

## *Centre Energie - Centre for Energy*

### Decarbonization of the French energy mix and the role of gas



**Sylvie Cornot-Gandolphe**

Associate Research Fellow

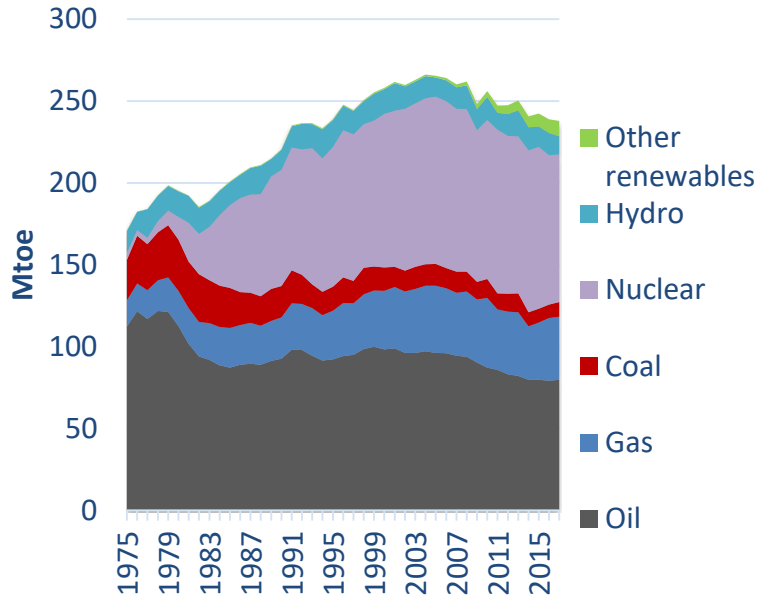
ENERGETIKA, Berlin, 10 April 2019

# Agenda: French decarbonization pathway and the role of gas

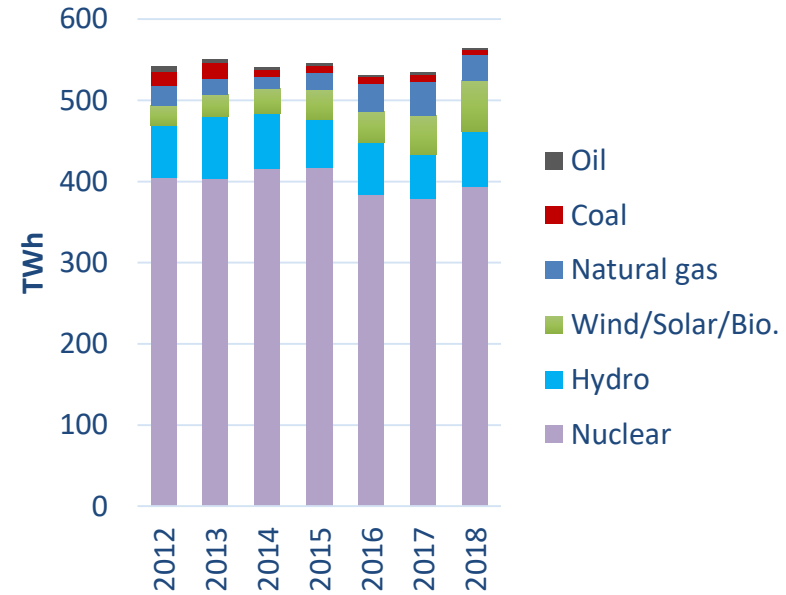
- Two draft policy documents
- The National Low Carbon Strategy to 2050 (“SNBC” in French), December 2018
- The Multiannual Energy Program 2019-2028 (“PPE” in French), January 2019
- Role of natural gas and renewable gas

# Background: French energy and electricity mix

## Primary Energy Consumption

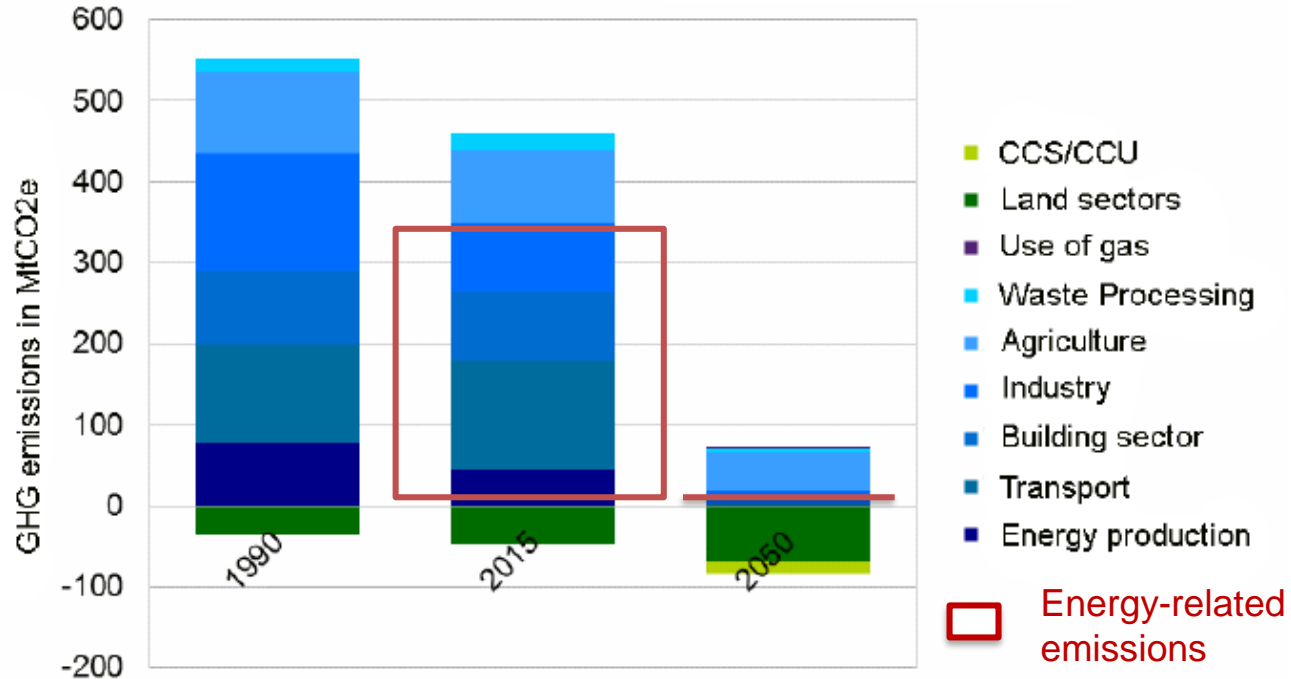


## Gross Electricity Production



*High dependency on imported oil and nuclear*  
*Natural gas: 16% of TPES*

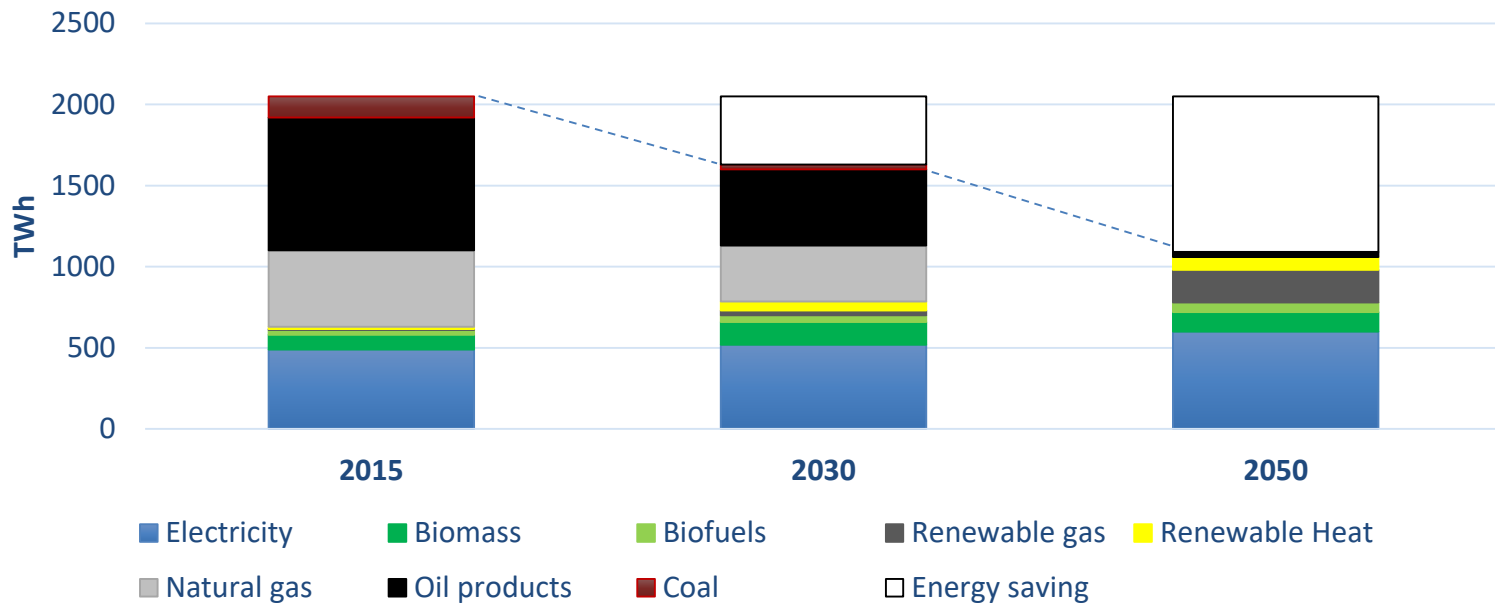
# National Low Carbon Strategy: Achieving carbon neutrality by 2050



1. Fully decarbonize energy supply
2. Reduce non-energy related emissions
3. Increase GHG sinks

# Towards full decarbonisation by 2050

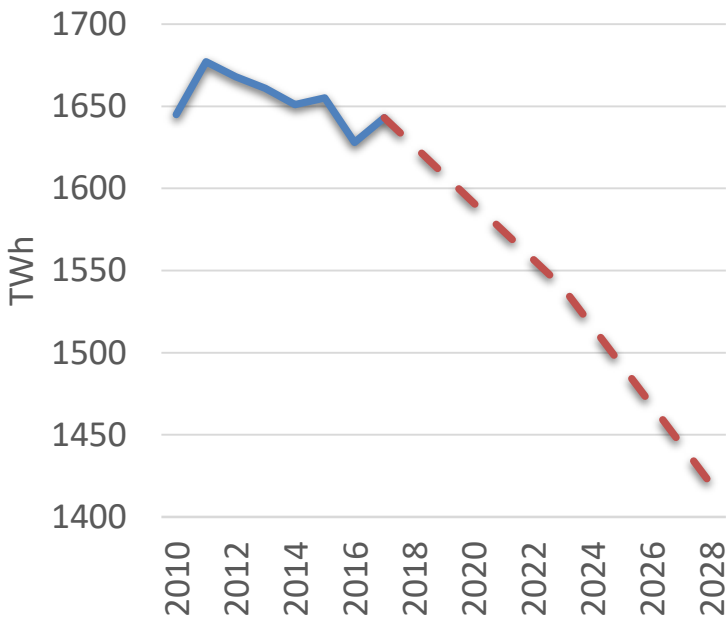
Energy consumption by vector



*Carbon neutrality implies a very sharp drop in energy consumption and a supply mainly composed of biomass and carbon-free electricity*

# PPE to 2028: Actions to reduce final energy consumption in all sectors

## Final energy consumption



## Policy Measures

- Carbon price (€86/t in 2022)  
(but social factors)
- White certificates

**2.5 million**  
of renovated  
houses by  
2023

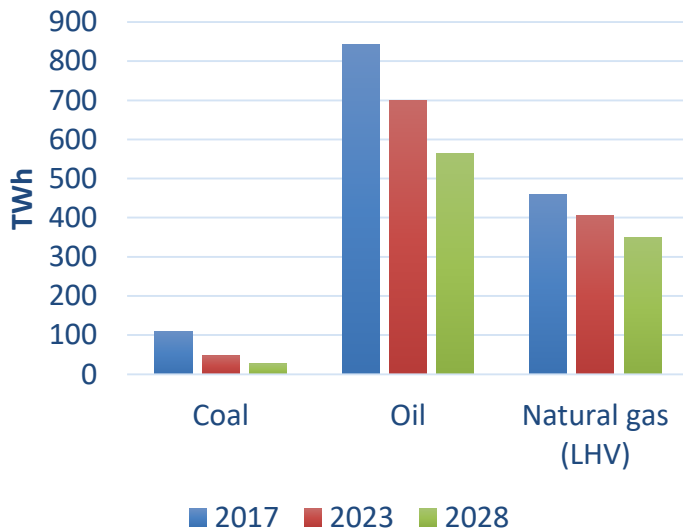
**4.8 million**  
of electric/  
hybrid vehicles  
by 2028

*A decline by 7% in 2023 and by 14% in 2028 compared to 2012*



# Moving away from coal and oil

Primary consumption of fossil fuels



## Specific measures to reduce coal and oil consumption

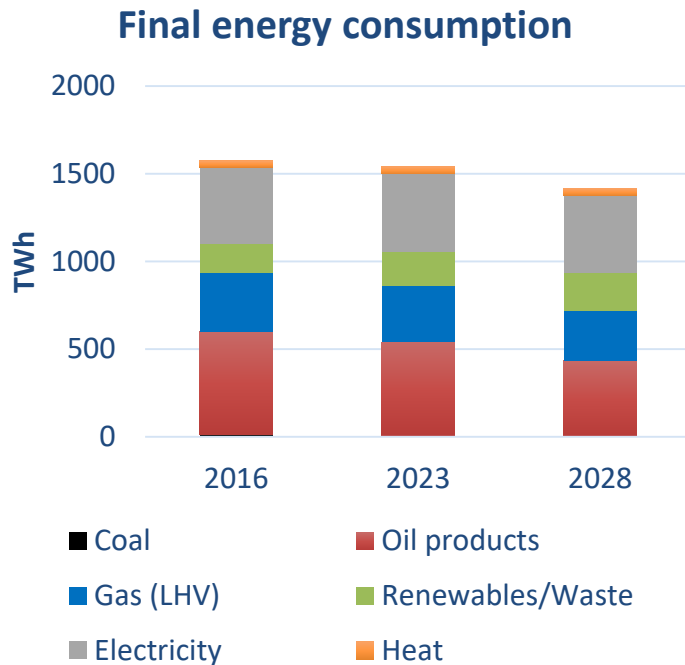
**1 million**  
of fuel boilers  
substituted by  
2023

**2022**  
Shutdown of the  
latest 4 coal-fired  
stations

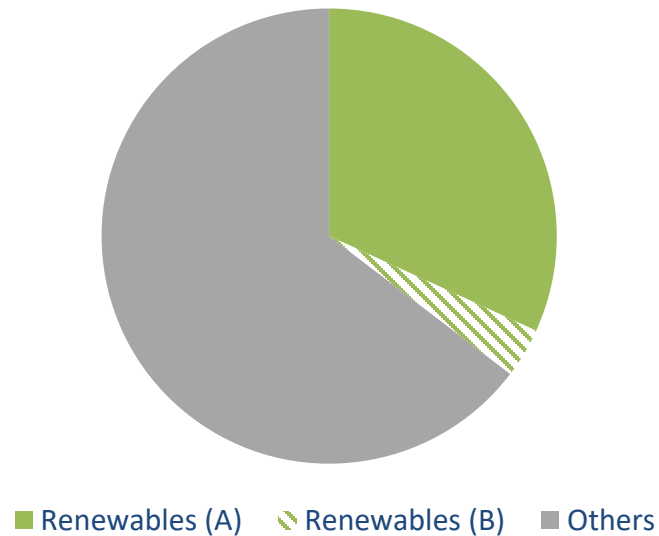
**Zero**  
Number of new fossil-  
fuel power plants  
authorized during the  
PPE

*By 2028, fossil fuel consumption declines by 33% compared with 2017*

## Growing share of renewables



## Gross final energy consumption 1527 TWh in 2028



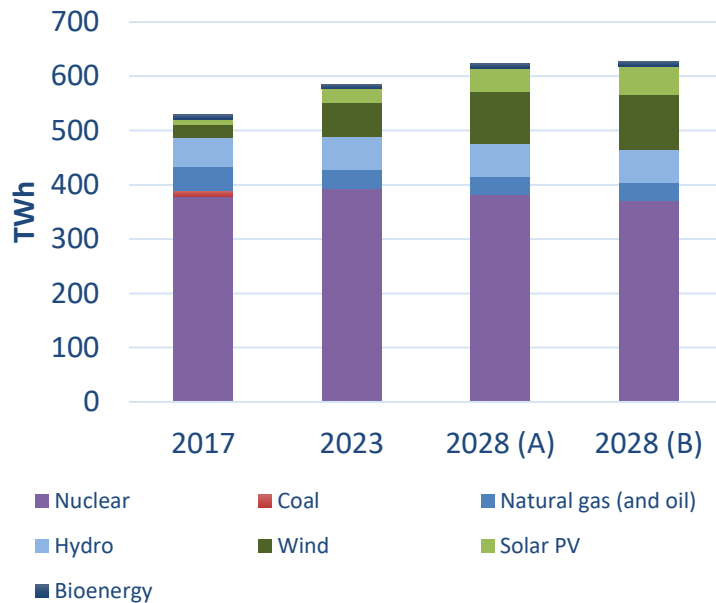
**Renewables account for 32% to 35% of gross final energy consumption in 2028**



## Power Sector

- **Nuclear: 50% by 2035**
  - 14 nuclear reactors closed by 2035
  - 4 to 6 during the PPE
  - Nuclear option remains opened
- **Renewables: Capacity X2**
  - From 47 GW in 2017 to 102-113 GW in 2028
  - Onshore wind: from 14 GW to 34-36 GW
  - Solar PV: from 8 GW to 36-45 GW

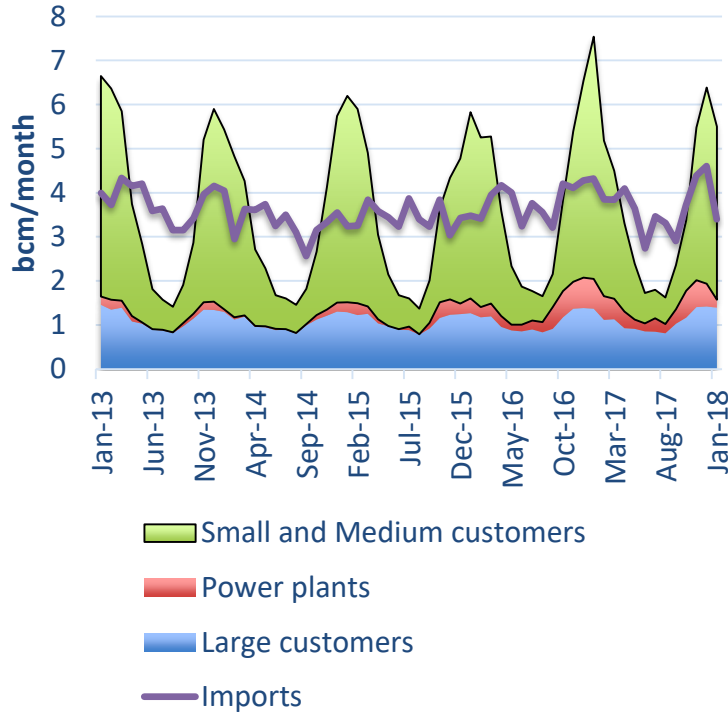
Gross electricity production



*Role of natural gas is limited in the electricity mix (5% in 2028)*

*But essential to cover peak electricity demand*

## Gas in the PPE



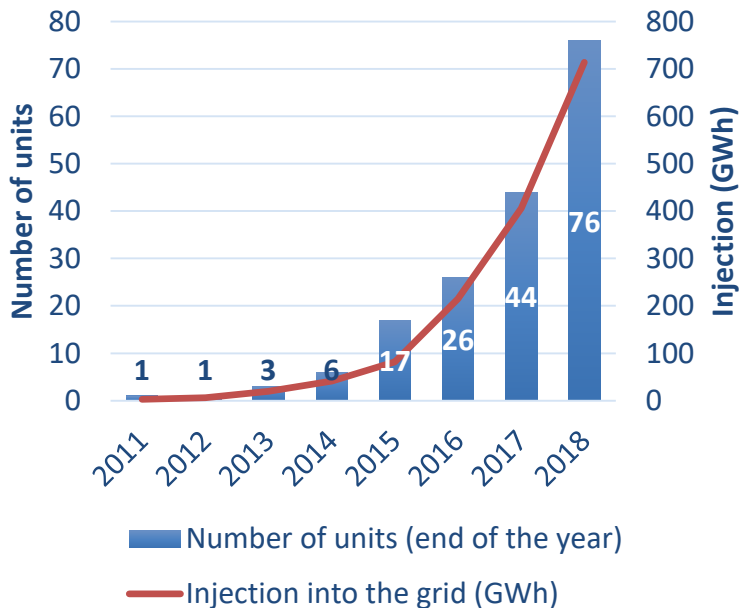
- Gas demand is weather sensitive and highly seasonal
- Gas demand in 2017: 493 TWh  
→ 420 TWh in 2028  
(450 TWh in 2030 in stakeholders' reference scenario)
- Reduction in buildings (efficiency and renewable heat)
- End of support policy to gas-CHP plants
- Increase in NGVs/bio-NGVs

**NGVs: 60,000 HDV, 110,000 LDV by 2028**

**Much lower than stakeholders view: 140,000 HDV and 180,000 LDV**

# A rising role for renewable gas

## Biomethane injection is taking off



- **2018: 76 biomethane plants with an injection capacity of 1.2 TWh/y**
- **In addition 661 projects with a capacity of 14 TWh/y**
- Small units (2/3 less than 15 GWh/y)
- Cost of production of injected biomethane: €95/MWh

# Biogas and biomethane in the PPE: a big disappointment

## PPE targets

- 7% of gas consumption by 2030, **provided production costs are reduced to €67/MWh by 2023** and to €60/MWh by 2028
- Up to 10% of gas consumption in case cost reductions are higher....
- Based on two annual calls for tender of 350 GWh/y each

To be compared with 10% by 2030 in the 2015 Law on Energy Transition for Green Growth and up to 90 TWh (all renewable gas) in stakeholders plans

	2023	2028 (A)	2028 (B)
Biogas production (TWh)	14	24	32
of which injected into the grid (TWh)	6	14	22
Percentage of final gas consumption	3%	6%	8%

*Use in transportation is favoured (incl. local use)*

# Hydrogen Plan: "making our country a world leader in this technology"

## Focus on green H2

- 2 pilot plants: GRHYD (Dunkerque), Jupiter 1000 (Fos-Sur-Mer)



## PPE targets

	End 2023	End 2028
<b>Demonstration plants</b>	<b>1 to 10</b>	<b>10 to 100</b>
Percentage of green H2 in industrial H2	10%	20% to 40%
Number of H2 light duty vehicles	5000	20 000 to 50 000
Number of H2 heavy duty vehicles	200	800 to 2 000

## Three applications

- Industrial H2
- H2 Mobility
- Energy storage

*Green hydrogen and Power-to-Gas are promising solutions for mid-to-long term decarbonisation*

## Conclusion

- **A 100% renewable gas mix in 2050?**
- **ADEME study conclusions**
  - Feasible (technically: a theoretical potential of 460 TWh of renewable gas)
  - Reduce gas demand (276 TWh to 361 TWh in 2050)
  - Overall cost of 100% renewable gas between €116 and €153/MWh
- **63 MtCO<sub>2</sub>/year avoided, for a shadow value of carbon of €200/t of CO<sub>2</sub> in 2050**
- **A fair balance to be found**





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# Centre Énergie – Centre for Energy

Sylvie Cornot-Gandolphe  
[Sylvie.cornot-gandolphe@orange.fr](mailto:Sylvie.cornot-gandolphe@orange.fr)

27, rue de la Procession, 75740 PARIS CEDEX 15  
Tél. 01 40 61 60 00 • Fax : 01 40 61 60 60  
[www.ifri.org](http://www.ifri.org)