



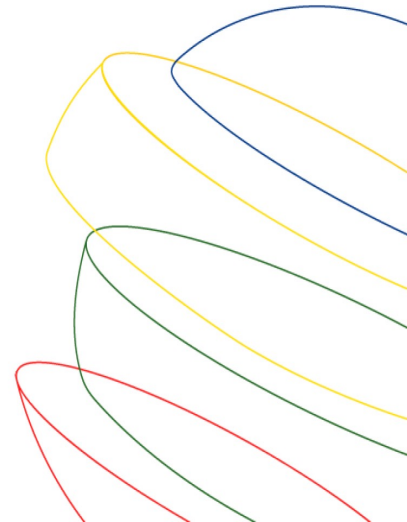
# GLOBAL CHP MARKET OVERVIEW

For COGEN World Coalition  
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Presented by  
Dr Simon MINETT  
Managing Director, Challoch Energy

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- Methodology and Sources
- World CHP Market Overview
- Overview of Regional CHP Markets
  - Europe
  - North America
  - Asia
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  - Australia
  - Current and Future Trends of CHP Market



# CHP MARKET OVERVIEW

## Methodology and Sources

### Methodology

- Desk research, including data collection; comparison and analysis of data from different sources
- Priority given to IEA data for consistency, as data from other sources do not cover the same period
- Analysis of CHP market development in the period 2009-2019, with focus on CHP fuel mix, CHP electricity and heat generation (when available), and electricity share in total electricity generation. The main report has more data on big markets in each region with additional information.

### Sources

- IEA
- Eurostat
- National Statistics Offices
- Other sources (COGEN Europe, Global Energy Monitor...)



[www.cogenworld.org](http://www.cogenworld.org)



# World

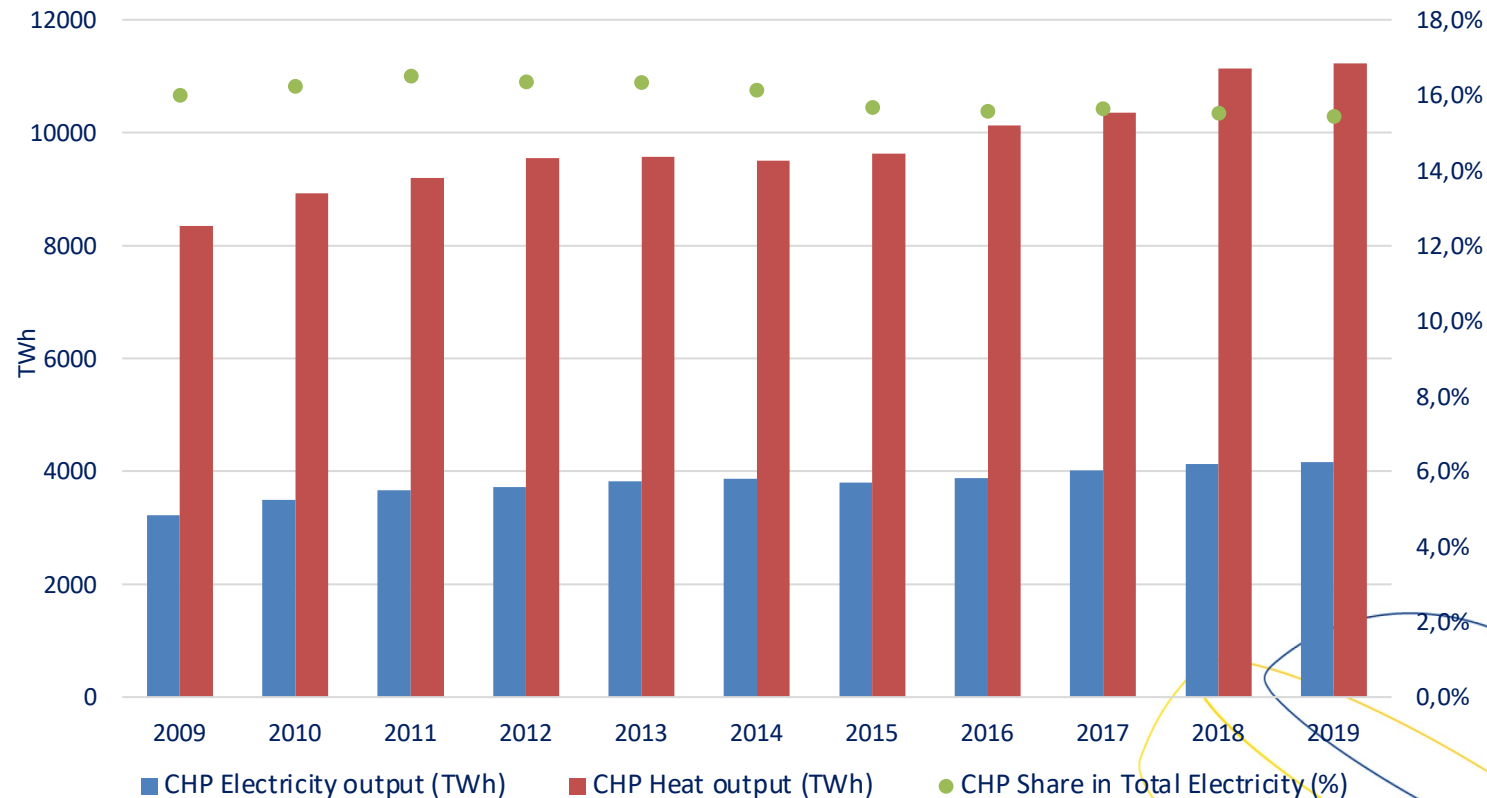
Electricity produced by CHP plants in 2019:

4,159TWh

- Electricity generation values from IEA database include condensing parts which may lead to overestimated values.
- We can observe an **increase of the CHP electricity output of almost 1,000TWh between 2009 and 2019.**
- During the given period, **CHP Heat output went up from 8,400TWh to 11,200TWh.**
- On the contrary, **the share of CHP in the total electricity generation has slightly decrease.**

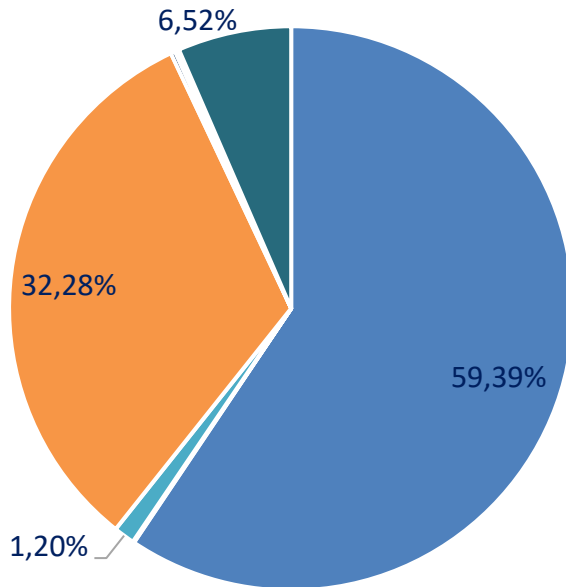


10-year Overview of CHP in the world



# CHP Fuel Mix

CHP Fuel Mix in the World



■ Coal and Coal products ■ Oil products ■ Natural gas ■ Biofuels and waste

Proportion of the other fuels:

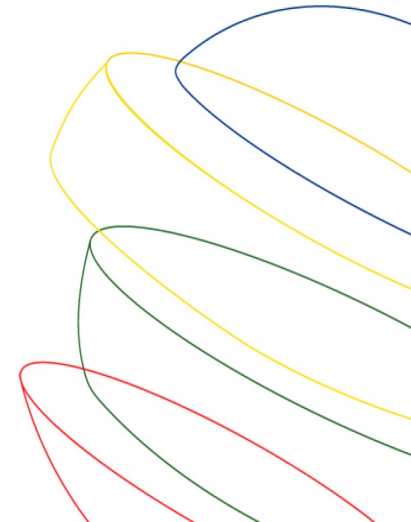
- Peat and peat products 0.08%
- Oil shale and oil sands 0.01%
- Nuclear 0.27%
- Geothermal 0.12%
- Solar/Wind/other 0.11%

**Commentary:**

- Fossil fuels continue to dominate with coal leading at 60%
- Biofuel is a growing share, now at ~6%
- 95% of the fuel mix share is held by 3 fuels: coal, natural gas and biofuels and waste.

**Future trends:**

- Gradual phaseout of coal
- Electrification of industry
- Hydrogen CHP technology gradually gaining ground → acceptance is rising, but economics not yet.



# Europe

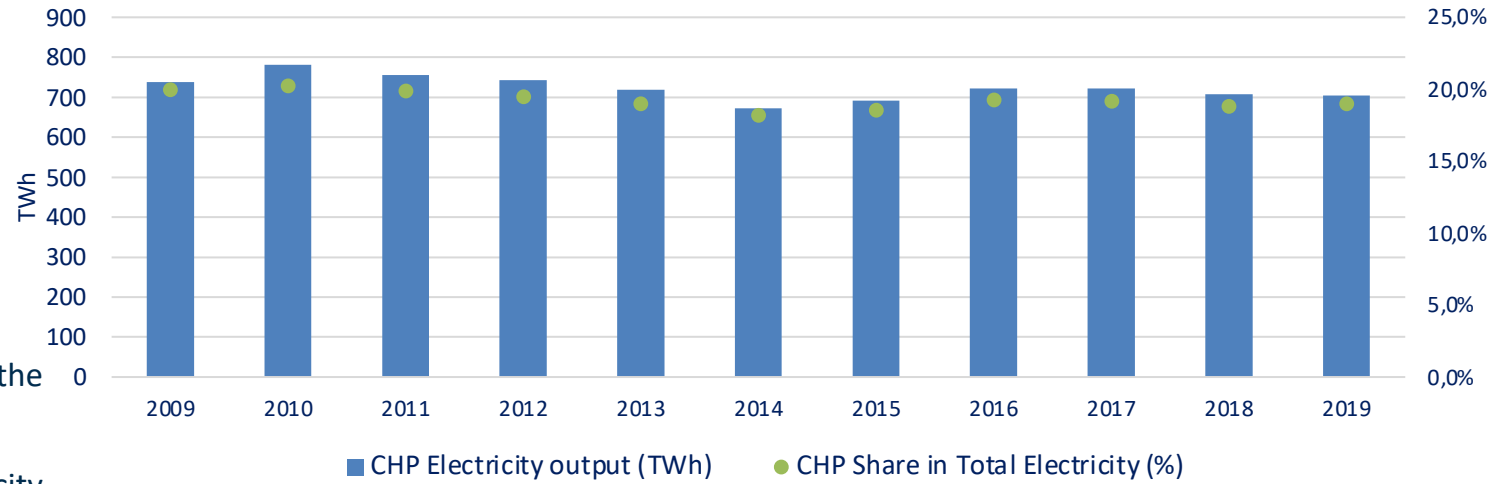
Electricity produced by CHP plants in 2019:



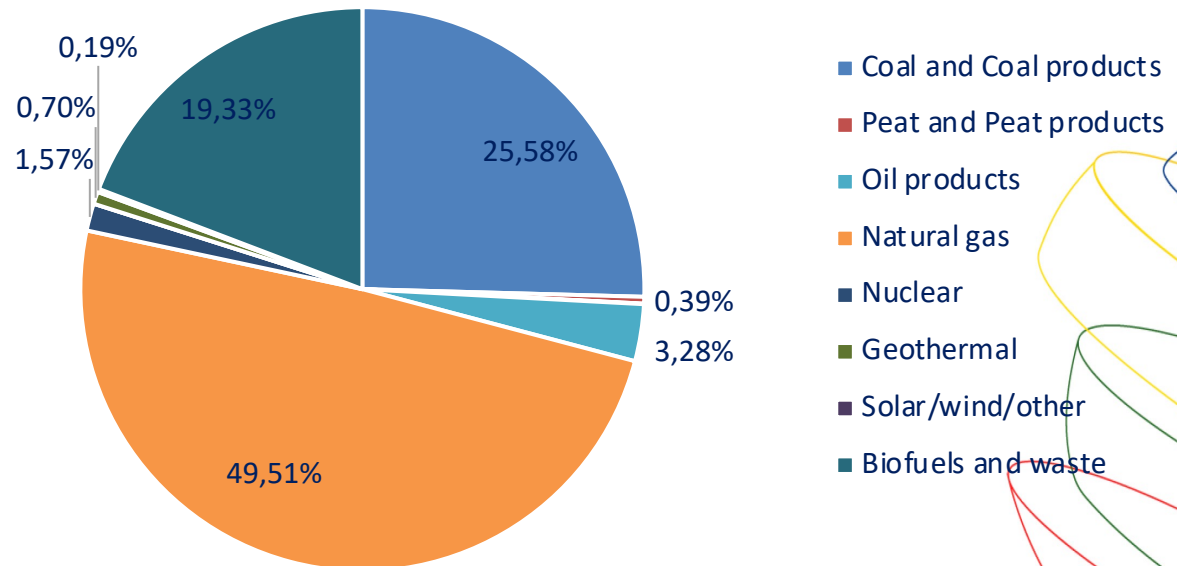
- CHP represents 20% of the electricity produced in Europe.
- Minor variations in electricity generation during the last 10 years (between 700 and 800 TWh).
- CHP's share of total electricity production stays stable at ~19%.
- The main fuels are **natural gas and coal**, followed by biofuels and waste.
- High share of solar, wind, other relative to the global fuel mix.



## 10-year Overview of CHP in Europe



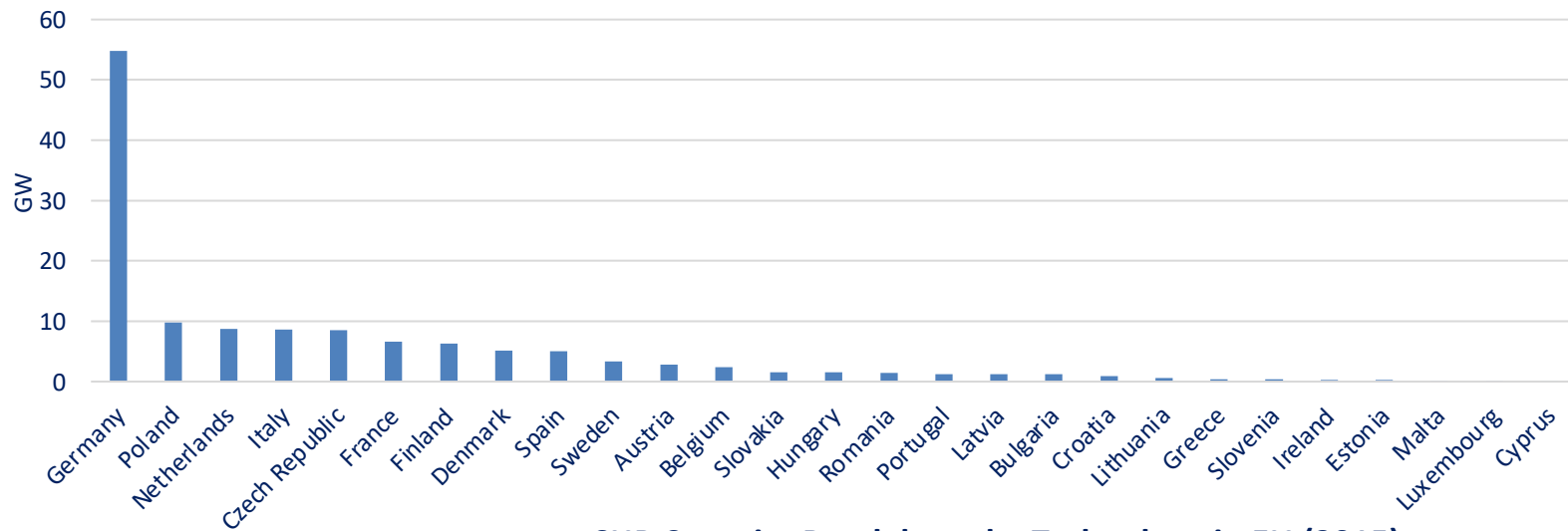
## CHP Fuel Mix in Europe



- Coal and Coal products
- Peat and Peat products
- Oil products
- Natural gas
- Nuclear
- Geothermal
- Solar/wind/other
- Biofuels and waste

# Additional details on EU27

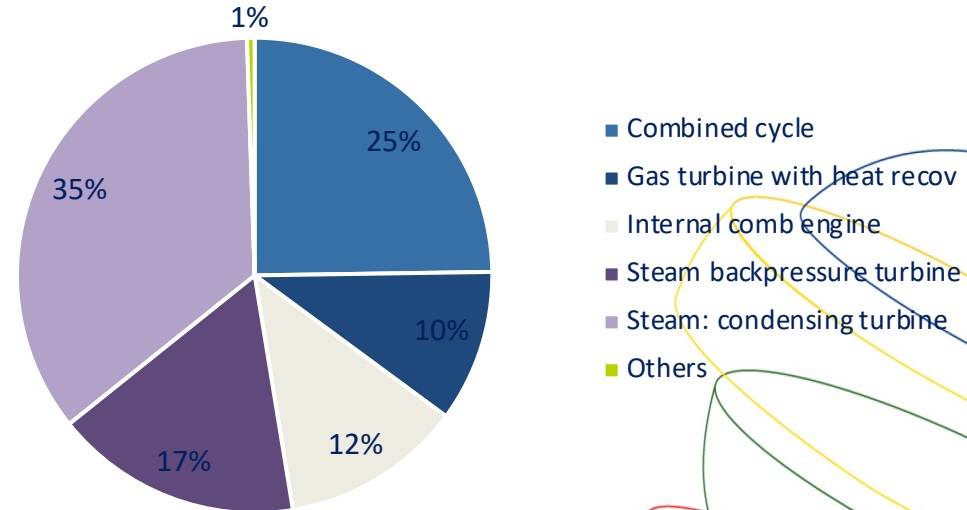
Total CHP Electrical Capacity in 2019



CHP Installed Capacity in 2019



CHP Capacity Breakdown by Technology in EU (2015)



- **Germany** has the largest CHP Installed capacity among the 27 countries of the EU.
- **Steam turbine** dominates the CHP market in EU with 52% of the CHP capacity. It is followed by combined cycle power plants and gas turbine.

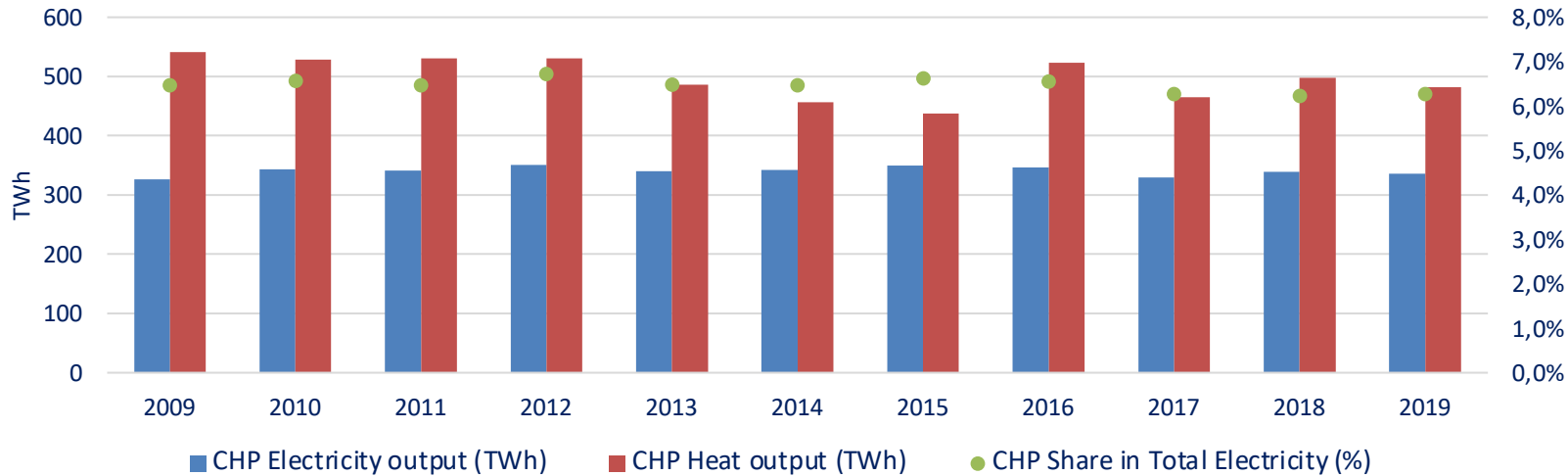


# North America

## 10-year Overview of CHP in North America

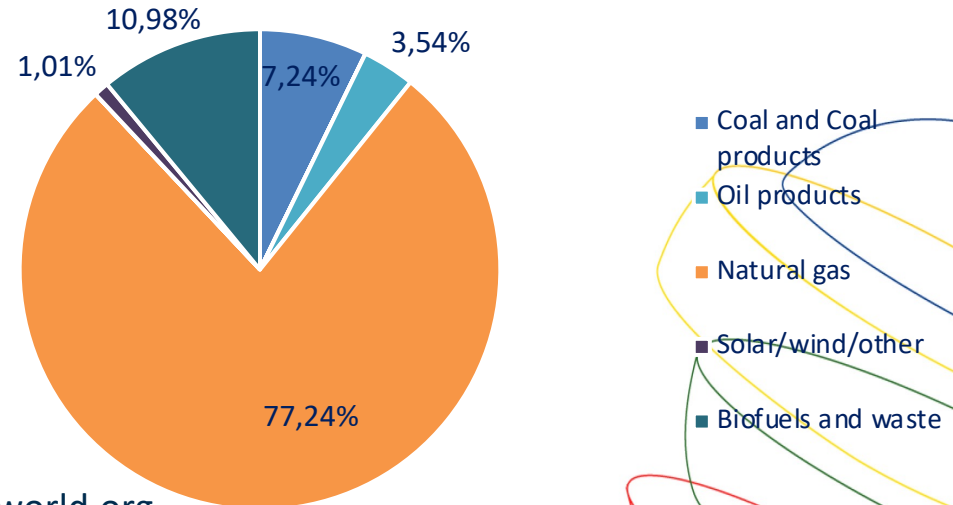
Electricity produced by CHP plants in 2019:

336TWh



- Little variation of the electricity output (**between 325 and 350TWh**).
- CHP's electricity share remains stagnant at **~6.5%** since 2008.
- The main fuel used for CHP in North America is **natural gas**, followed by biofuels and waste, and coal. We can notice a small share of solar/wind/other in the CHP fuel mix.
- Leading market: USA

## CHP Fuel Mix in North America





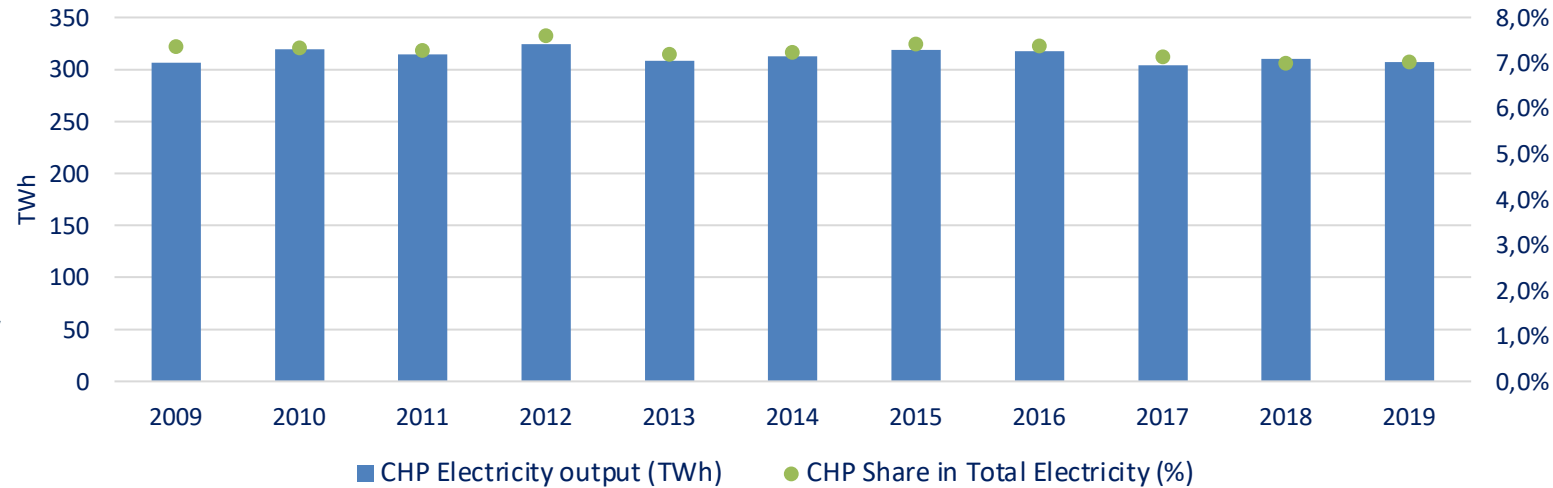
# United States

Electricity produced by CHP plants  
in 2019:



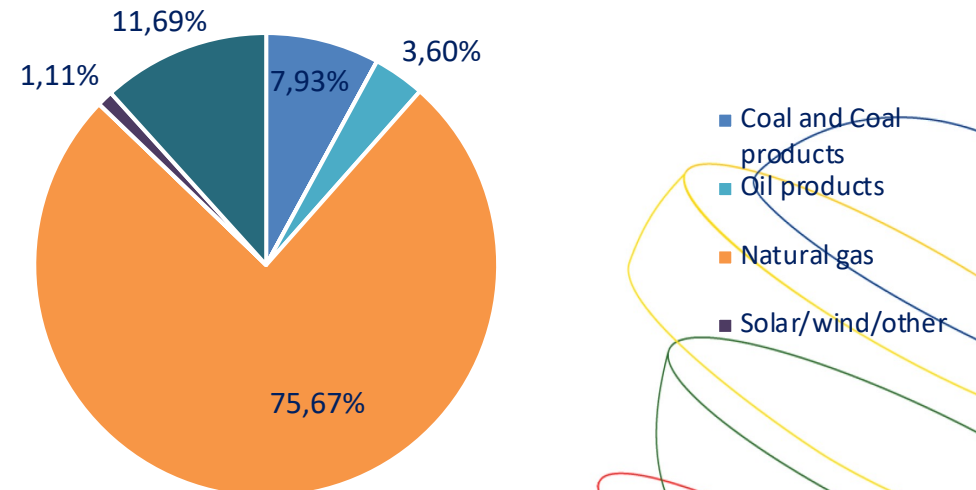
→ 91% of the electricity produced by CHP in North America

10-year Overview of CHP in the U.S.



- Little variation of the electricity output (**between 300 and 325TWh**).
- Stable evolution of the CHP electricity share (**~7.5%**).
- As the U.S. is the main producer of electricity by CHP in North America, its fuel mix is almost the same as the North American one. **Natural gas** is the main fuel.

CHP Fuel Mix in the U.S.

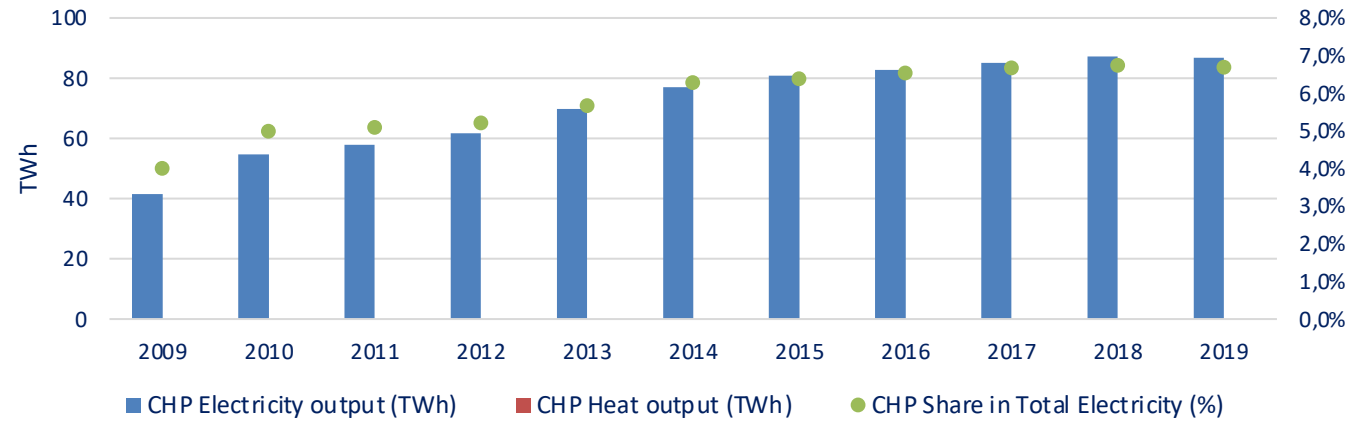


# Central and South America

Electricity produced by CHP plants in 2019:

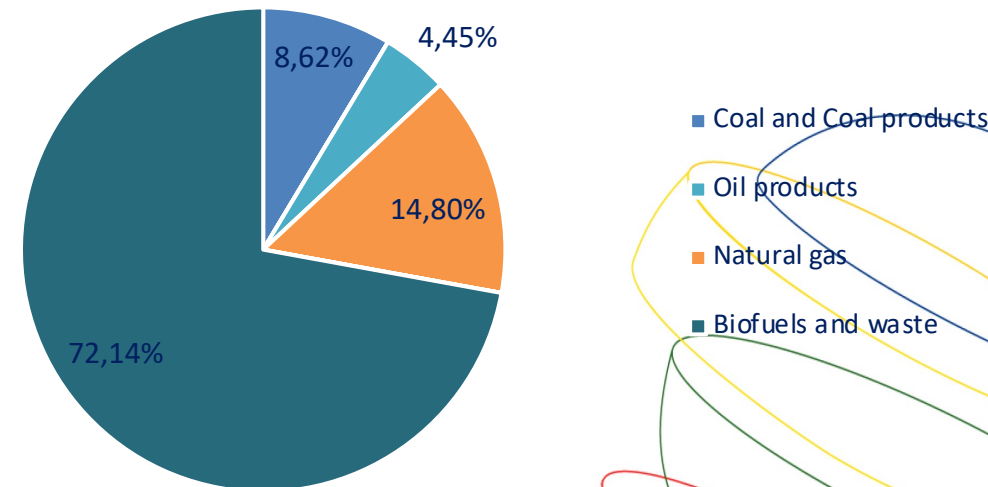


10-year Overview of CHP in South America



- In ten years, the CHP electricity output of South America doubled from 40TWh to 87TWh.
- During the same time, the share of CHP electricity gained 3%. In 2019 it was 6.7%.
- **Biofuels and waste** category clearly dominates the CHP fuel market in South America. It is followed by natural gas and coal.
- According to IEA data, South America experienced the largest growth rate in the world in term of CHP electricity output during the given period (2009-2019).
- Leading markets are Brazil and Mexico.

CHP Fuel Mix in South America



# Brazil

Electricity produced by CHP plants in 2019:



➤ Brazil = ~90% of CHP electricity produced in South America.

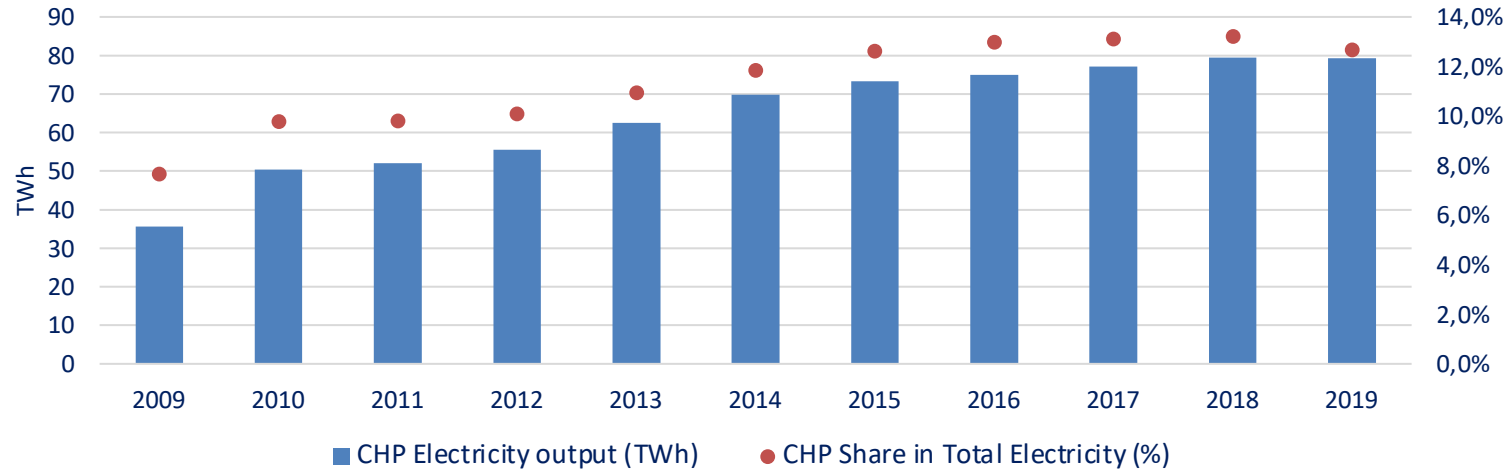
➤ As Brazil produces 90% of the electricity produced by CHP in South America, the electricity output as well as the fuel mix follow the same trends than the region.

➤ CHP electricity output over 10 years increased **from 34TWh to 79TWh**, an annual growth rate of 13%.

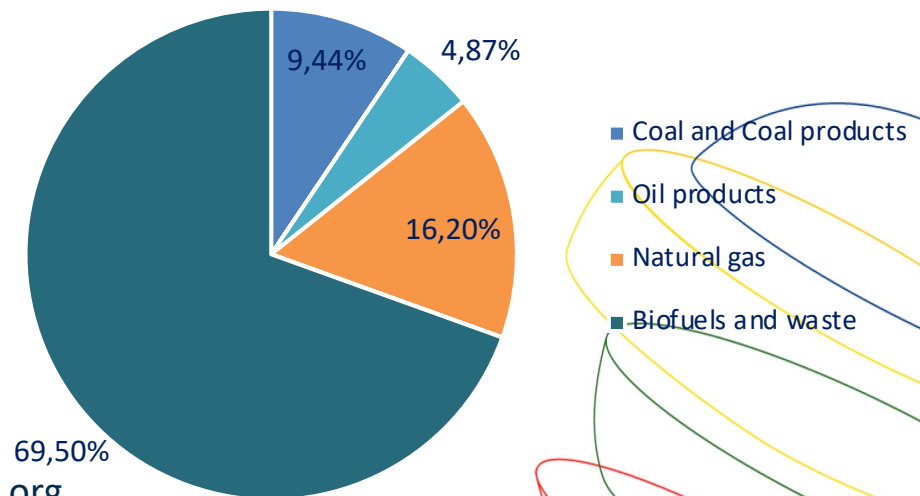
➤ CHP's share of electricity was almost **13%** in 2018.

➤ The main fuel used to power CHP is **biofuels and waste**.

## 10-year Overview of CHP in Brazil



## CHP Fuel Mix in Brazil

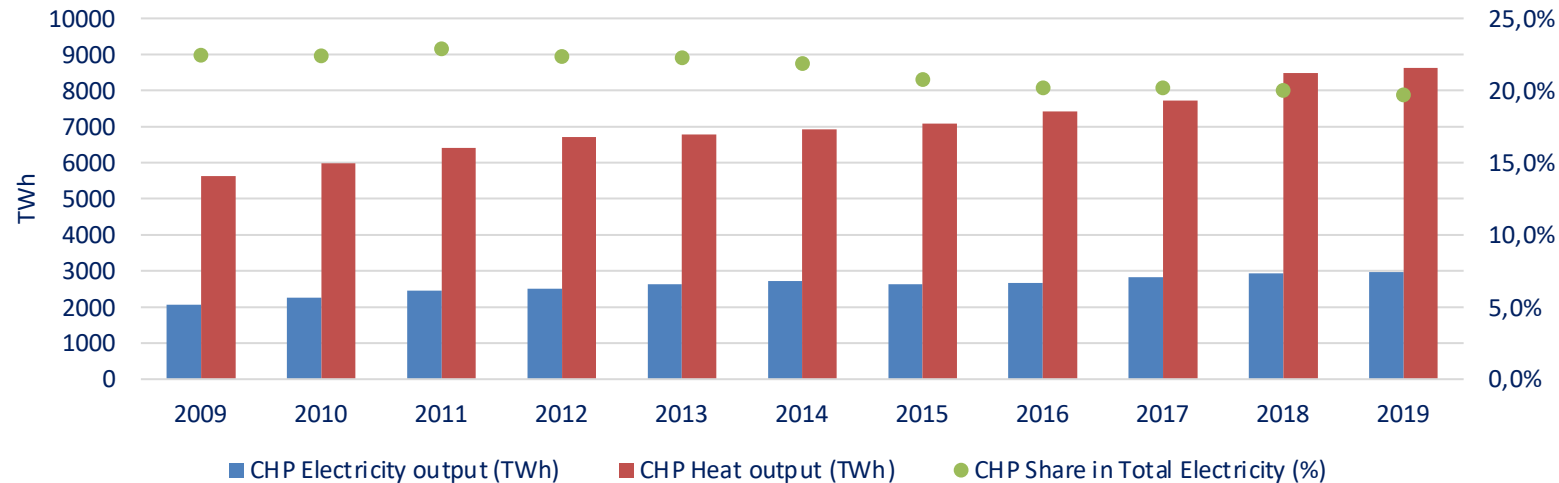


# Asia

Electricity produced by CHP plants in 2019:

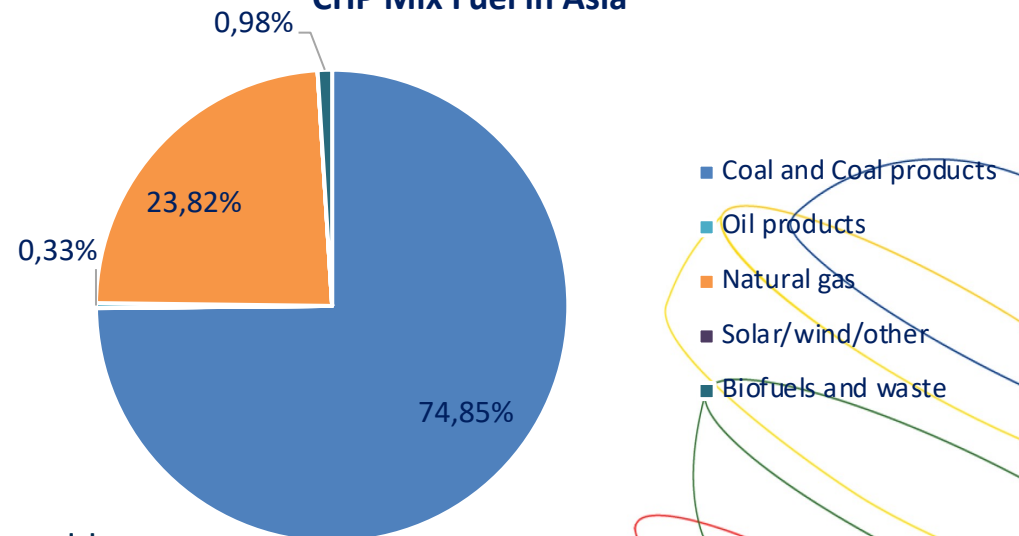


## 10-year Overview of CHP in Asia



- Increase of the electricity output **from 2,000 TWh to almost 3,000TWh.**
- Despite an increase in output, CHP's share of electricity has decreased steadily since 2013 **from 22% to 19%.**
- Asian electricity markets are prioritising other technologies for development.
- Asia's main fuel remains **coal, and this is due to China's very high consumption of coal to power CHP.** The rest of the fuel used in Asia is almost exclusively natural gas.
- Leading countries: China, Japan, India

## CHP Mix Fuel in Asia



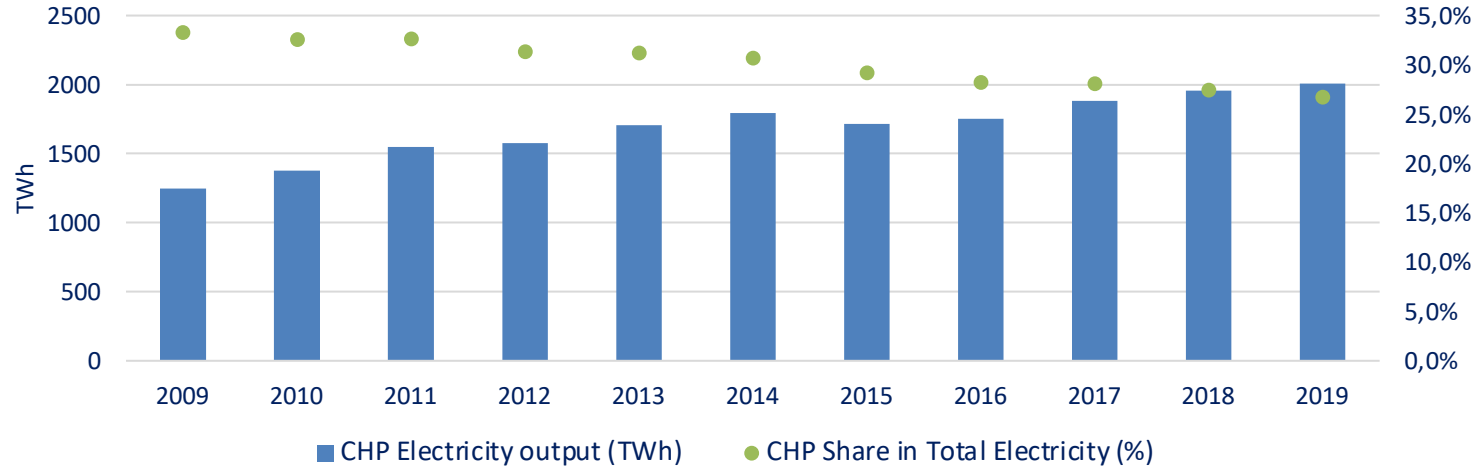
# China

Electricity produced by CHP plants  
in 2019:



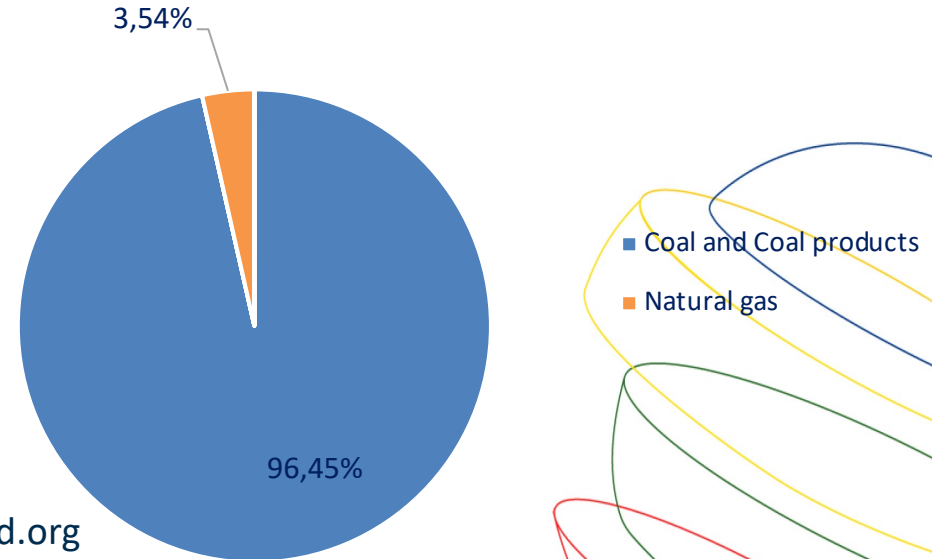
China represents **68%** of all CHP electricity produced in Asia.

10-year Overview of CHP in China



- Increase of the electricity output **from 1,200TWh to 2,000TWh.**
- Small decrease of the CHP electricity share in the total electricity generation **(from 33% to 27%).**
- China does not seem to develop its CHP capacity at the same rate as its electricity demand. This suggests that China prioritises other technologies.
- **Coal** largely dominates the CHP fuel market in China. Natural gas has only a share of less than 4%.

CHP Fuel Mix in China

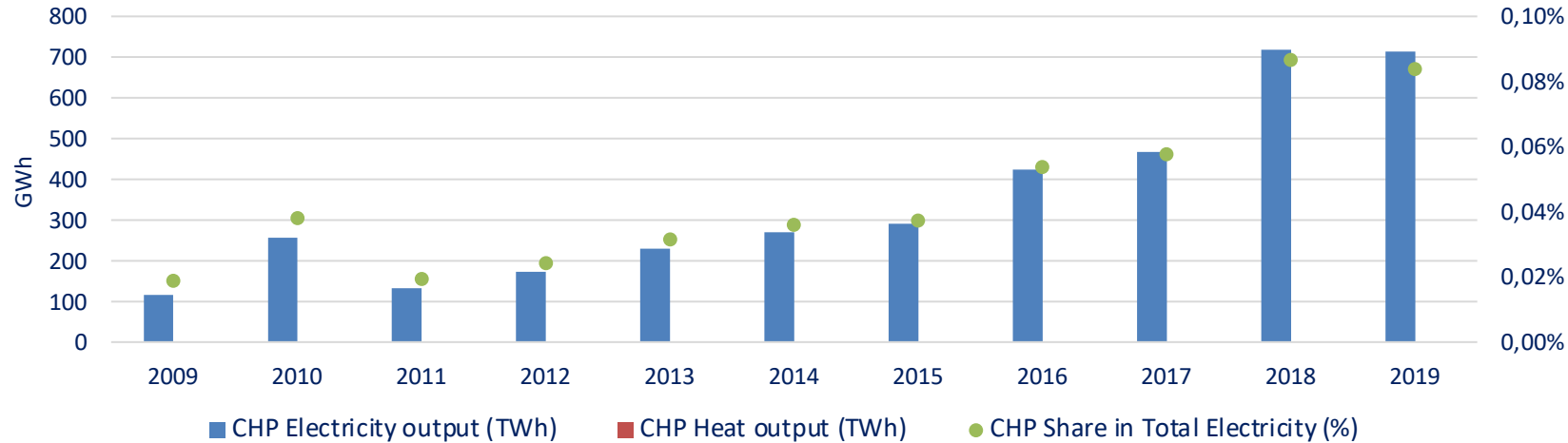


# Africa

Electricity produced by CHP plants in 2019

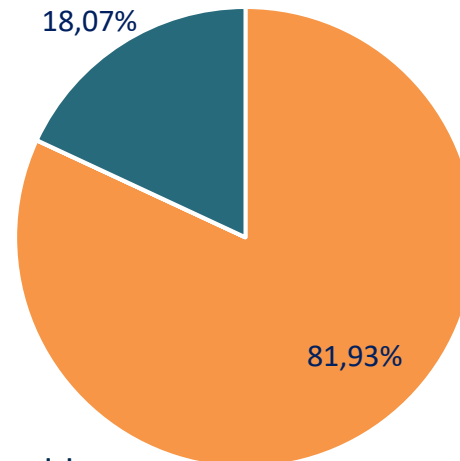


## 10-year Overview of CHP in Africa



- Increase of the CHP electricity output from 110GWh to 714GWh.
- The share of CHP electricity output in the African electricity generation is insignificant. In 2019 it was c.0.08%.
- According to the Energy balance table of Africa (IEA), CHP is powered with **biofuels and waste and natural gas**.
- No complete data from the IEA to do analysis by African countries.

## CHP Fuel Mix in Africa



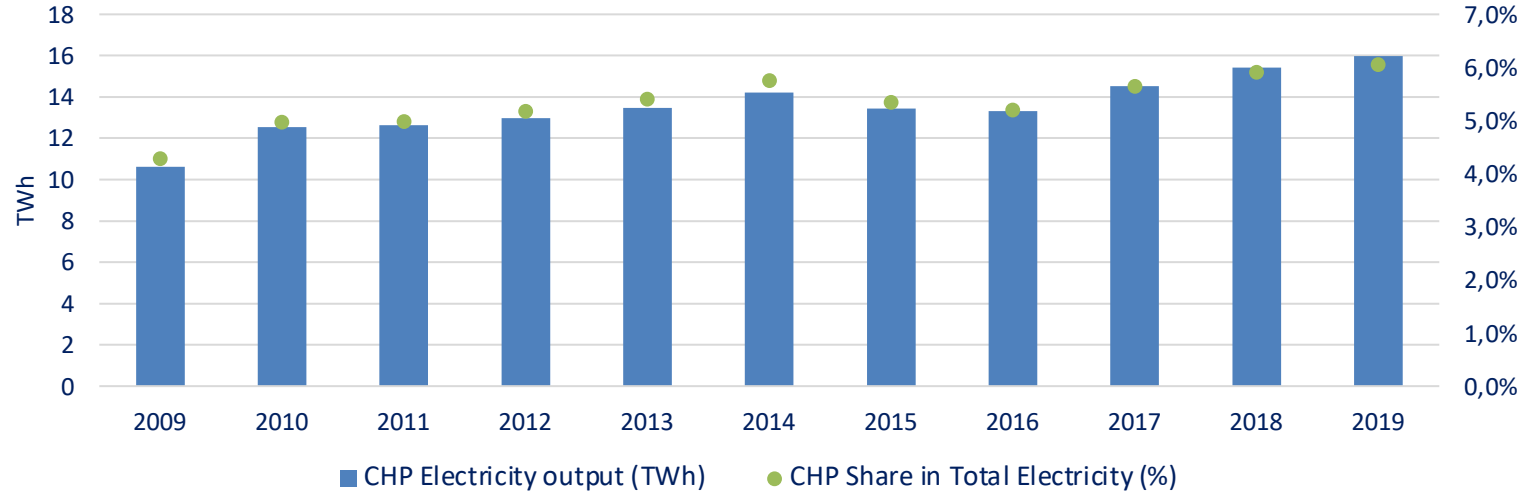
- Natural gas
- Biofuels and waste

# Australia

Electricity produced by CHP plants  
in 2019:

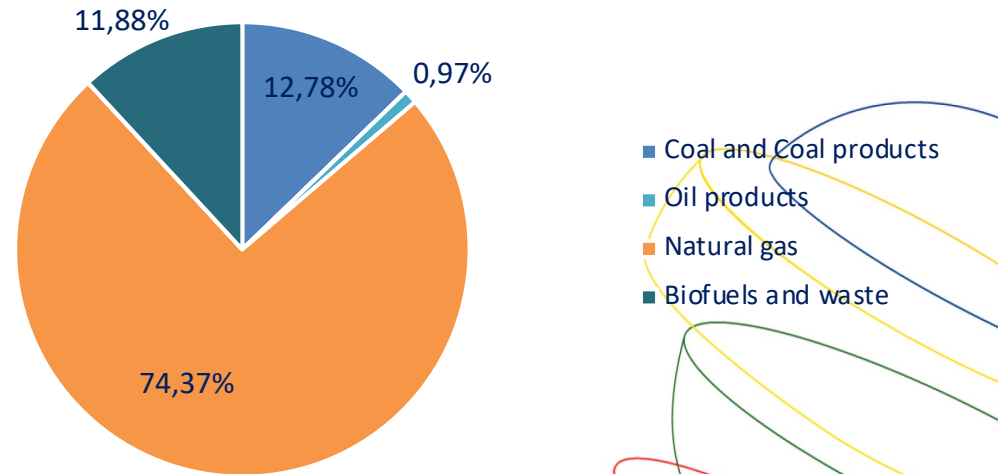


## 10-year Overview of CHP in Australia



- Small variations of CHP electricity output (**between 10.6 and 16TWh**).
- CHP's share of electricity remains constant (**4-6%**).
- High share of **natural gas** in CHP fuel mix. Coal, biofuels and waste are used in the same proportions.

## CHP Fuel Mix in Australia



# Current and future trends of the CHP Market

	Geography	Technology	Fuel	Size	End-Users
<b>Current situation</b>	<p>Asia Pacific accounted for a 55.7% share of the CHP market in 2020.</p> <p>Europe and North America have also a developed CHP market.</p>	<p>Gas and steam turbines are the two main technologies on the market.</p>	<p>Natural gas and coal are currently the most used fuels in the world.</p>	<p>Large capacity plants dominate the market because of the important use of CHP in the industrial sector.</p>	<p>Industries such as chemicals or pulp and paper are currently the main end-users of cogeneration.</p> <p>Commercial and residential facilities (hospitals, universities, district heating) in lesser measure.</p>
<b>Forecast</b>	<p>Growth in India and China due to the industrial expansion and technological innovations.</p> <p>A growth in South America, particularly in Brazil, is expected to continue.</p>	<p>Fuel cells are expected to be increasingly used in the next years, as it is a technology with clean by-products (water and heat).</p> <p>Micro-CHP fuel cell have already emerged on the market. Larger CHP fuel cells begin to be installed in the US, Japan and South Korea.</p>	<p>A transition from coal-based generation to cleaner powered generation is assumed. Gas should still have an important part to play because of its relatively low greenhouse emissions compared to other fuels. However, some part of the world such as the EU are establishing greenhouse emissions regulations which could be a barrier for new CHP running on fossil fuels.</p> <p>Consequently, it is expected to observe an increase of the use of renewable resources like solar, geothermal or biofuels.</p> <p>Hydrogen should experience a rapid growth linked to the fuel cell emergence in the CHP sector.</p>	<p>High demand for up to 10MW capacity from residential and commercial end-users.</p> <p>Use of Micro-CHP to replace domestic boilers.</p>	<p>Increase in the commercial and residential CHP installations: CHP as a key technology for city and district level utilities. Power or Heat produced by utilities can be used on-site, distributed to the local facilities or transmitted to the grid/district heating.</p>





**COGEN**  
WORLD COALITION

**Hans Korteweg**

Executive Director

Tel.: +32 (0)2 772 82 90

E-mail: [executive\\_director@cogenworld.org](mailto:executive_director@cogenworld.org)

[www.cogenworld.org](http://www.cogenworld.org)