHORE WIND LEVELISED COST* ($/MWH)



Note: Pricing data has been inflation corrected to 2014. We assume the debt ratio of 70%, cost of debt (bps to LIBOR) of 175, cost of equity of 8%. *Data is for Northern Europe.

Source: Bloomberg New Energy Finance

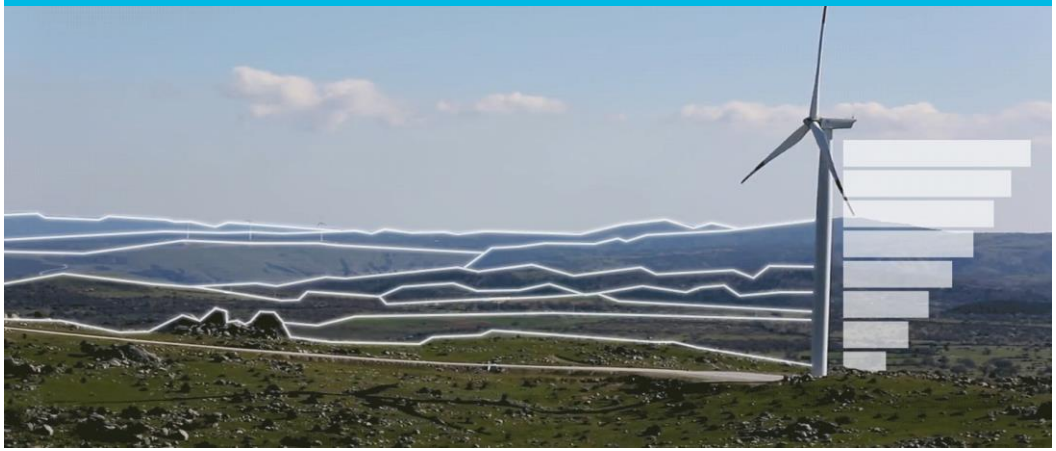
CAPACITY FACTOR IMPROVEMENTS

Bloomberg NEW ENERGY FINANCE

LONGER BLADES

LOW-WIND TURBINES AT HIGH-WIND SITES

SITE-OPTIMISED POWER CURVES

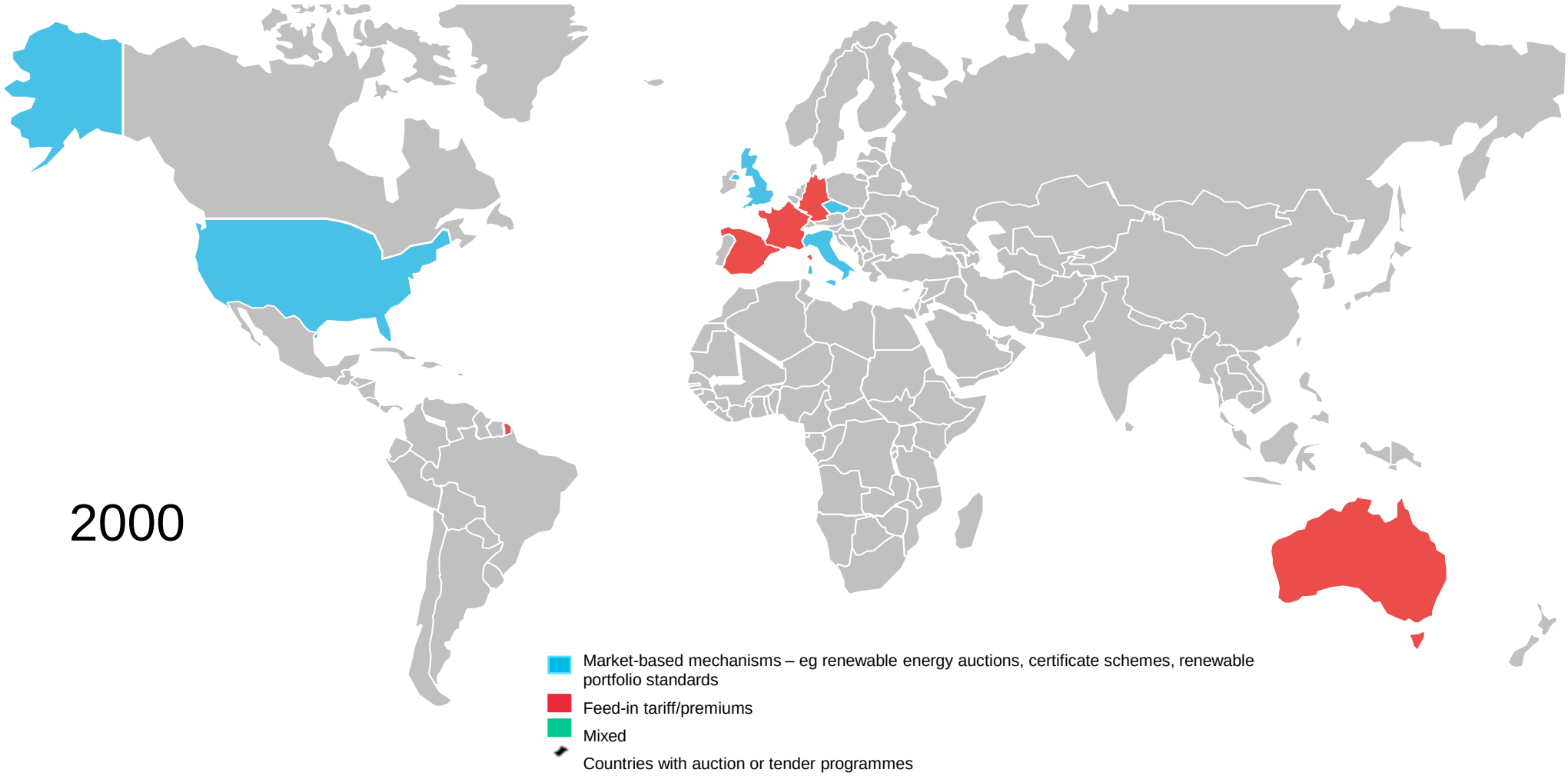


HIGHER TOWERS

Source: Siemens, Nordex, GE, Vestas

RENEWABLE ENERGY - THE MARCH OF THE PRICE SIGNAL

Bloomberg NEW ENERGY FINANCE



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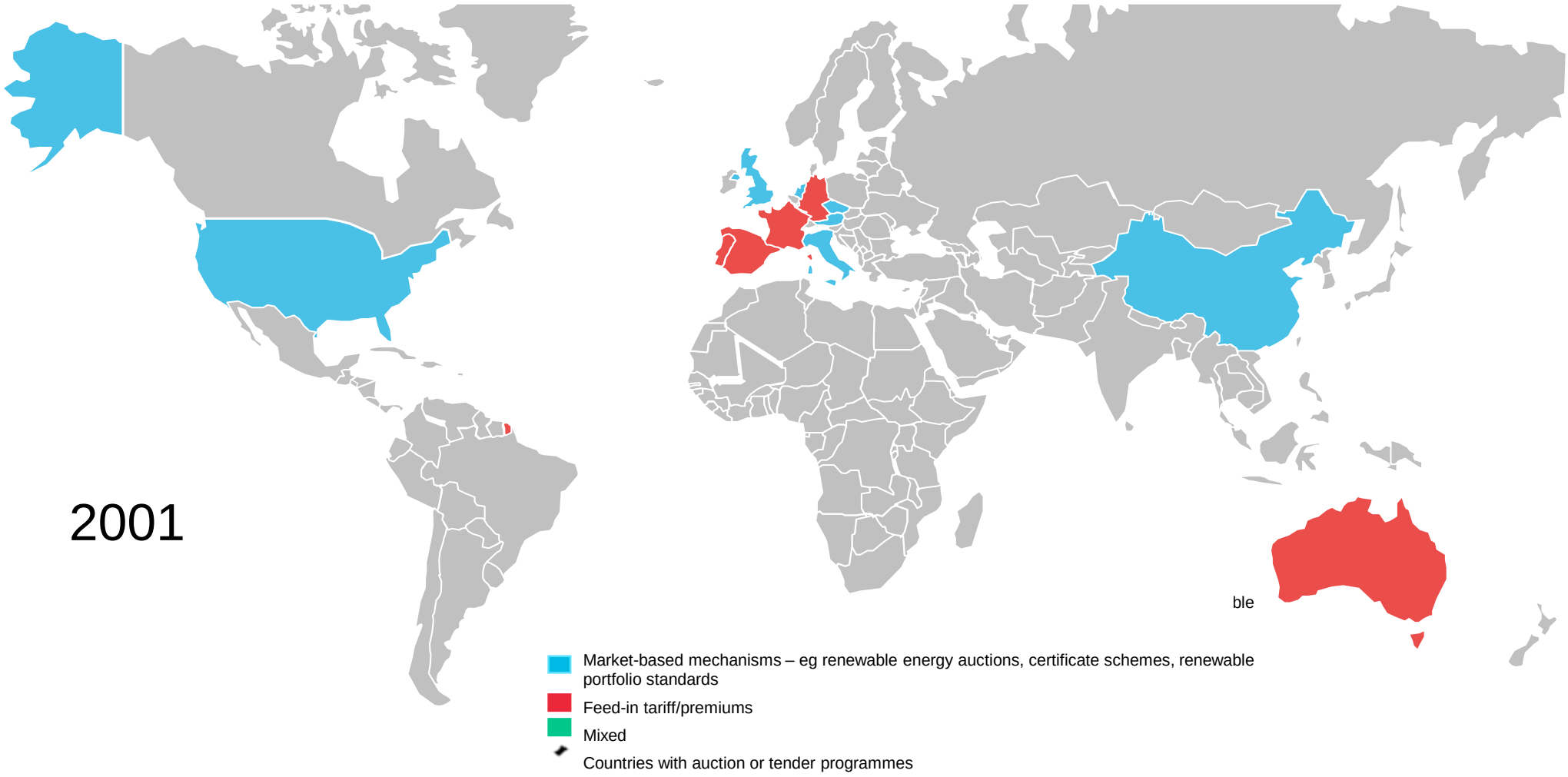

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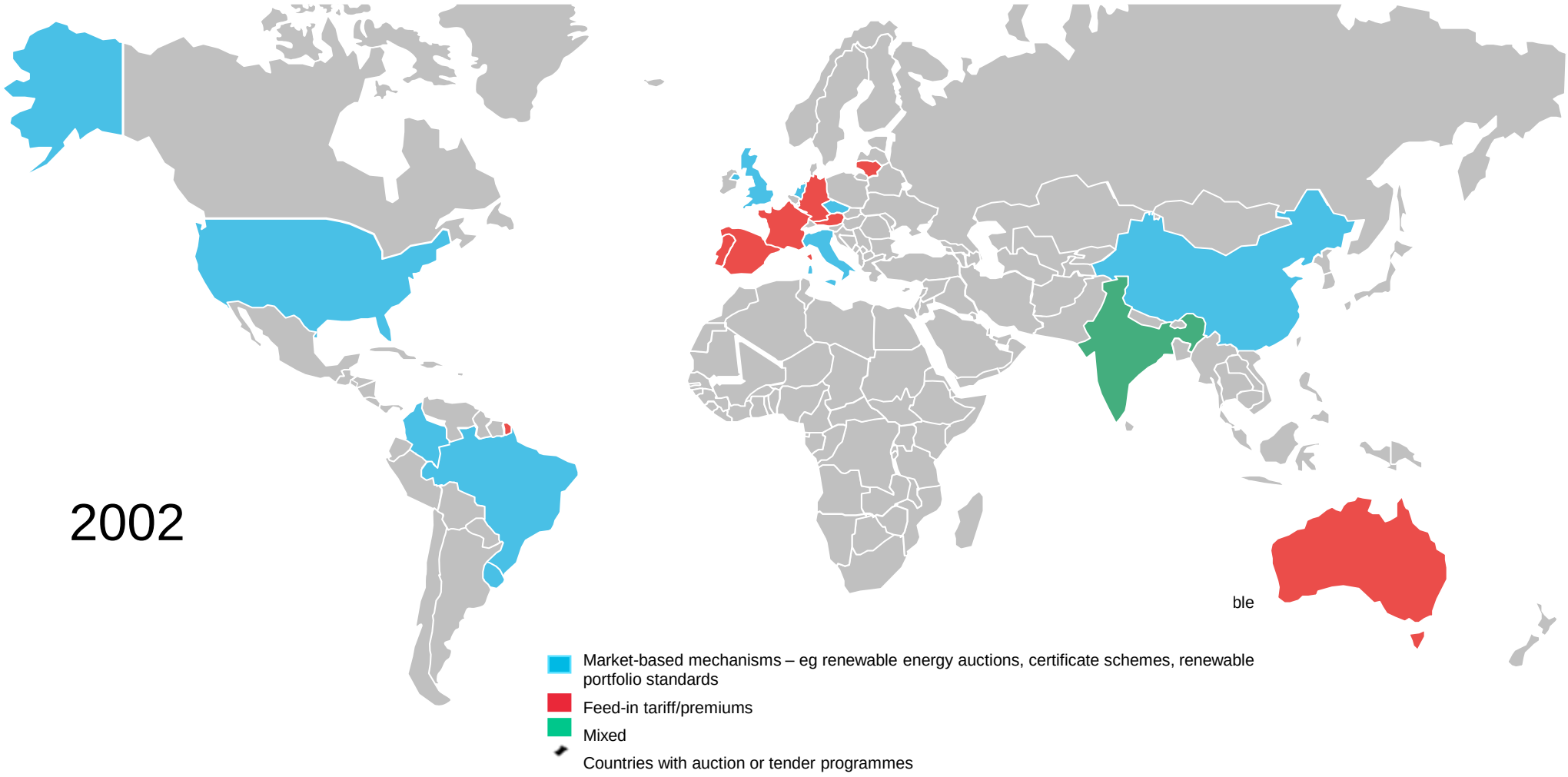

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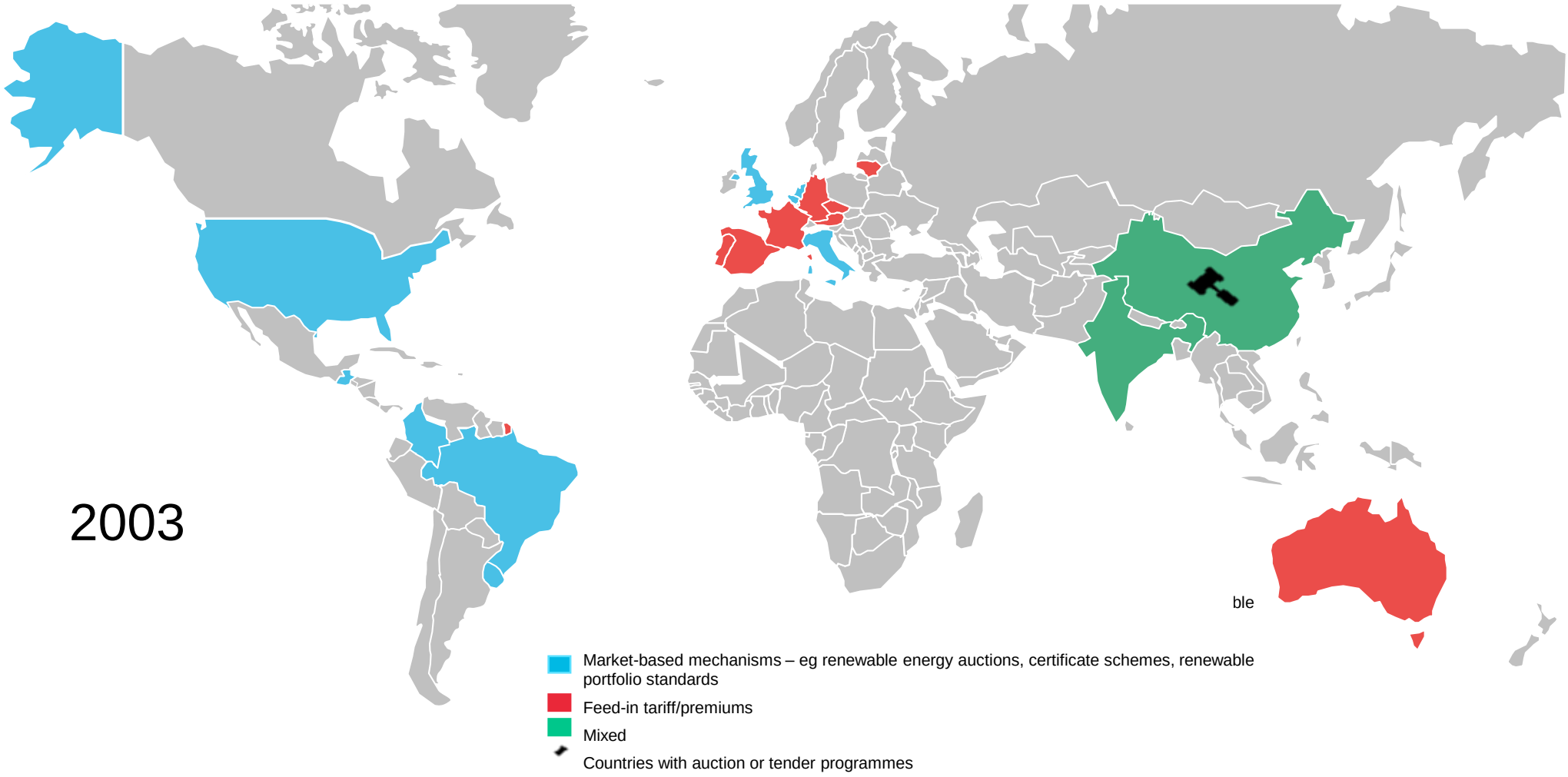

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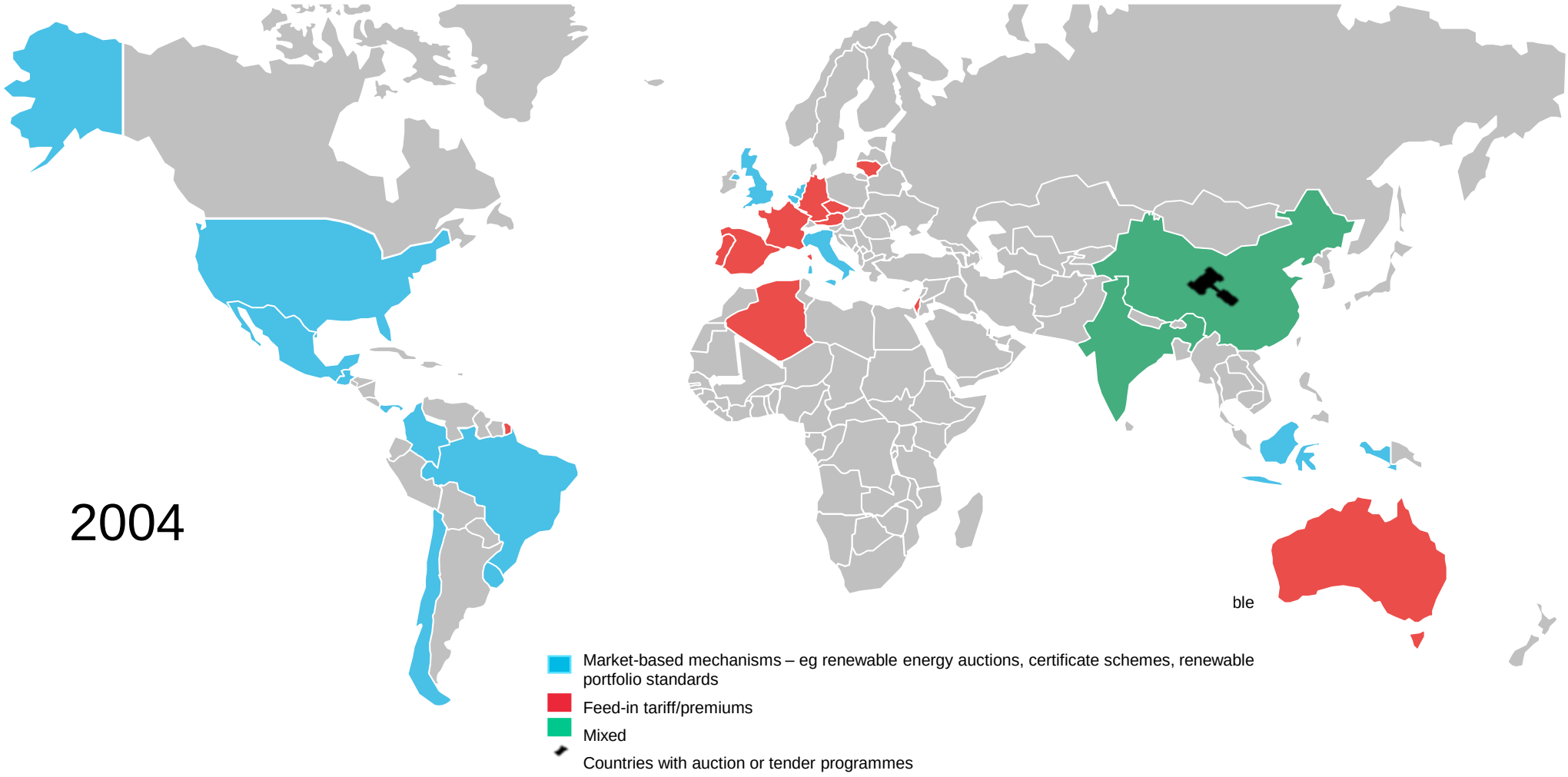

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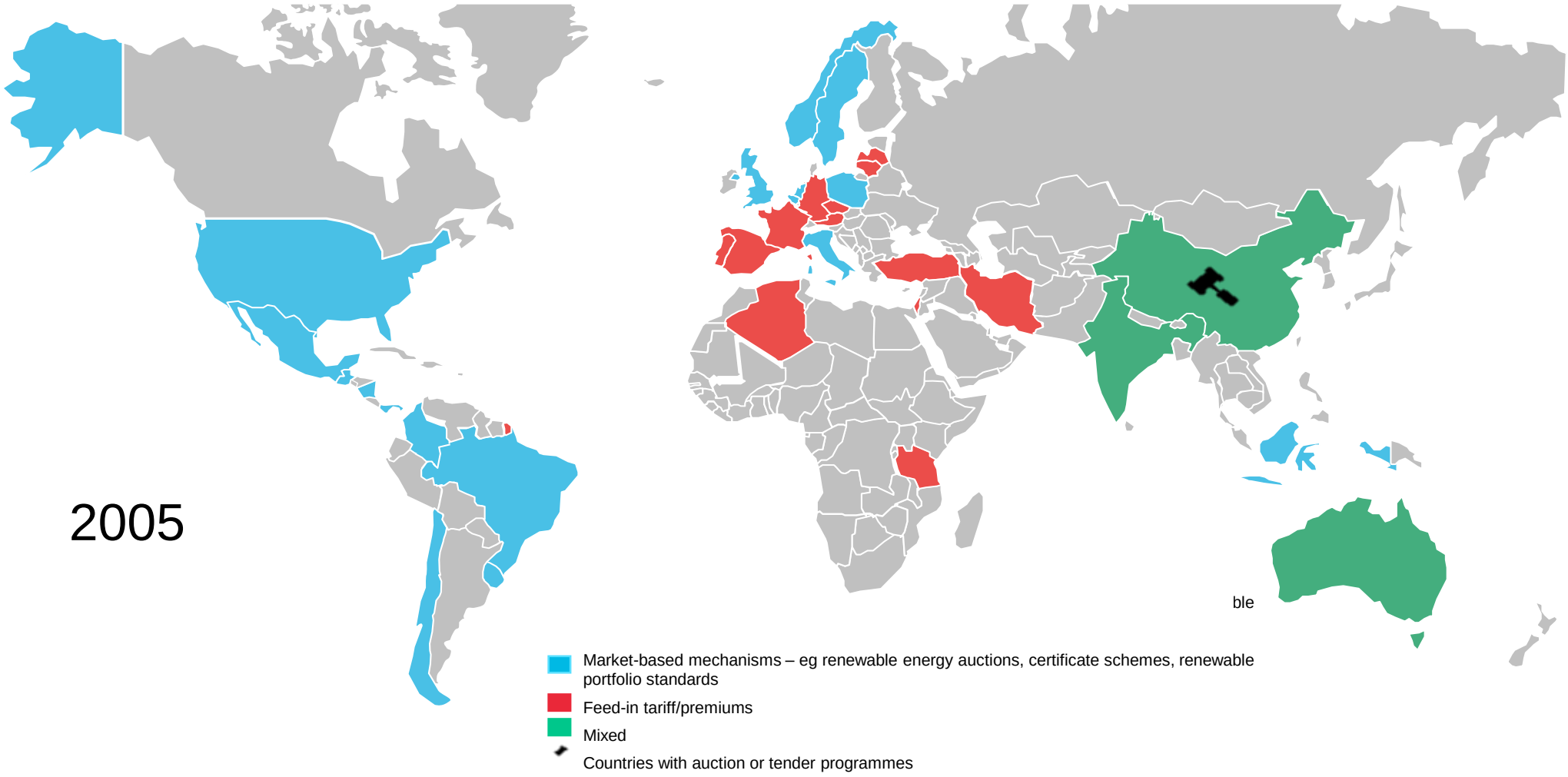

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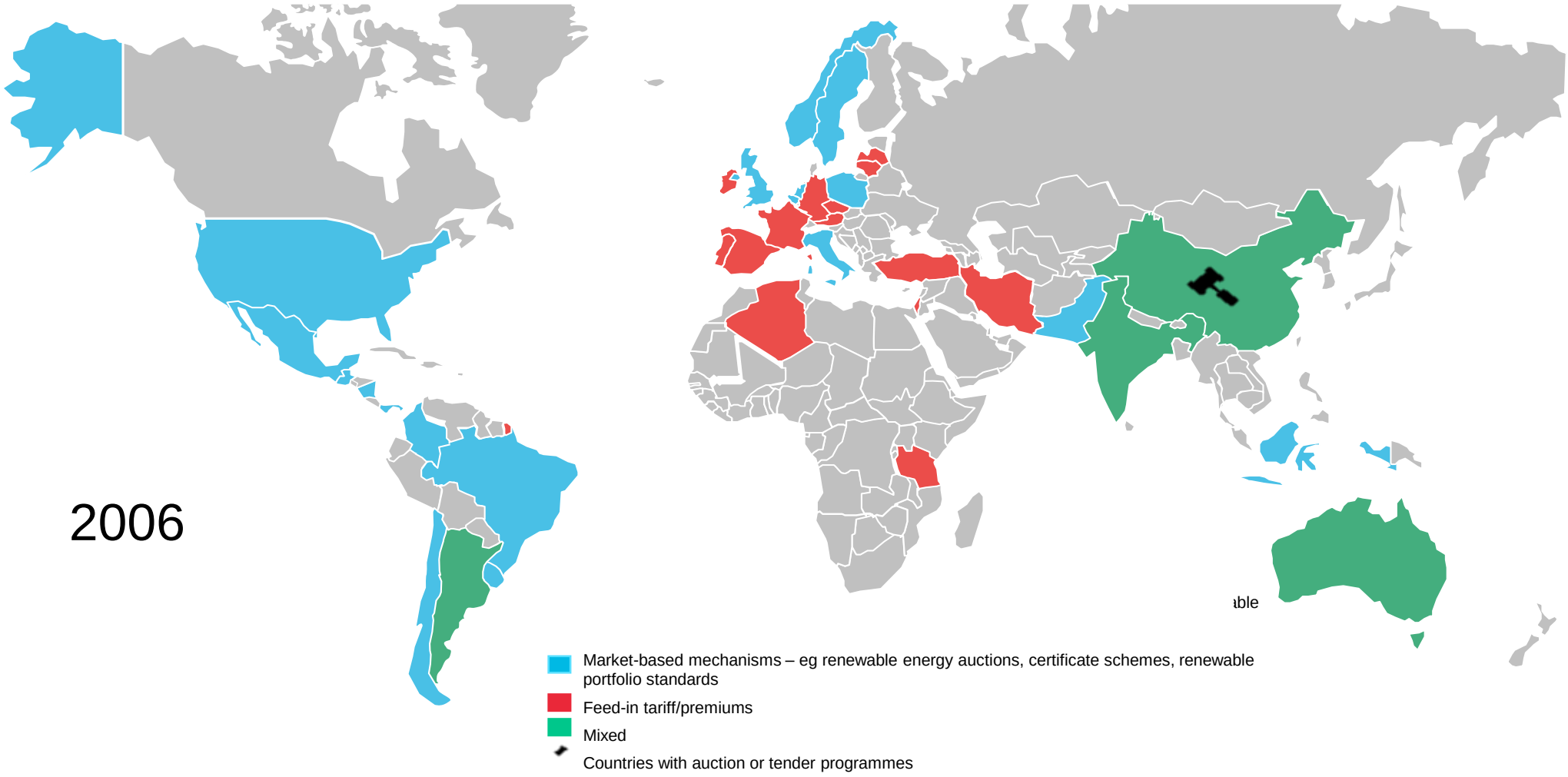

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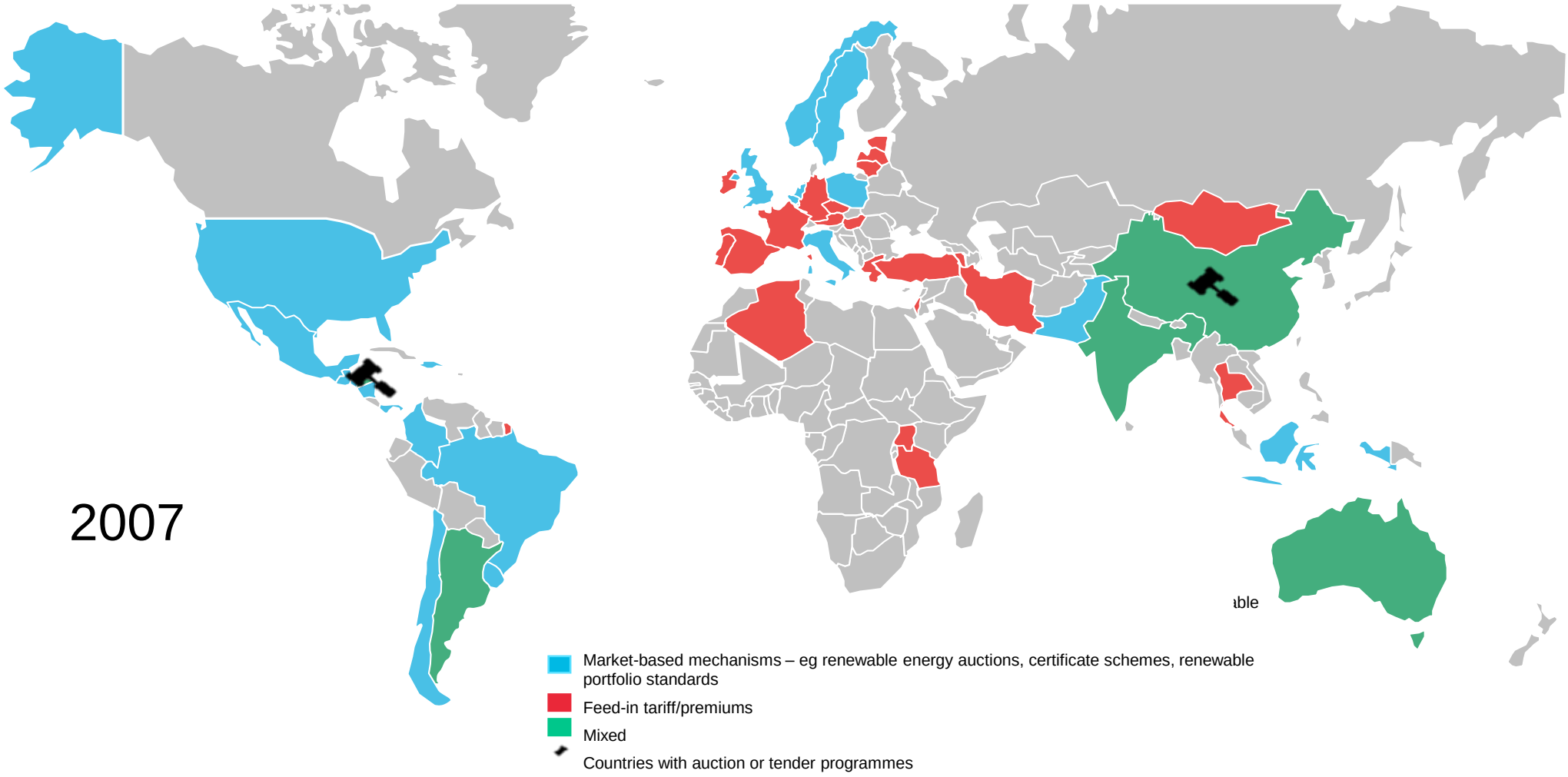

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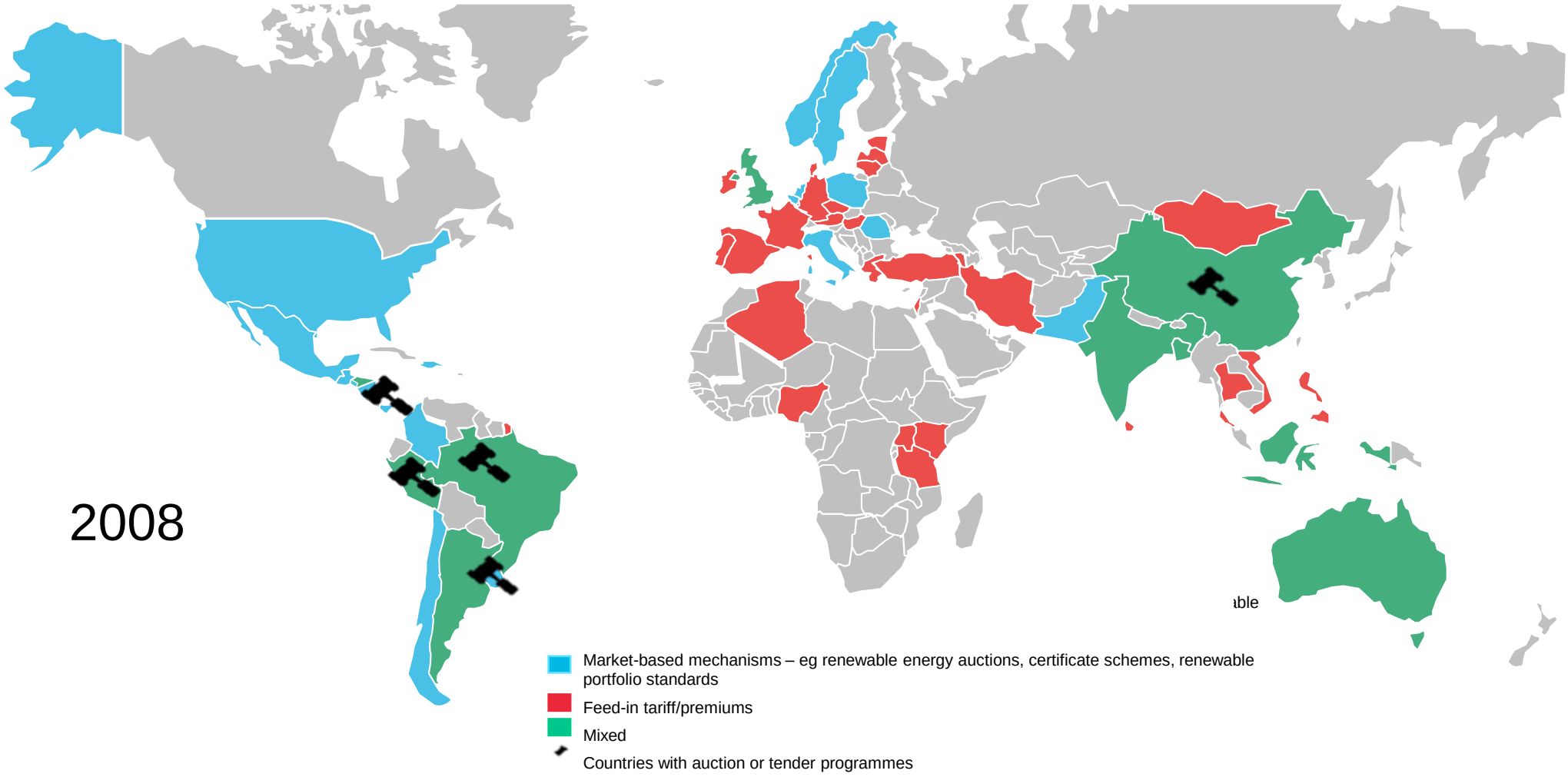

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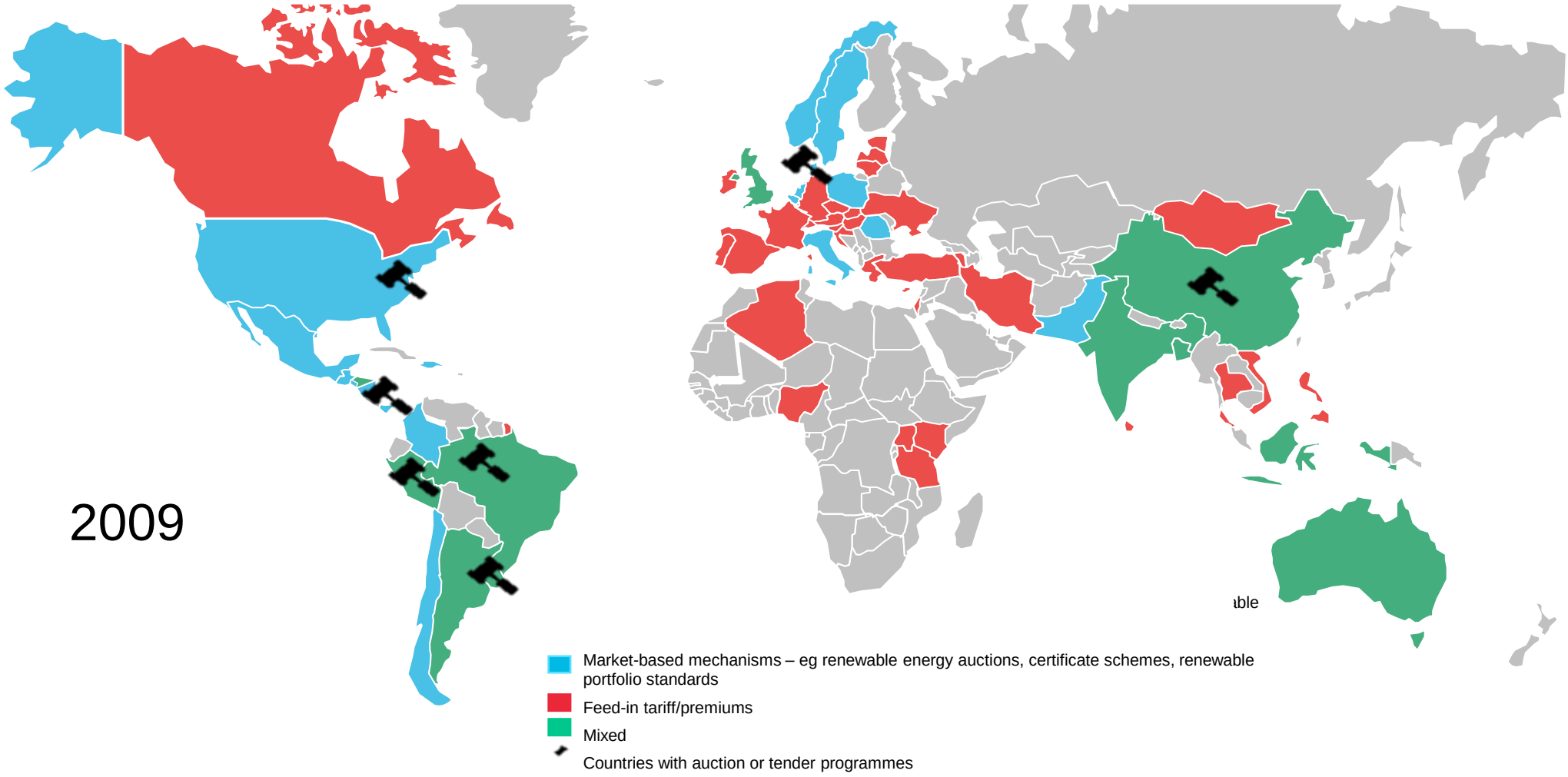

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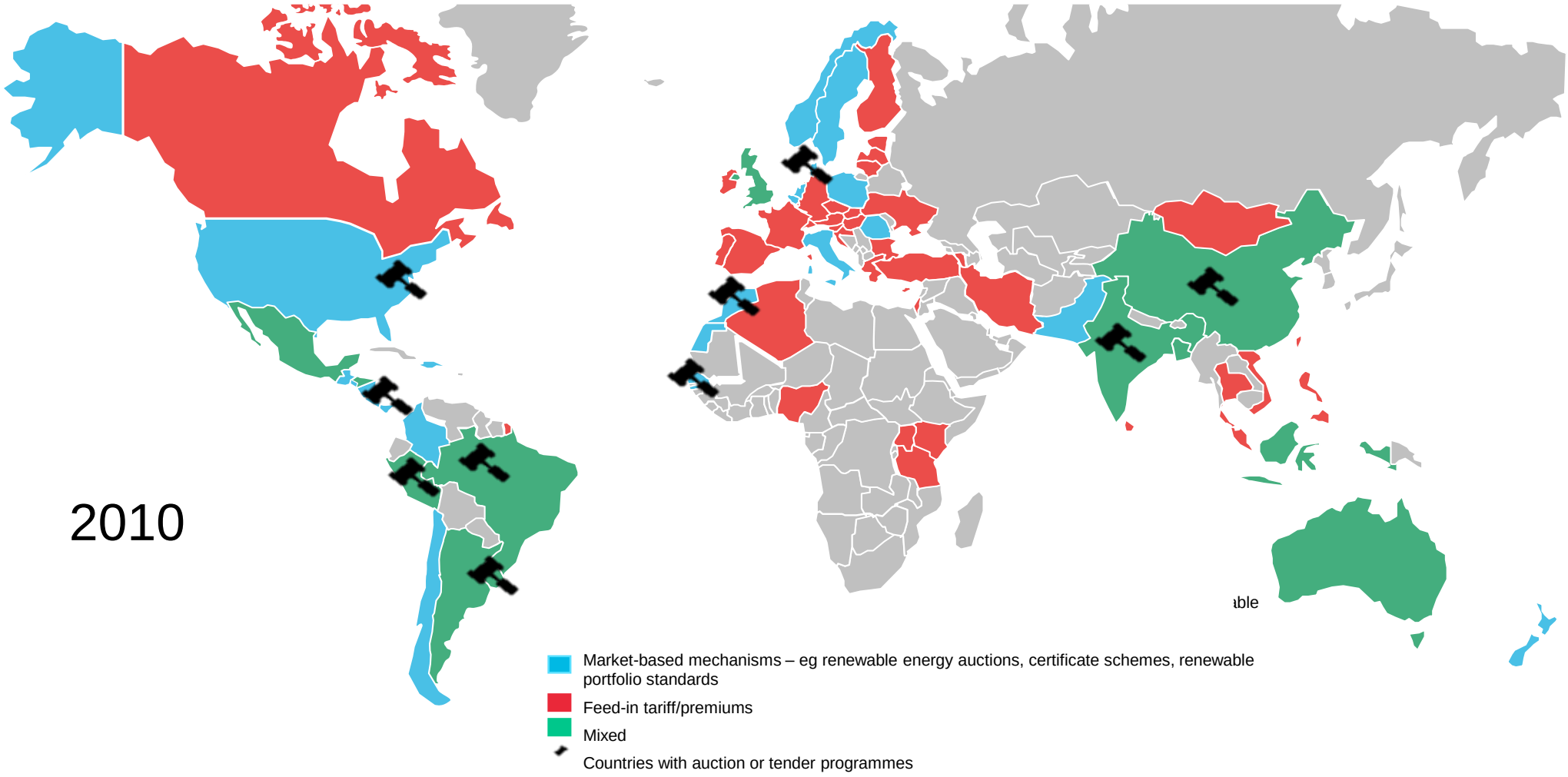

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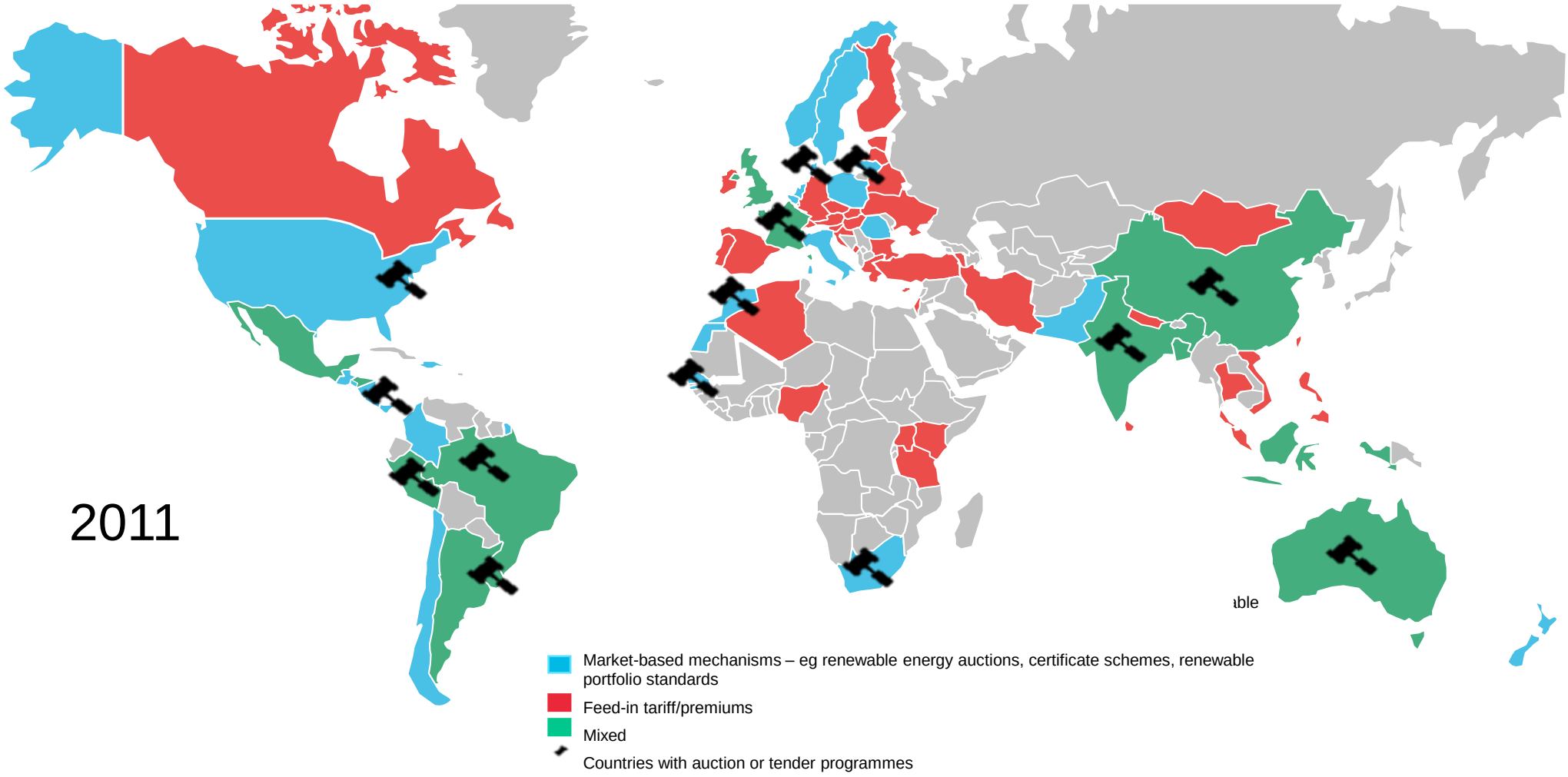

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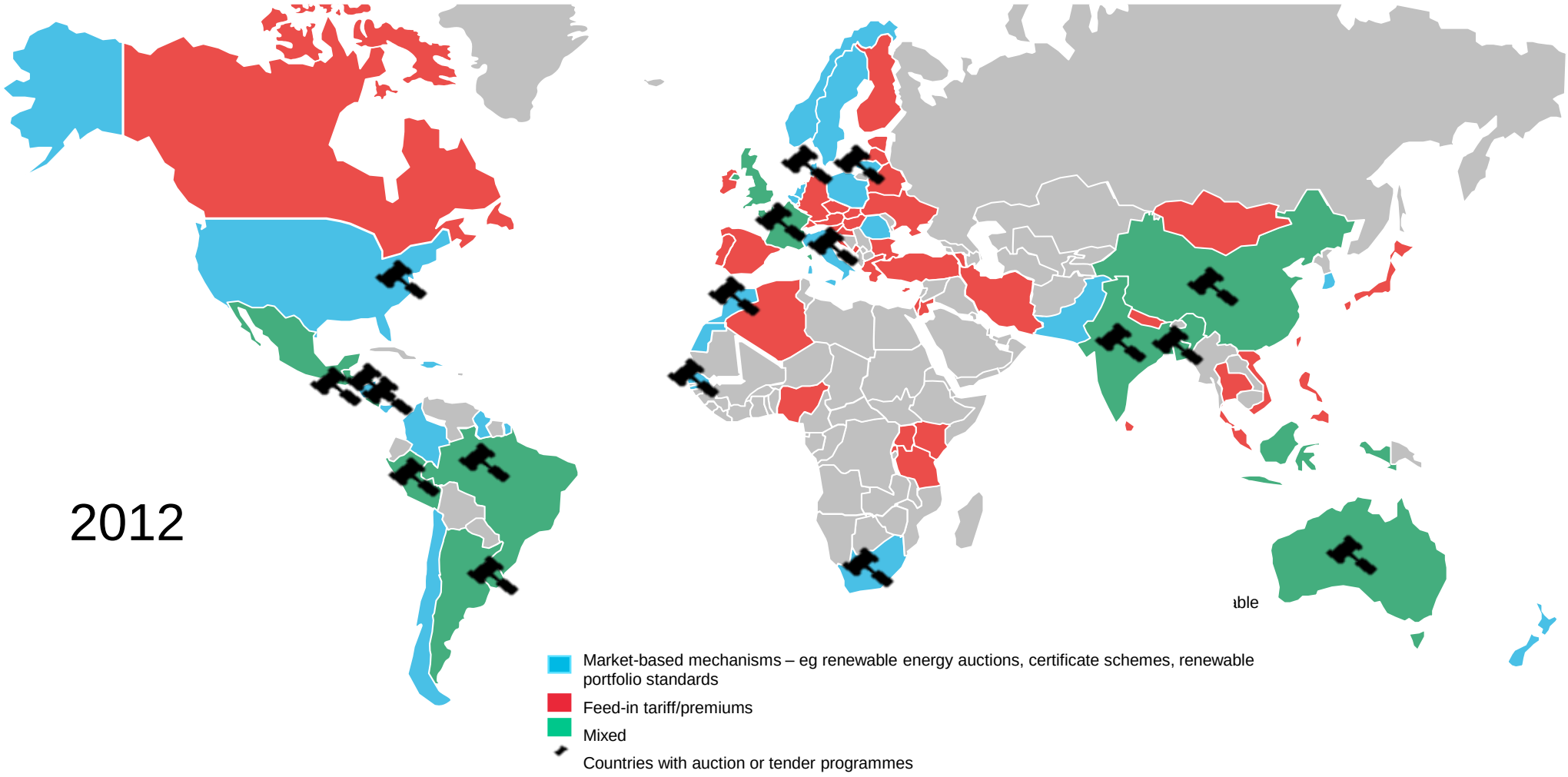

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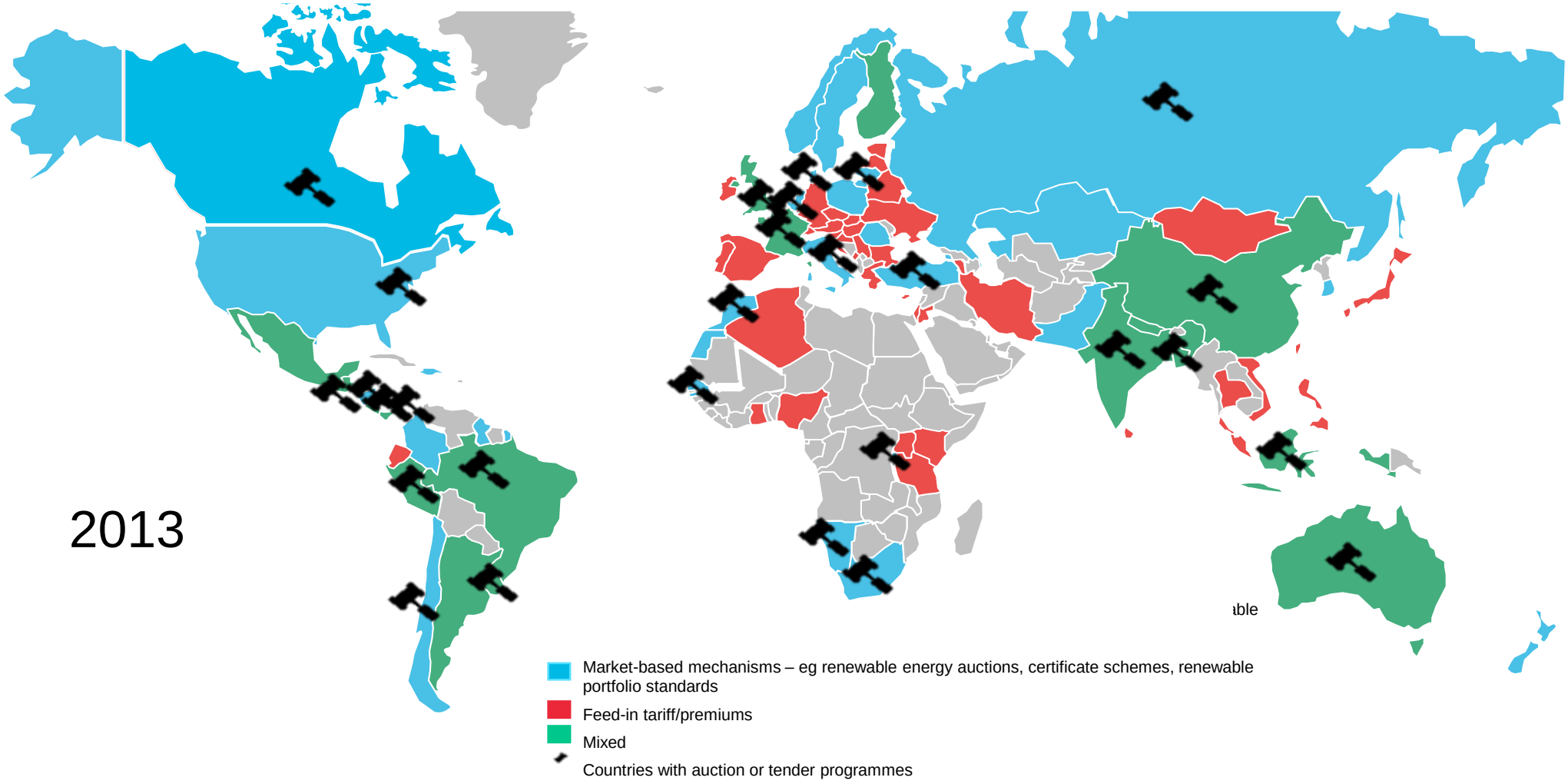

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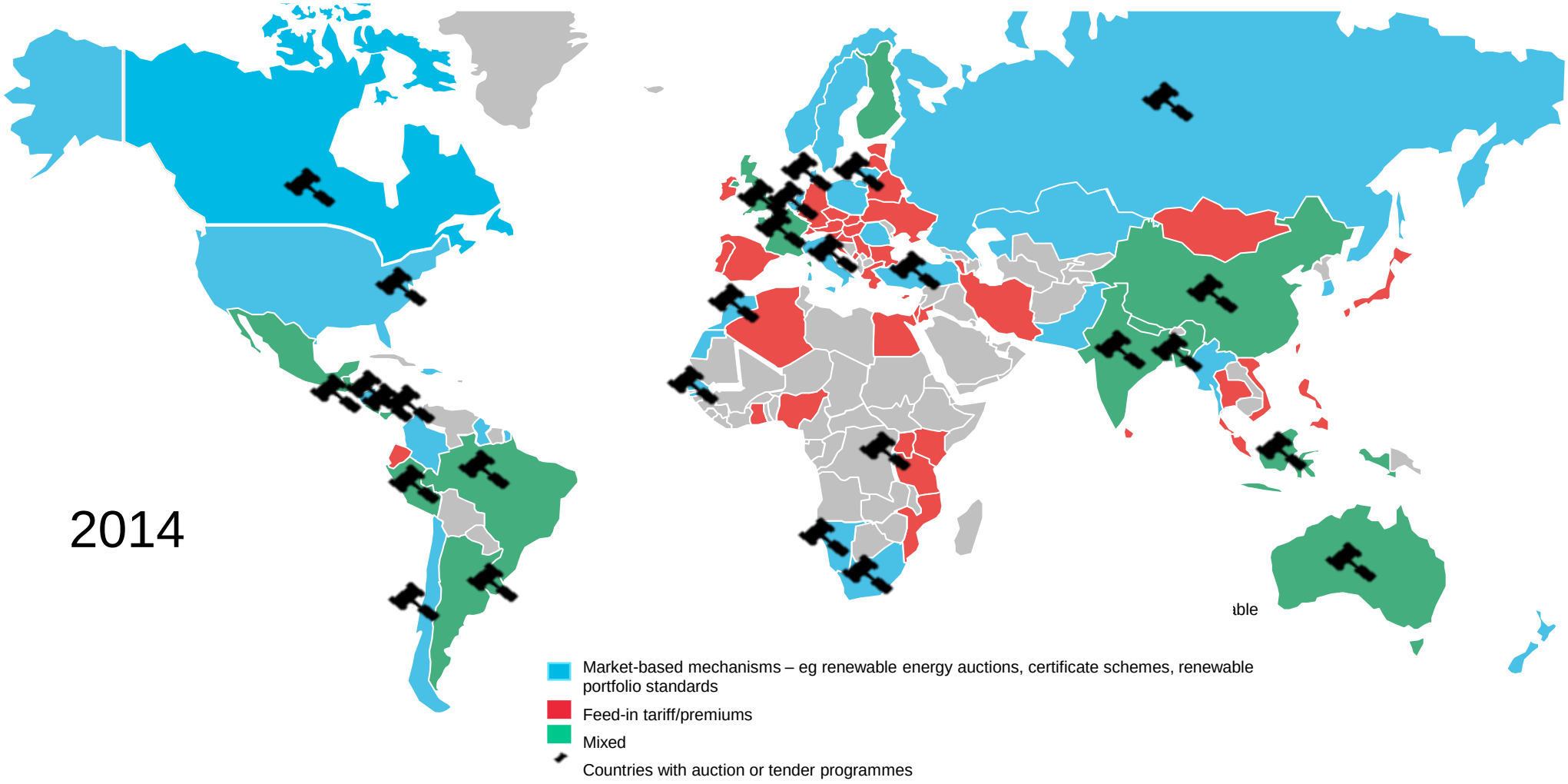

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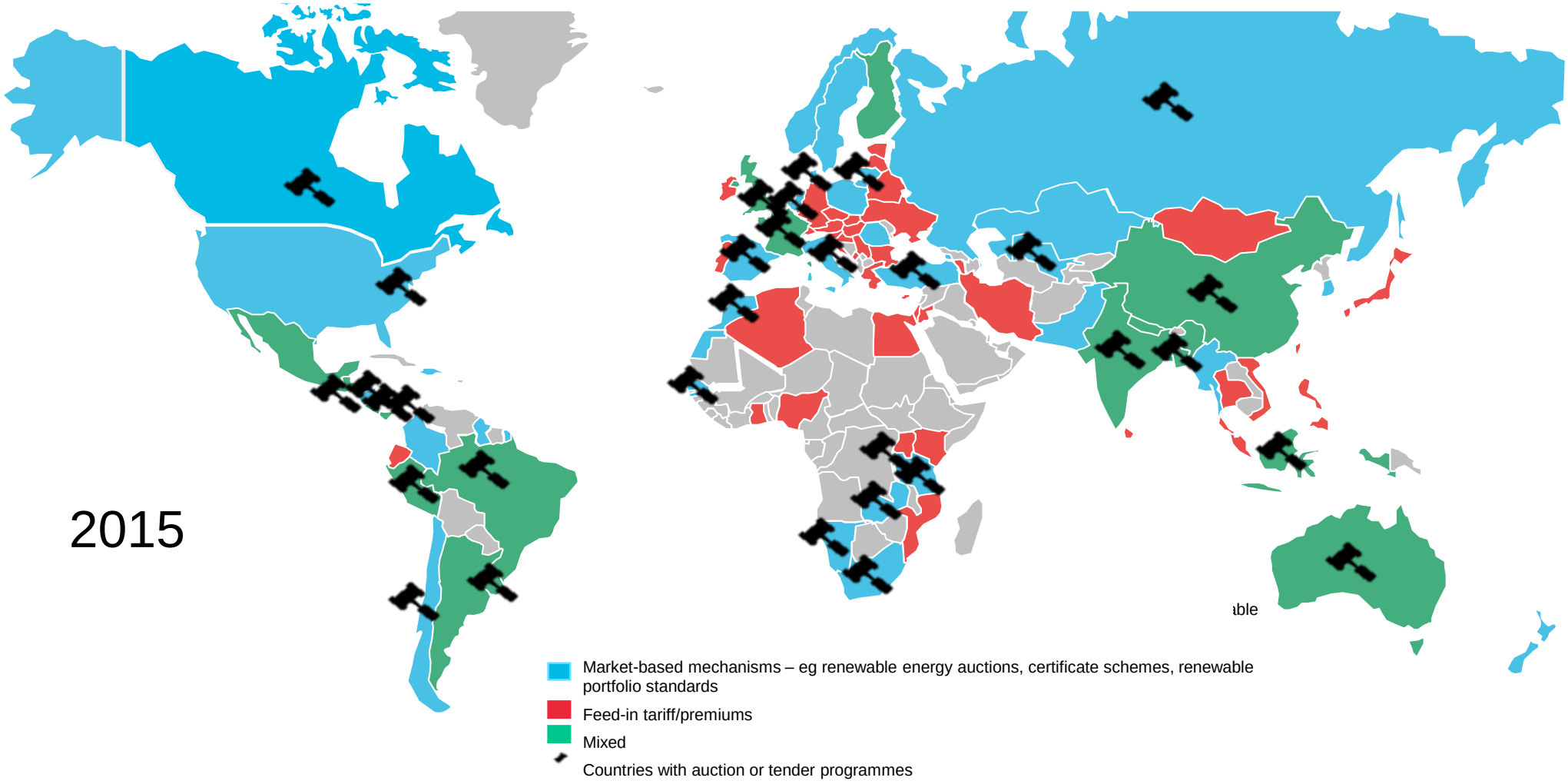

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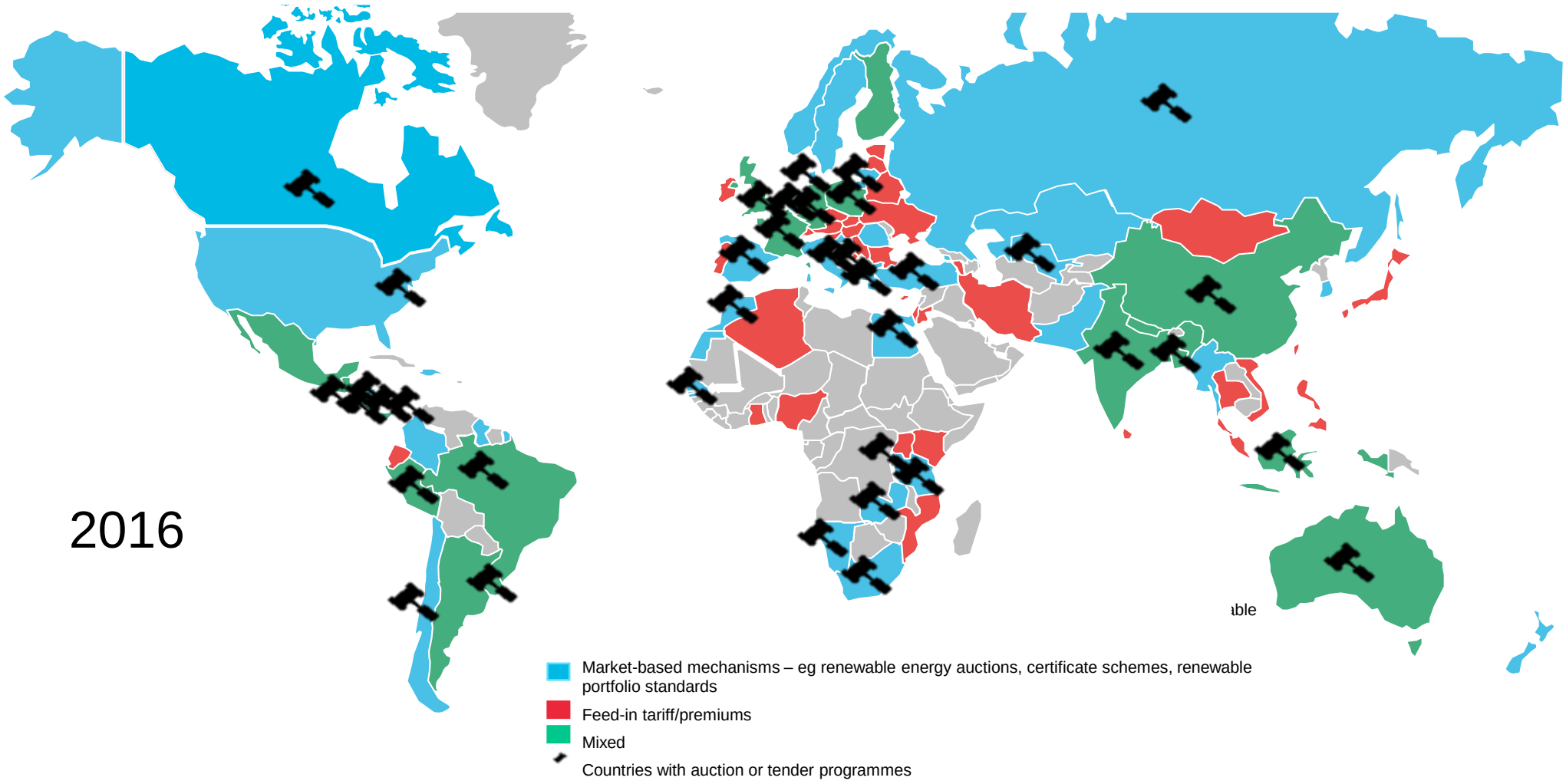


ELECTRIC VEHICLES

Bloomberg NEW ENERGY FINANCE

CARS AND TRUCKS IN USE WORLDWIDE, 2016

1.3 billion

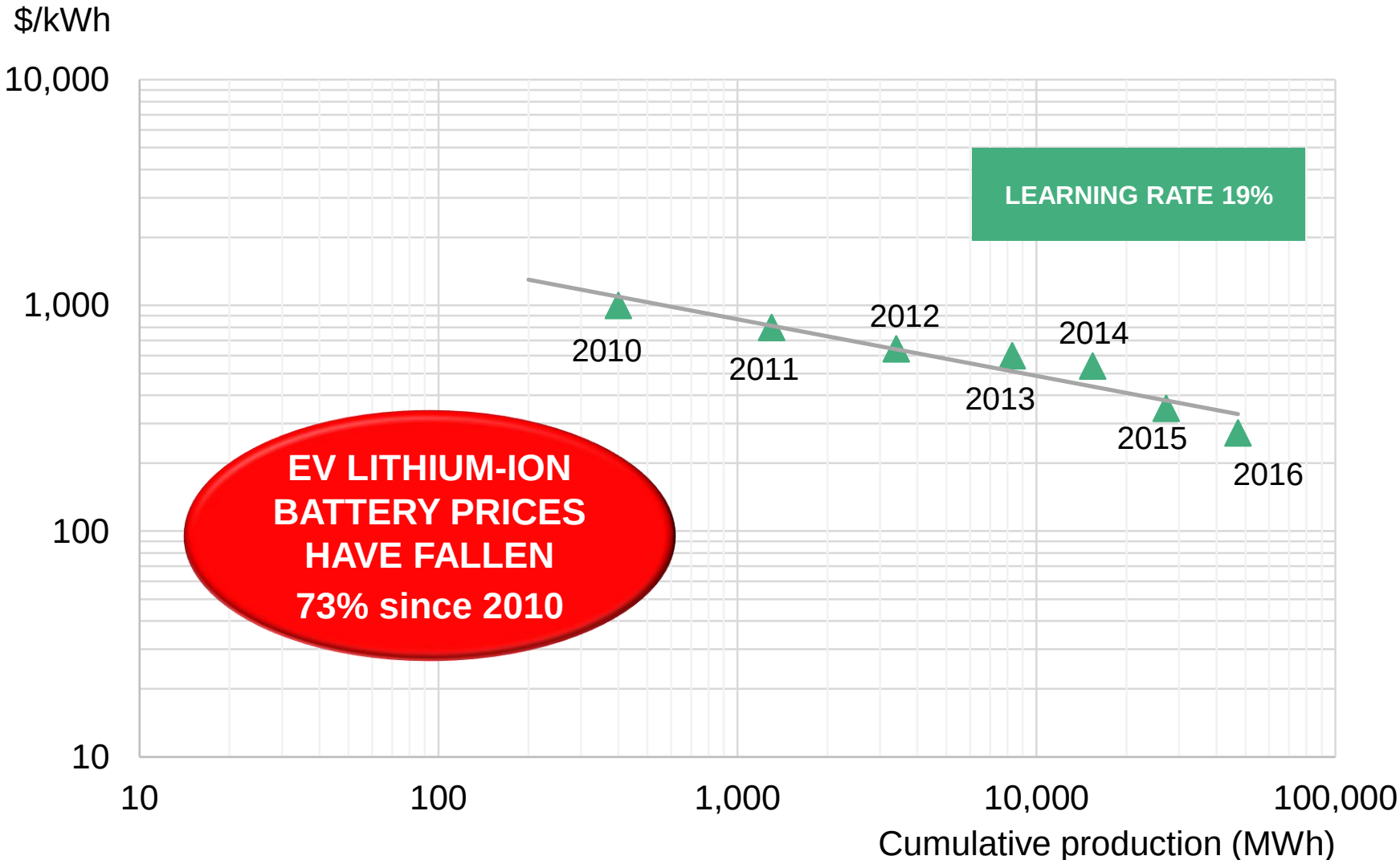
ELECTRIC VEHICLES IN USE WORLDWIDE, END 2016

1.8 million (to scale)

Source: Bloomberg New Energy Finance, International Organization of Motor Vehicle Manufacturers

BNEF BATTERY PRICE LEARNING RATE
2013-2016 ($ PER KWH)

Bloomberg NEW ENERGY FINANCE



Notes: This includes cells plus pack prices. For years where there were two surveys, the data in this chart is an average for the year. Prices are nominal.

Source: Bloomberg New Energy Finance

EV MASS MARKET / SECOND CARS
$30,000 + 200 MILES RANGE

Bloomberg NEW ENERGY FINANCE

Images: Tesla, BMW, VW, GM, Nissan

PARIS

Picture: UNFCCC

PARIS

Bloomberg NEW ENERGY FINANCE

> The Paris Agreement is a monumental triumph for people and our planet.
>
> *Ban Ki Moon, former UN SG*

> Together we have opened the door to a sustainable and climate-safe future for all.
>
> *Christiana Figueres, former head, UNFCCC*

> This is a turning point. This gives us the best possible shot to save the one planet we got.
>
> *Barack Obama, US President*

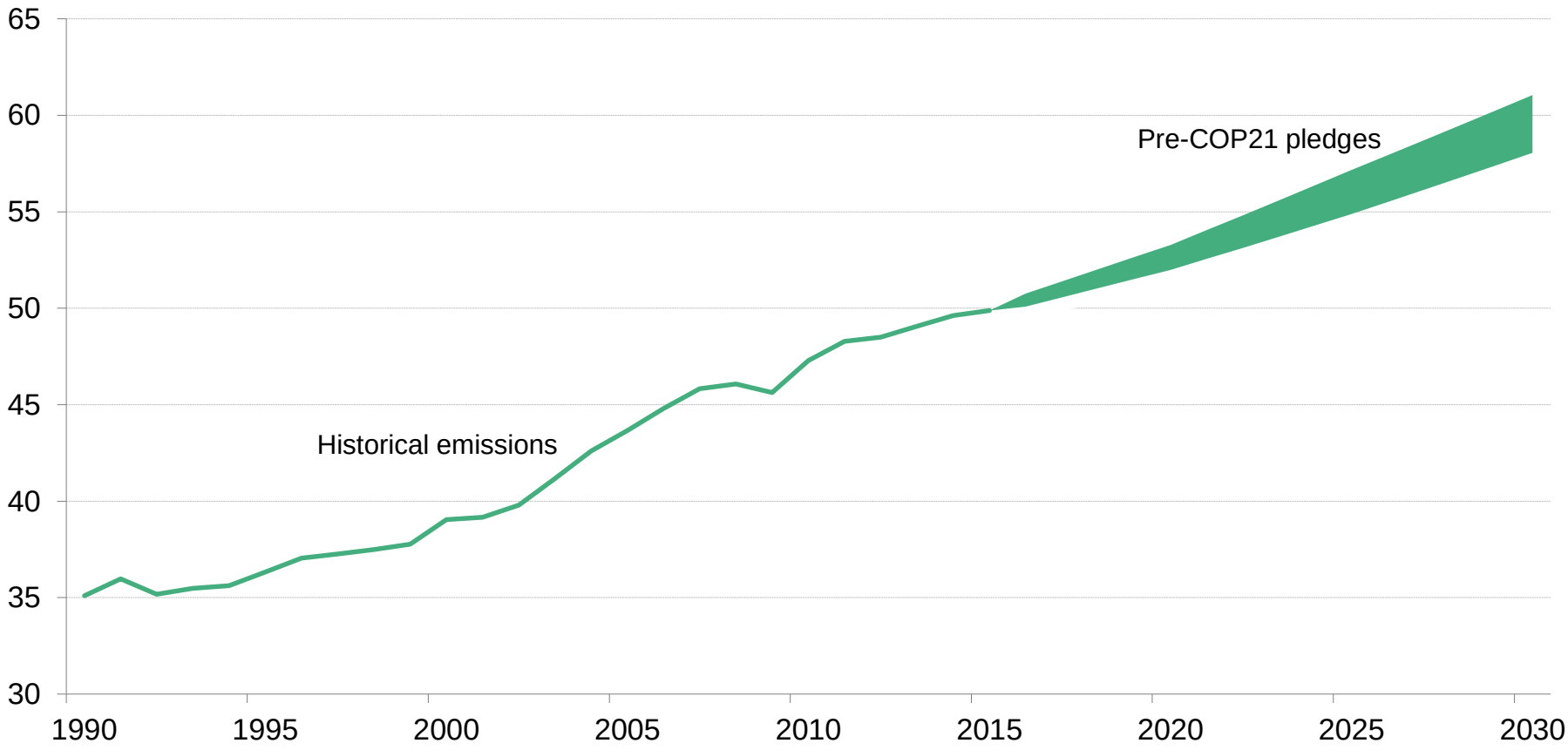
> The Paris Agreement has been an unprecedented historic success.
>
> *Miguel Arias Cañete, European Commissioner for Climate Action and Energy*

> It is a sign of hope. It can have a positive influence on the living conditions of billions of people.
>
> *Angela Merkel, Chancellor of Germany*

> Today's agreement signals nothing less than a renaissance for humankind.
>
> *Mr. Mogens Lykketoft, President, UN General Assembly*

GLOBAL GREENHOUSE GAS EMISSIONS
(GTCO2)

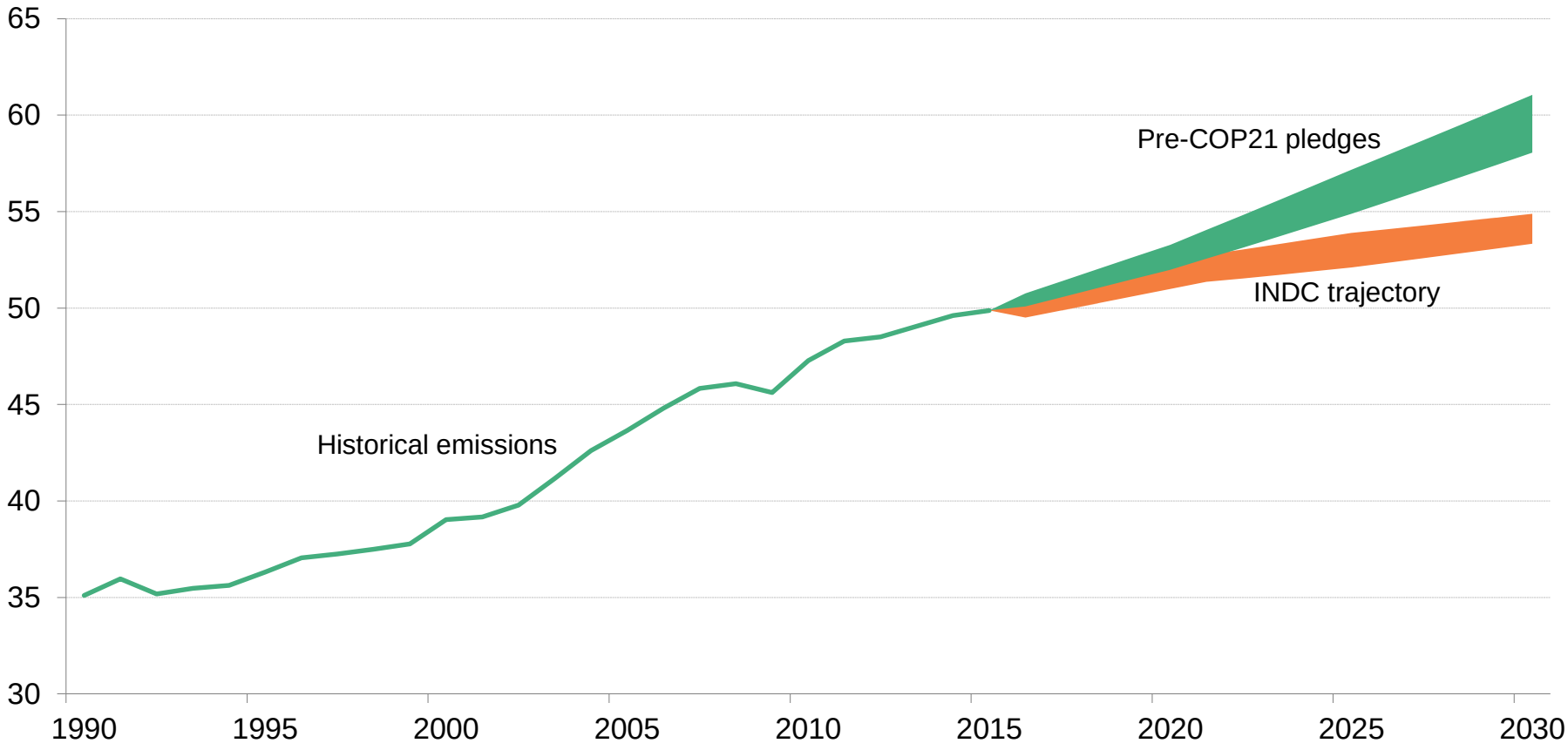
Bloomberg NEW ENERGY FINANCE



Source: UNFCCC, UNEP, Climate Action Tracker, Bloomberg New Energy Finance

GLOBAL GREENHOUSE GAS EMISSIONS
(GTCO2)

Bloomberg NEW ENERGY FINANCE



Source: UNFCCC, UNEP, Climate Action Tracker, Bloomberg New Energy Finance

GLOBAL GREENHOUSE GAS EMISSIONS
(GTCO2)

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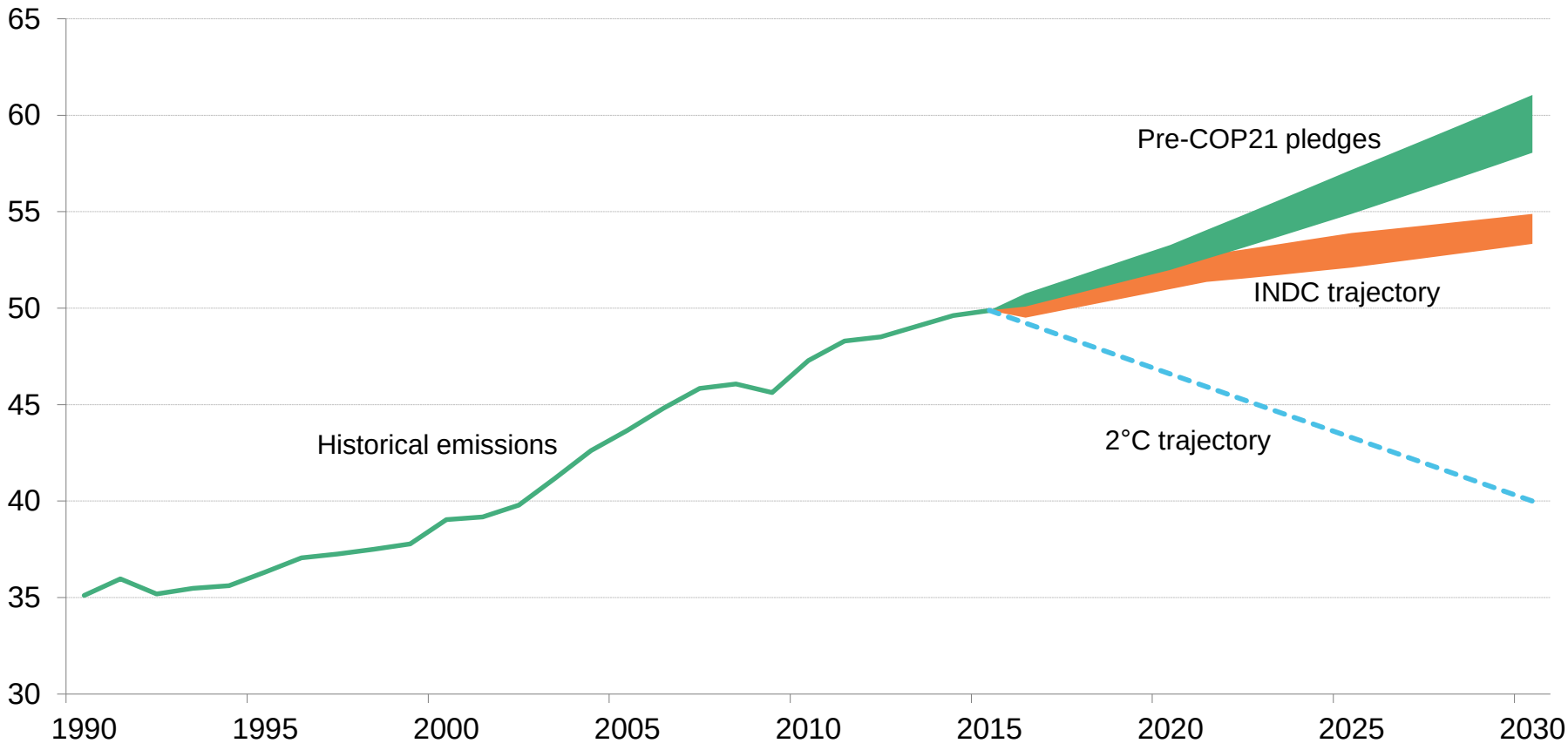
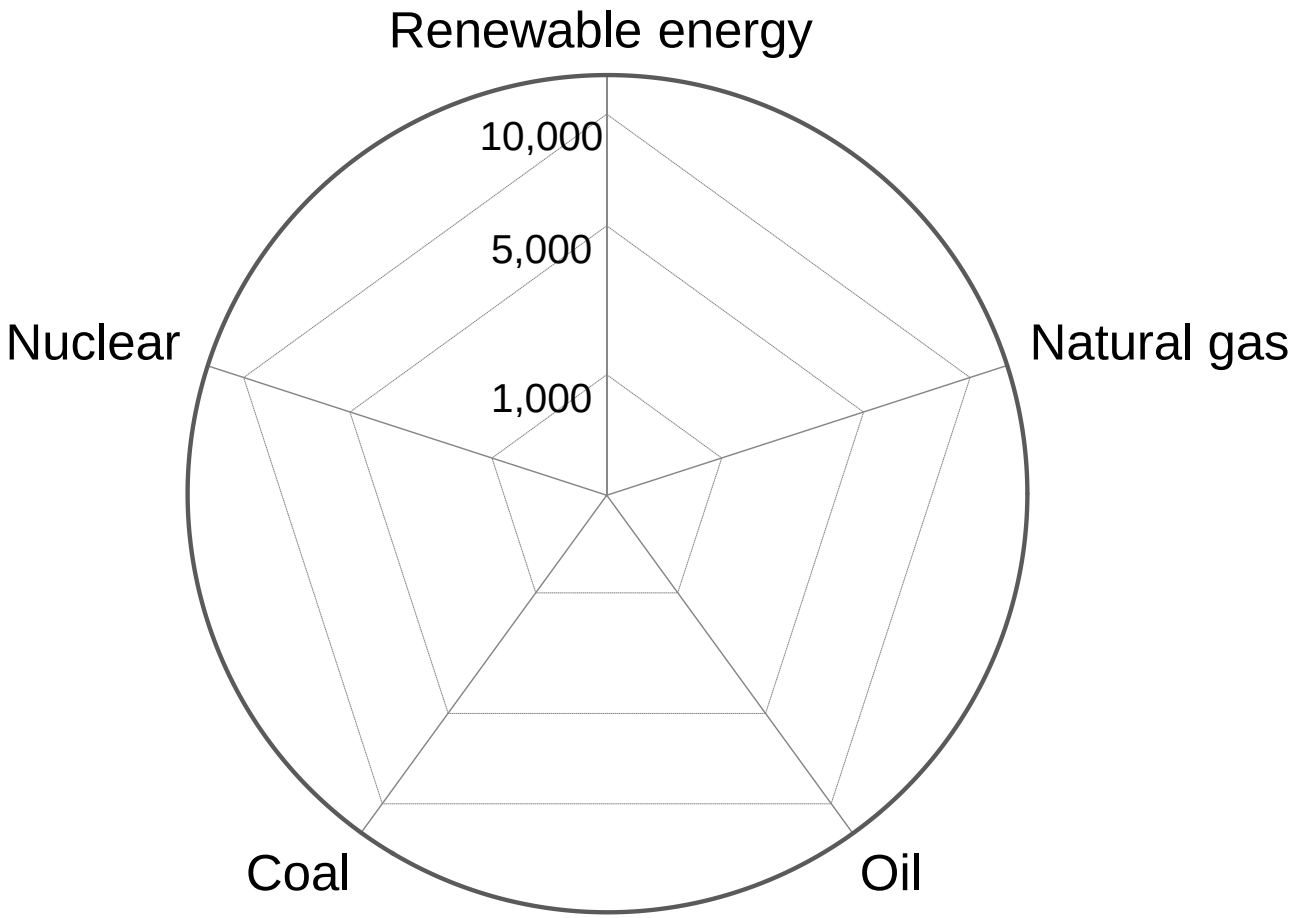


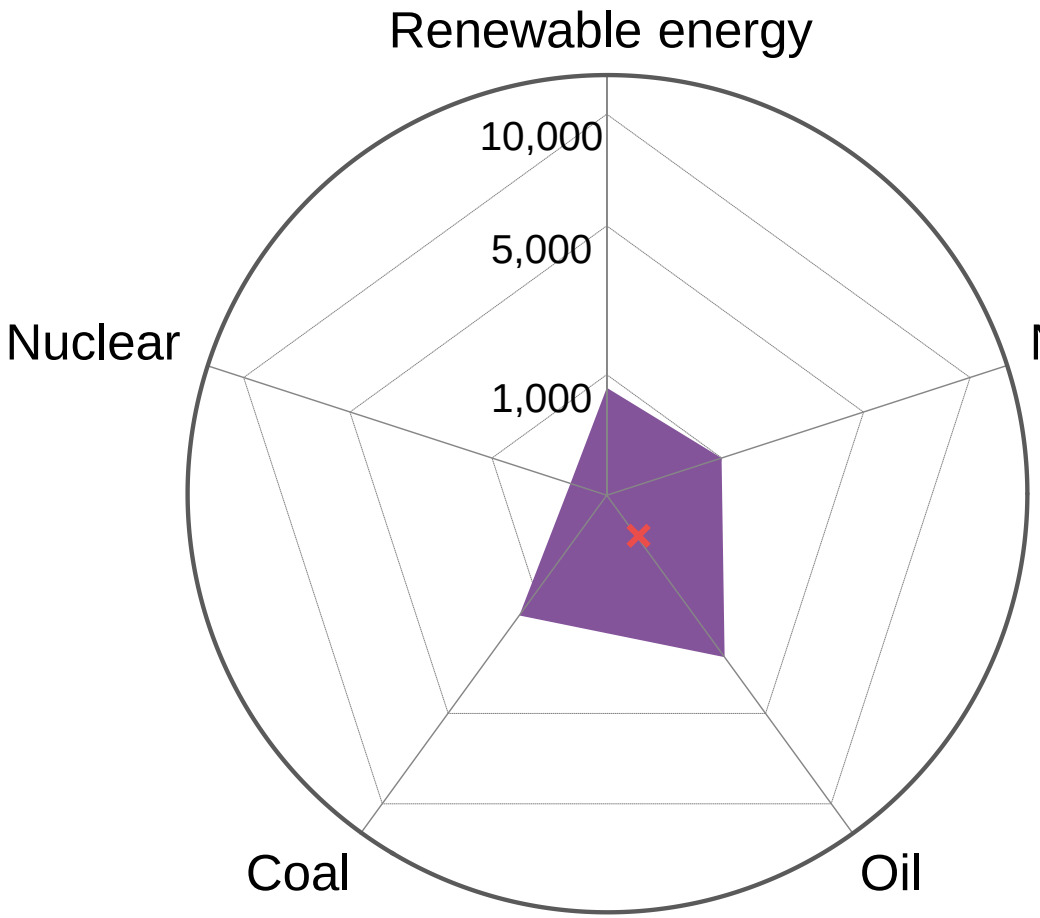
Source: UNFCCC, UNEP, Climate Action Tracker, Bloomberg New Energy Finance

GLOBAL PRIMARY ENERGY SUPPLY (MTOE)



Source: Bloomberg New Energy Finance

GLOBAL PRIMARY ENERGY SUPPLY, 1975 (MTOE)

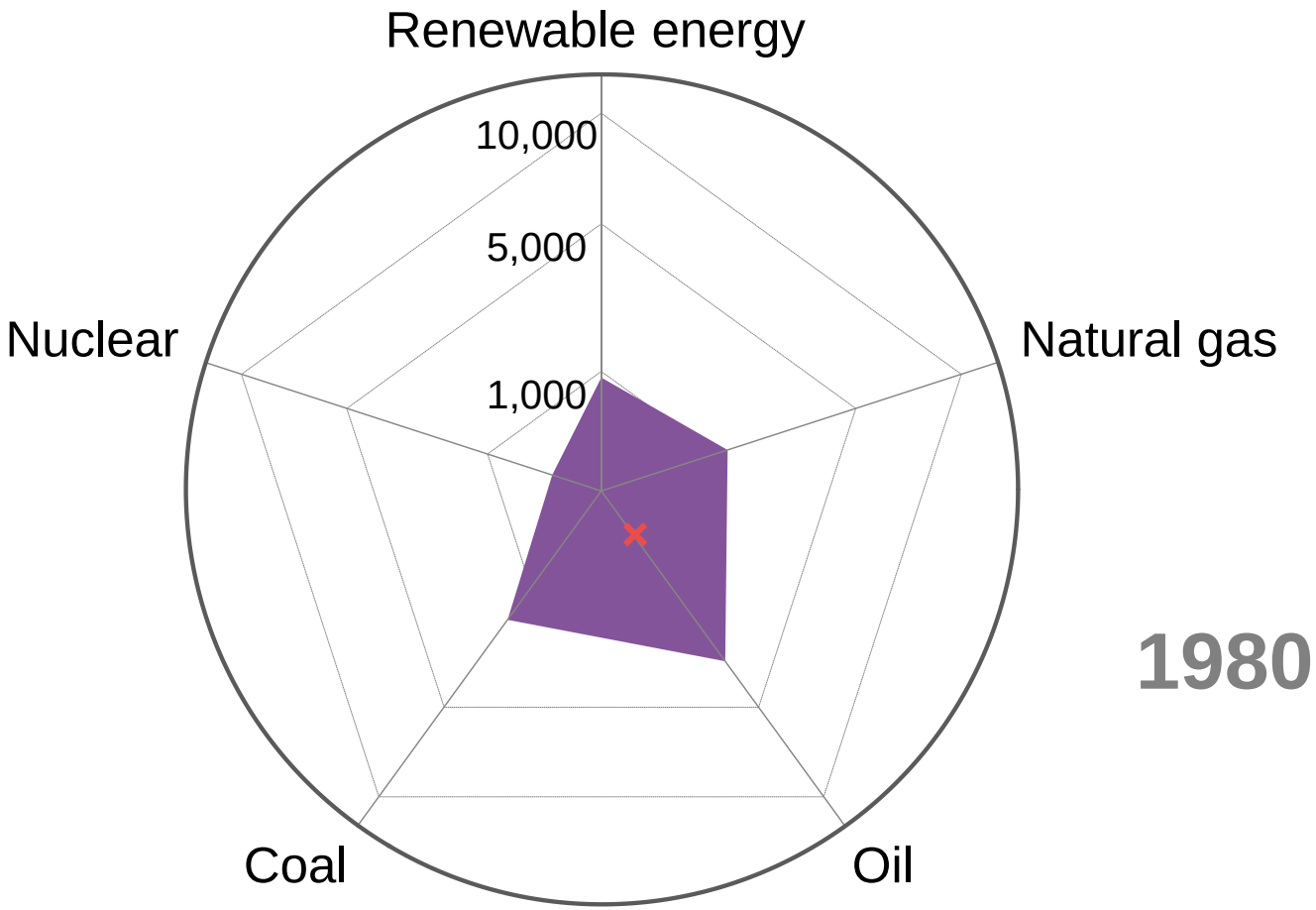


1975

Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

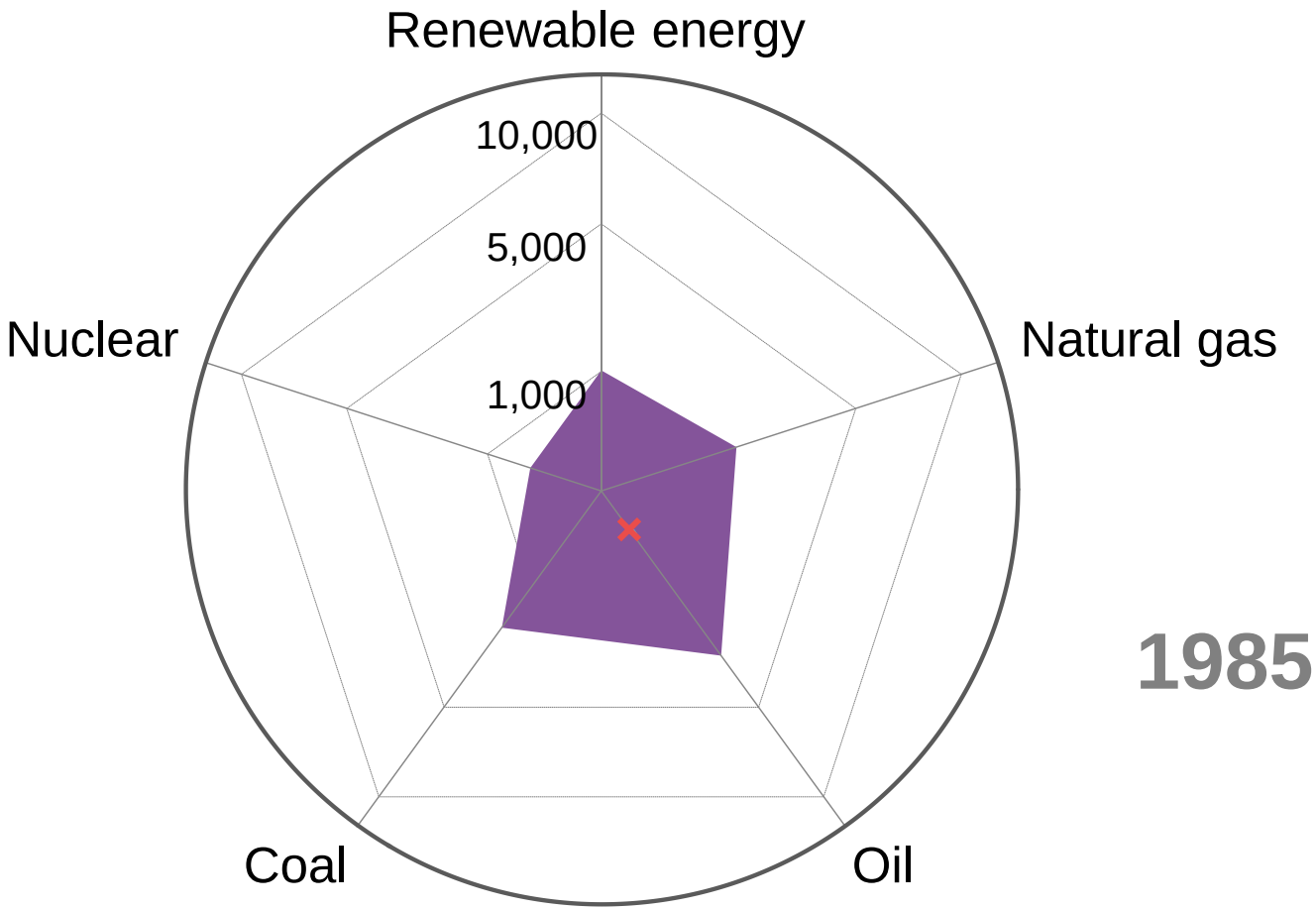
GLOBAL PRIMARY ENERGY SUPPLY, 1980 (MTOE)



Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

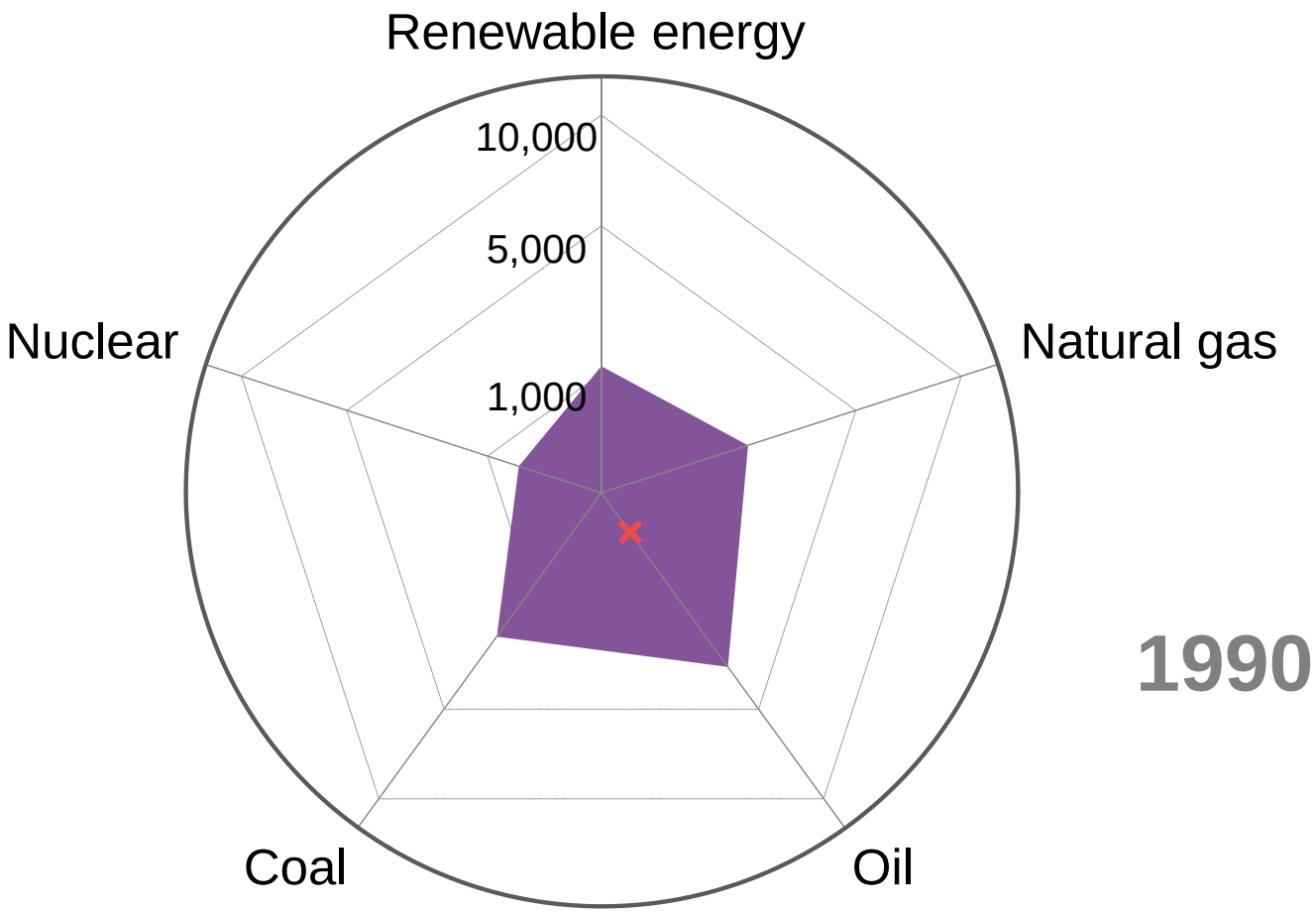
GLOBAL PRIMARY ENERGY SUPPLY, 1985 (MTOE)



Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

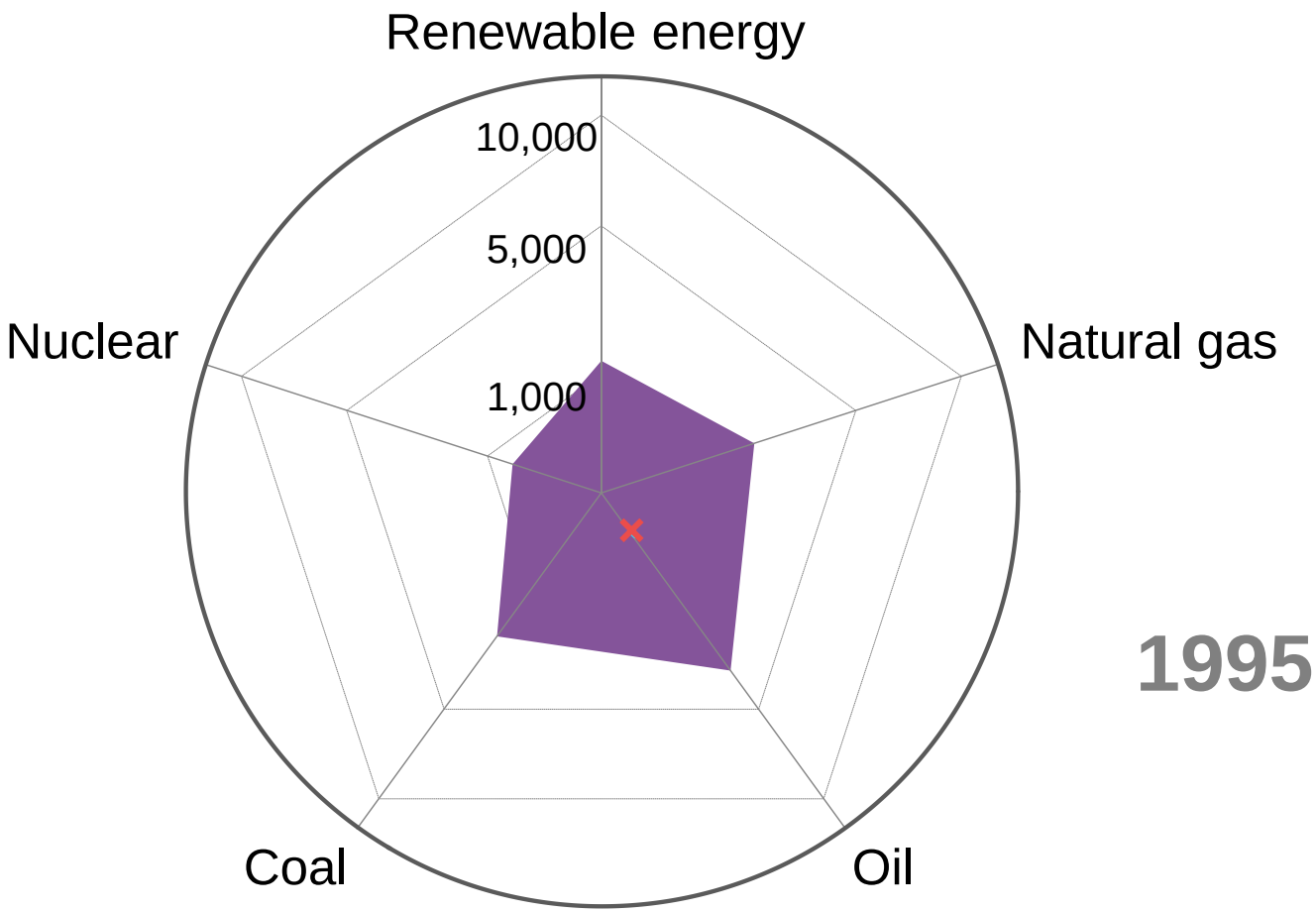
GLOBAL PRIMARY ENERGY SUPPLY, 1990 (MTOE)



Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

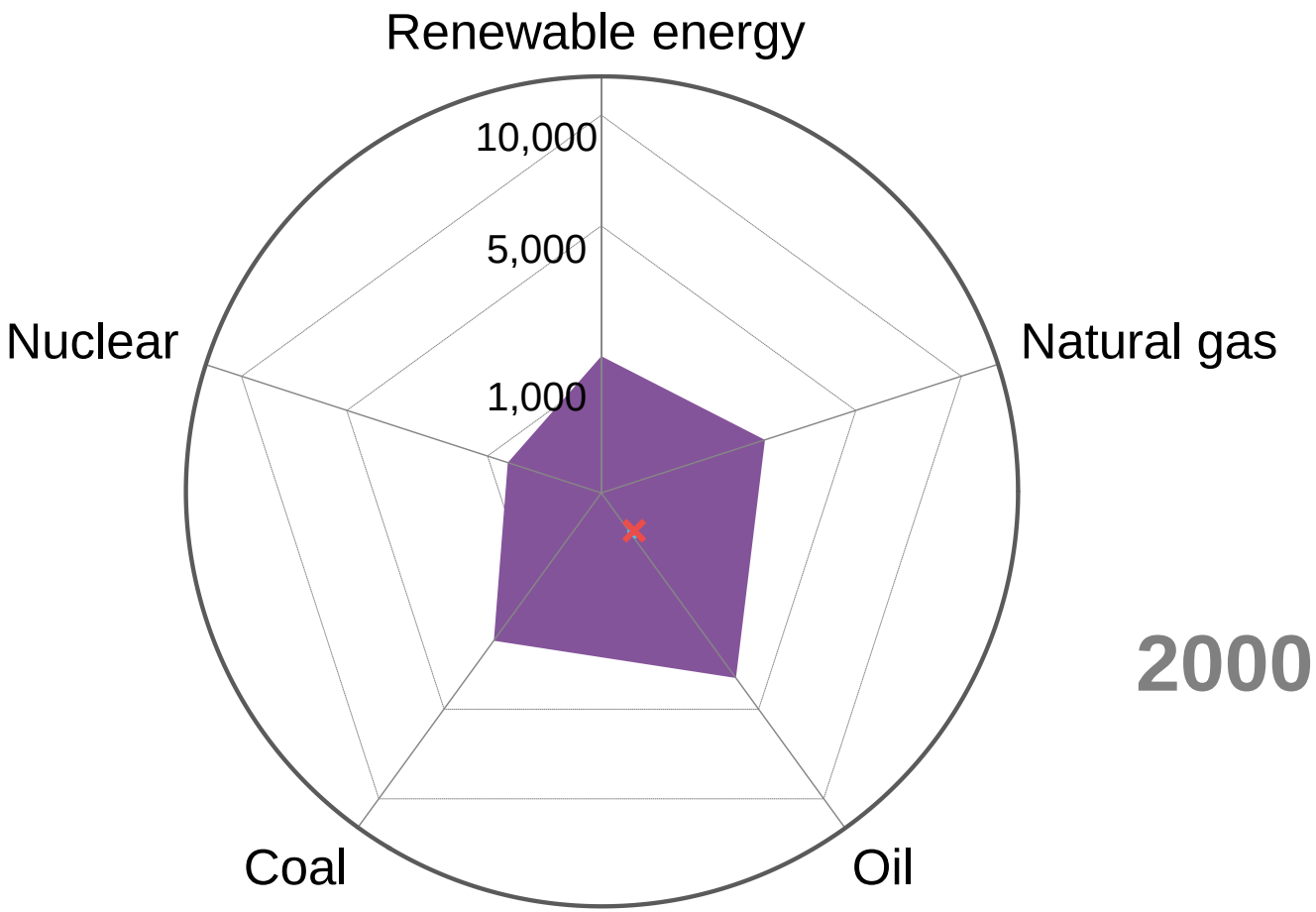
GLOBAL PRIMARY ENERGY SUPPLY, 1995 (MTOE)



Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

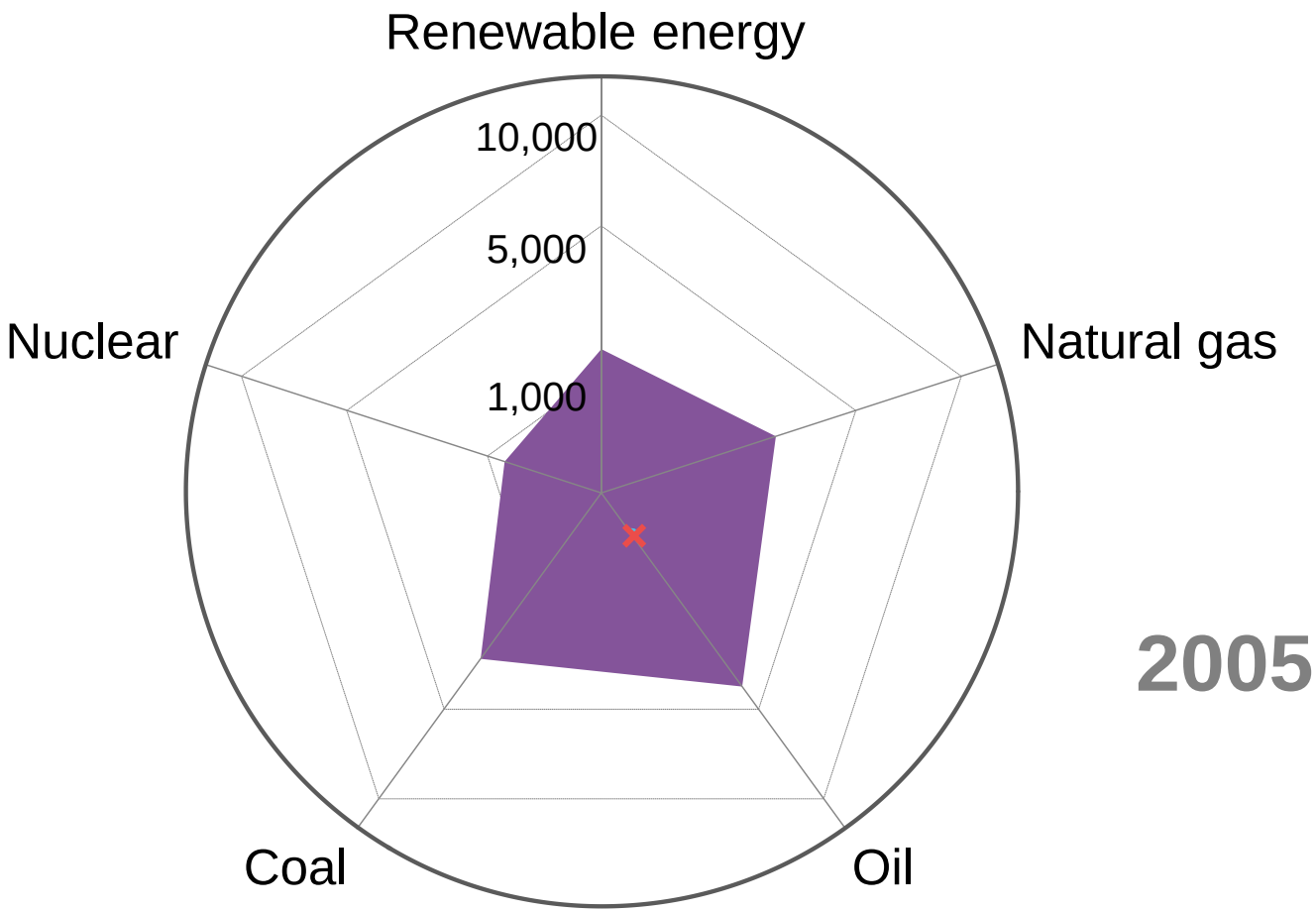
GLOBAL PRIMARY ENERGY SUPPLY, 2000 (MTOE)



Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

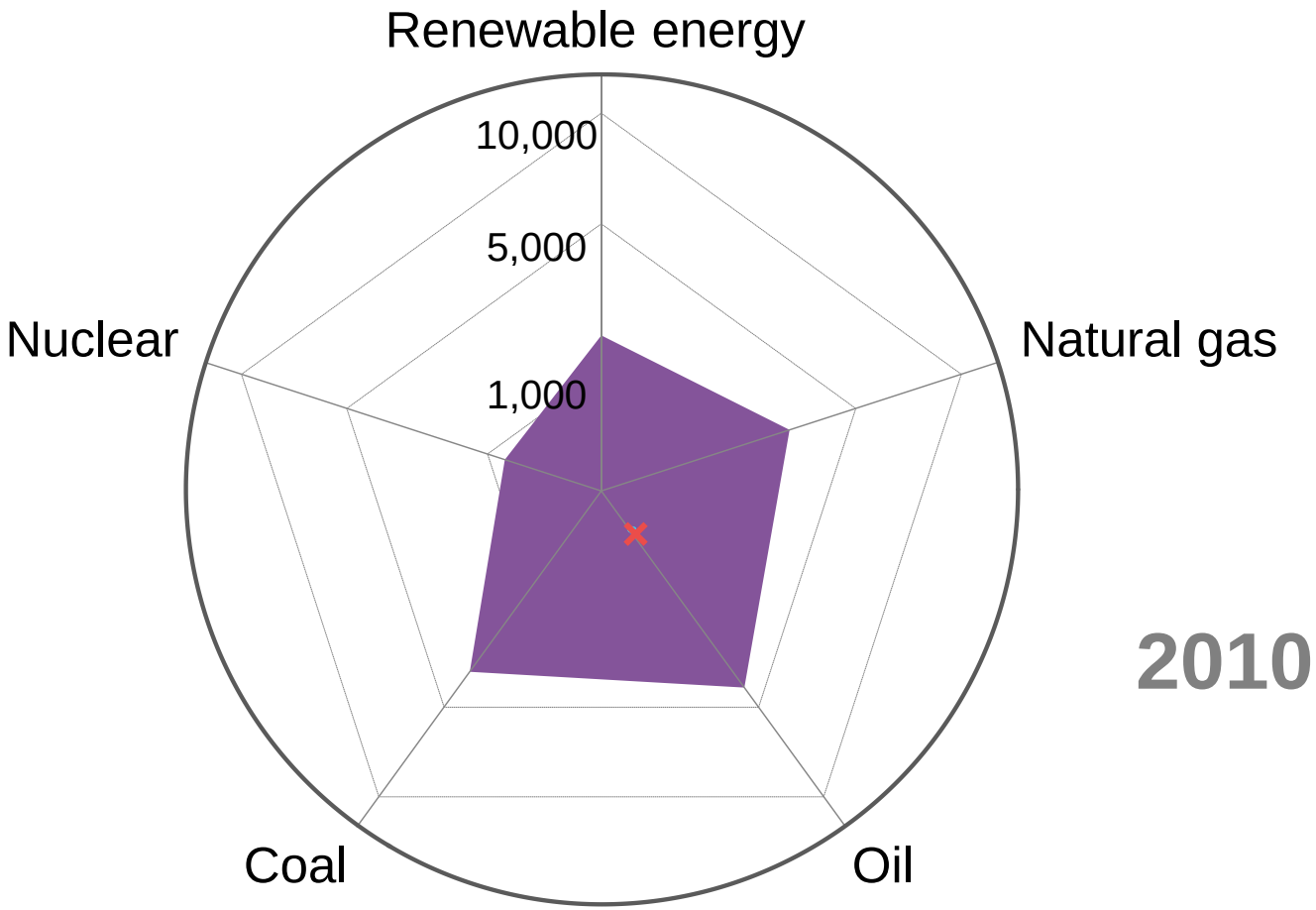
GLOBAL PRIMARY ENERGY SUPPLY, 2005 (MTOE)



Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

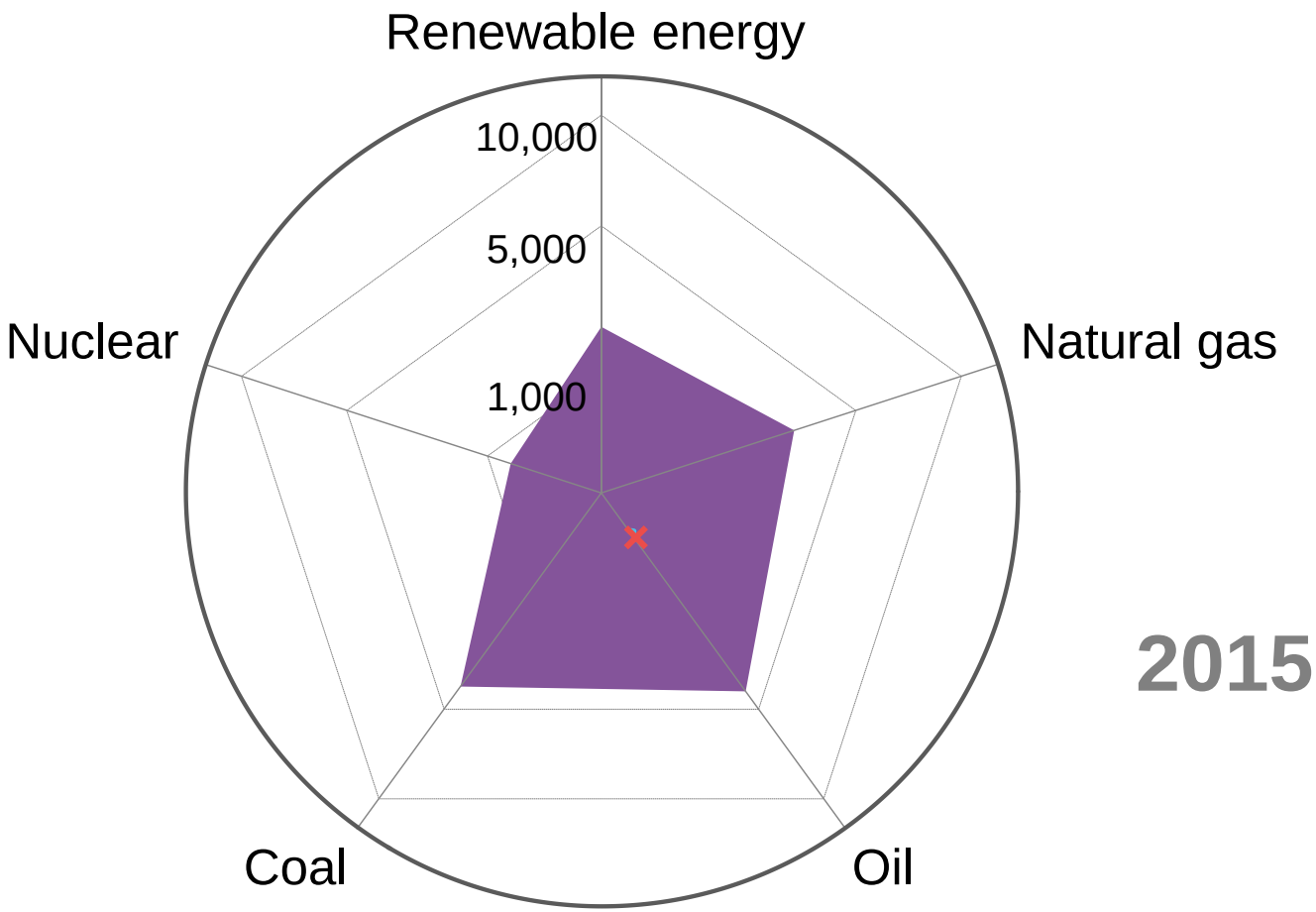
GLOBAL PRIMARY ENERGY SUPPLY, 2010 (MTOE)



Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

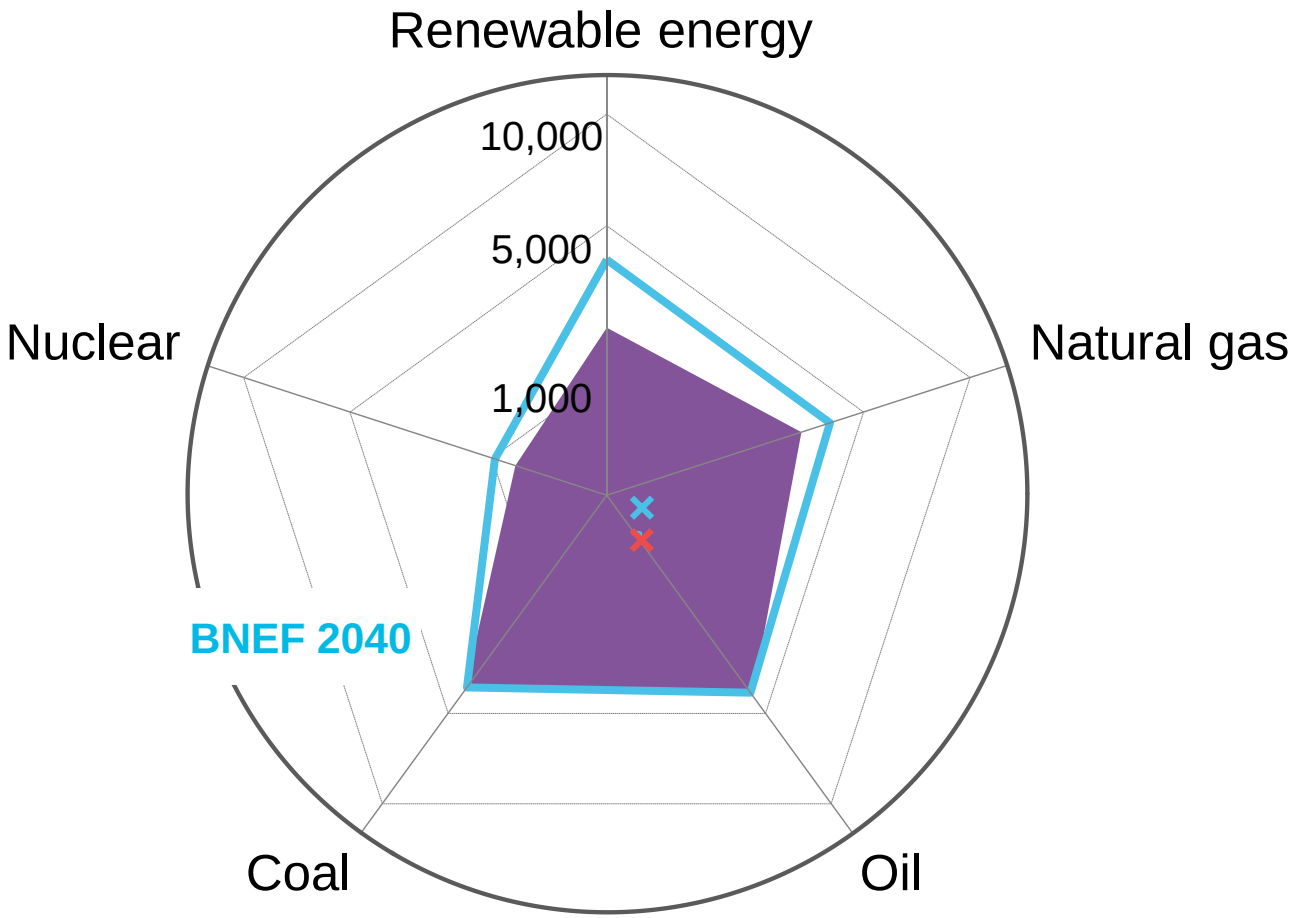
GLOBAL PRIMARY ENERGY SUPPLY, 2015 (MTOE)



Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

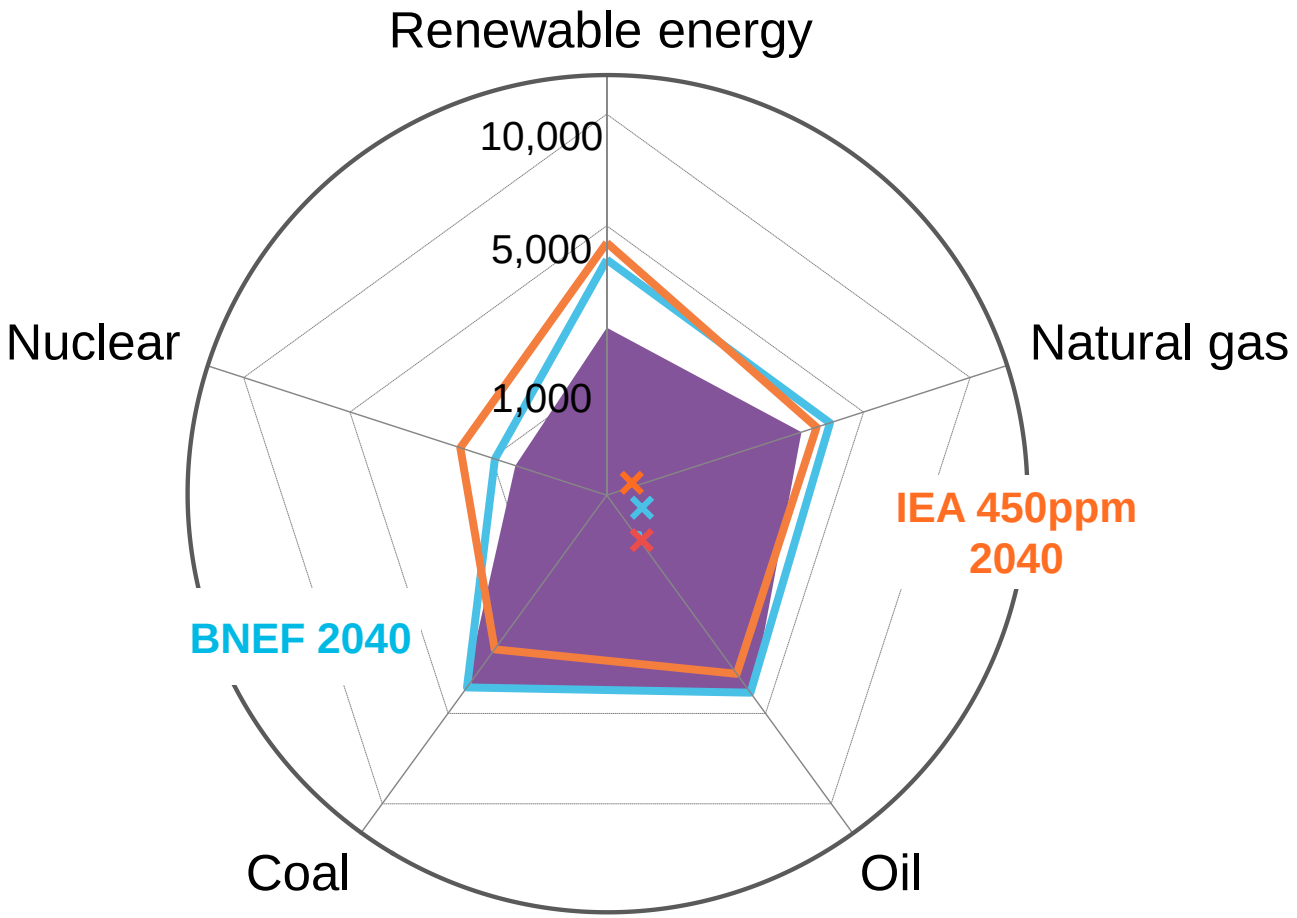
GLOBAL PRIMARY ENERGY SUPPLY (MTOE)



Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

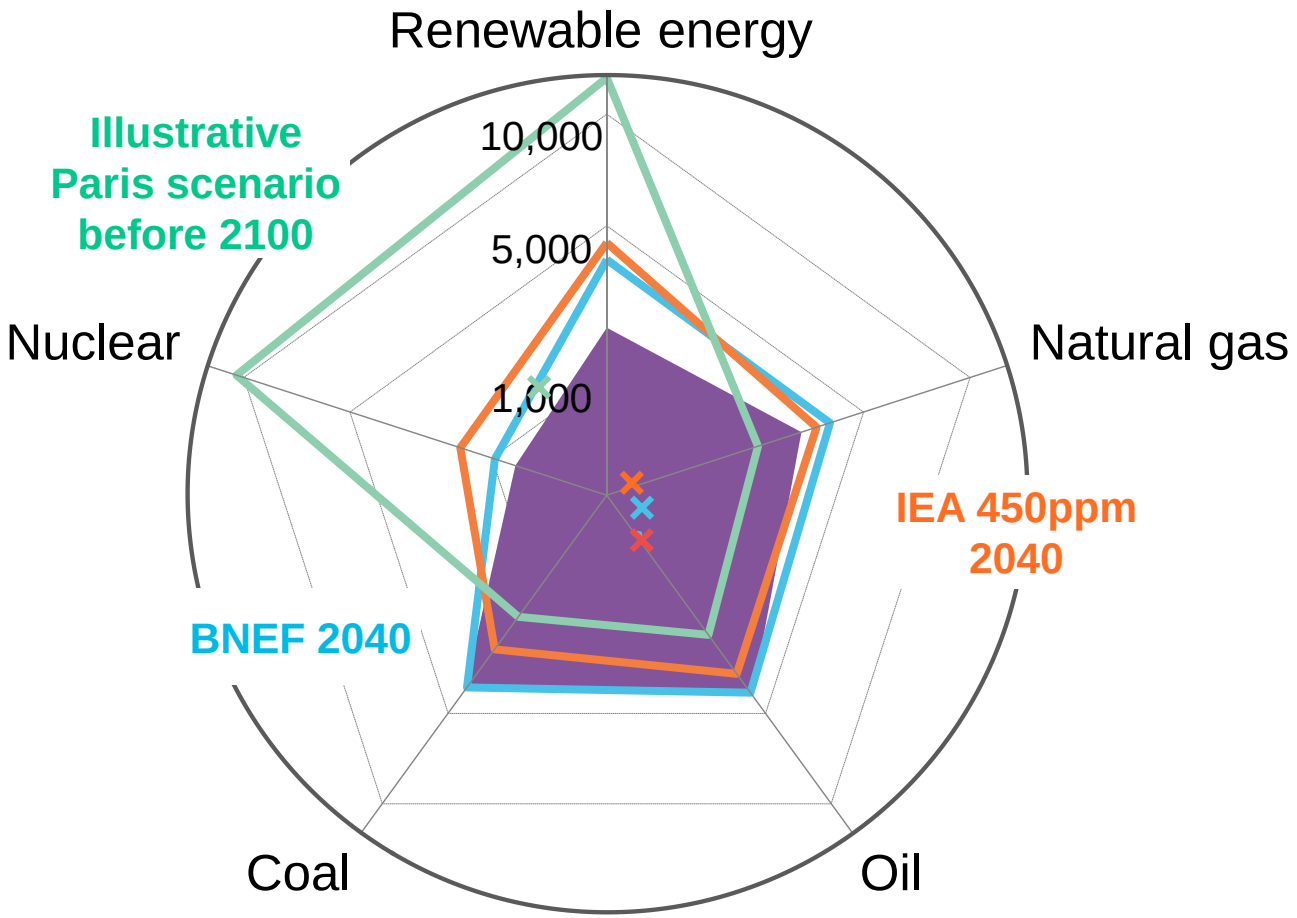
GLOBAL PRIMARY ENERGY SUPPLY (MTOE)



Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro.

Source: Bloomberg New Energy Finance, IEA

GLOBAL PRIMARY ENERGY SUPPLY (MTOE)

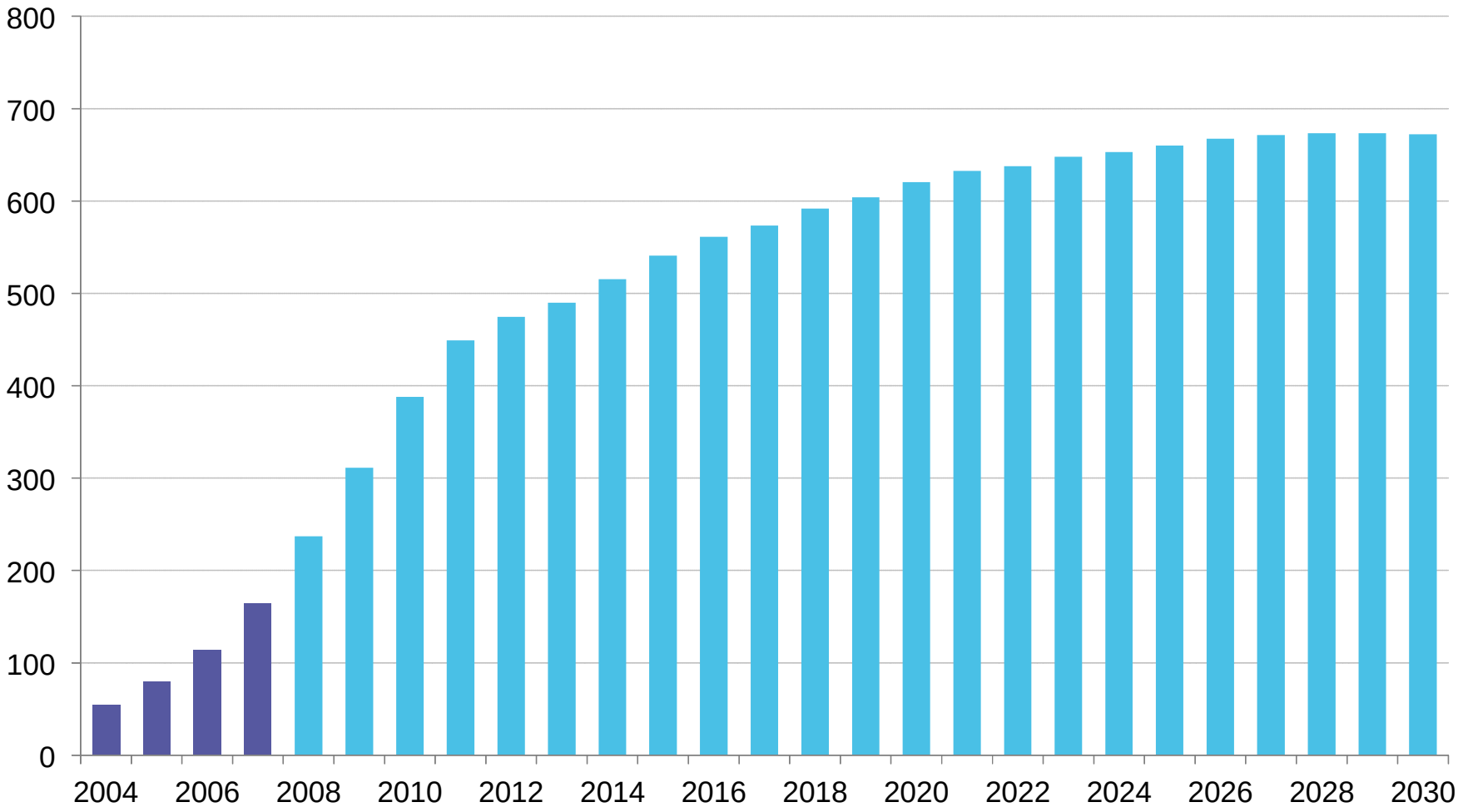


Note: BNEF adjusted IEA NPS forecast using its own electricity generation and EV demand forecast. Renewables total includes bioenergy and hydro. Paris illustrative scenario assumes some carbon capture.

Source: Bloomberg New Energy Finance, IEA

CLEAN ENERGY CAPITAL REQUIREMENT TO 2030 ($BN)

Bloomberg NEW ENERGY FINANCE

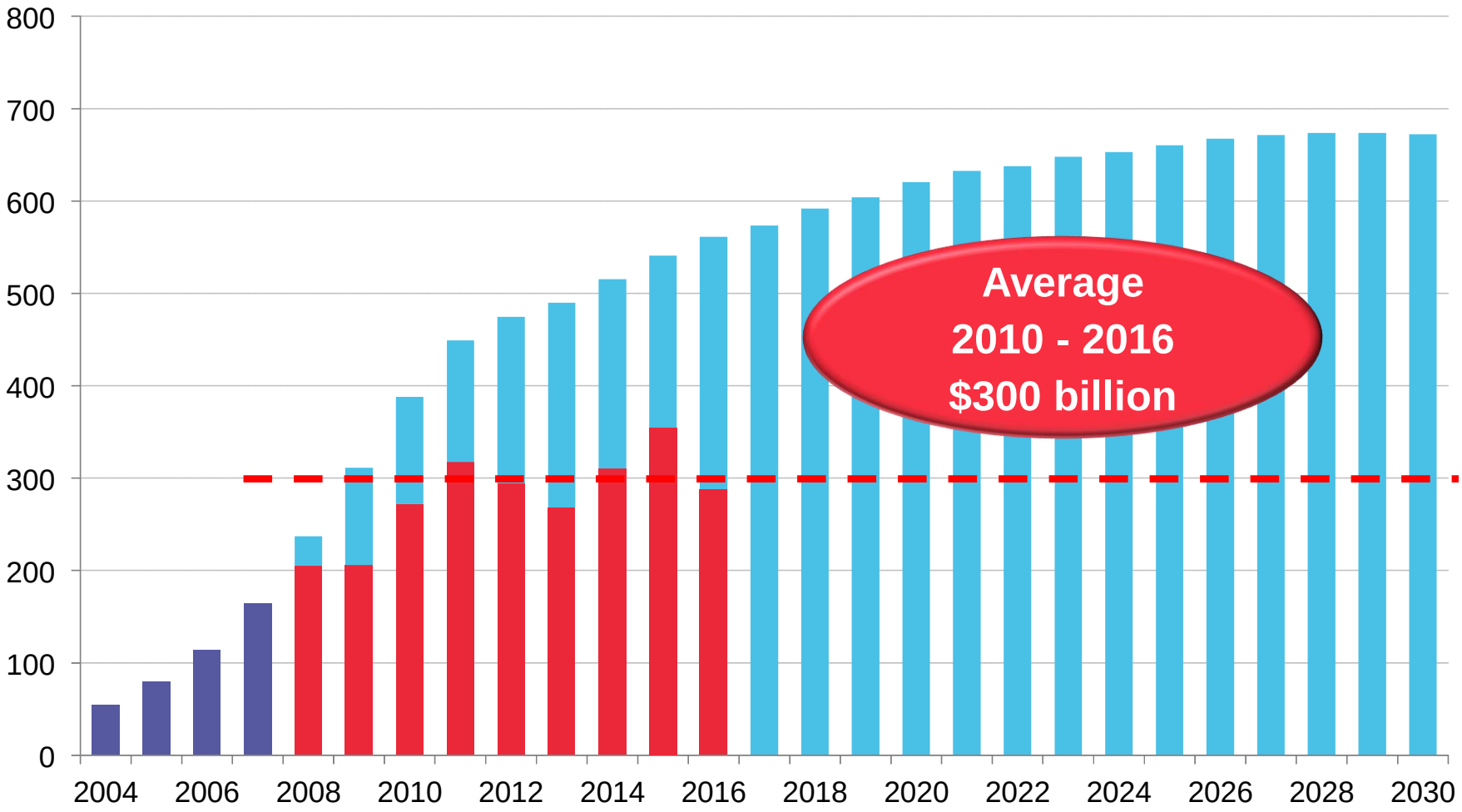


Note: Global Futures figures from 2008 restated to reflect current investment calculation methodology

Source: New Energy Finance Global Futures 2008, Bloomberg New Energy Finance

CLEAN ENERGY CAPITAL REQUIREMENT TO 2030 ($BN)

Bloomberg NEW ENERGY FINANCE



Note: Global Futures figures from 2008 restated to reflect current investment calculation methodology

Source: New Energy Finance Global Futures 2008, Bloomberg New Energy Finance

WHY IS ALL THIS SO HARD?

Bloomberg NEW ENERGY FINANCE

1. Challenge of information (technology, engineering, human behaviour, economics etc)
2. Challenge of strategy(decision-making in uncertainty, poverty reduction vs growth)
3. Challenge of leadership (political, business, civic society)
4. Challenge of implementation (unintended consequences, agenda creep)
5. Challenge of inertia (social, physical, financial, incumbency)

Source: Bloomberg New Energy Finance

Thanks!

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

SERVICES
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Asia Pacific Service
EMEA Service
Applied Research
Events and Workshops

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