

Modeling the energy transition of the south-east region of France:

The role of hydrogen for the integration of variable renewables
(571)

Carlos ANDRADE, Sandrine SELOSSE, Nadia MAÏZI

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MINES ParisTech, PSL University
Centre for Applied Mathematics, Sophia Antipolis

The RÉGION SUD PROVENCE-ALPES-CÔTE D'AZUR

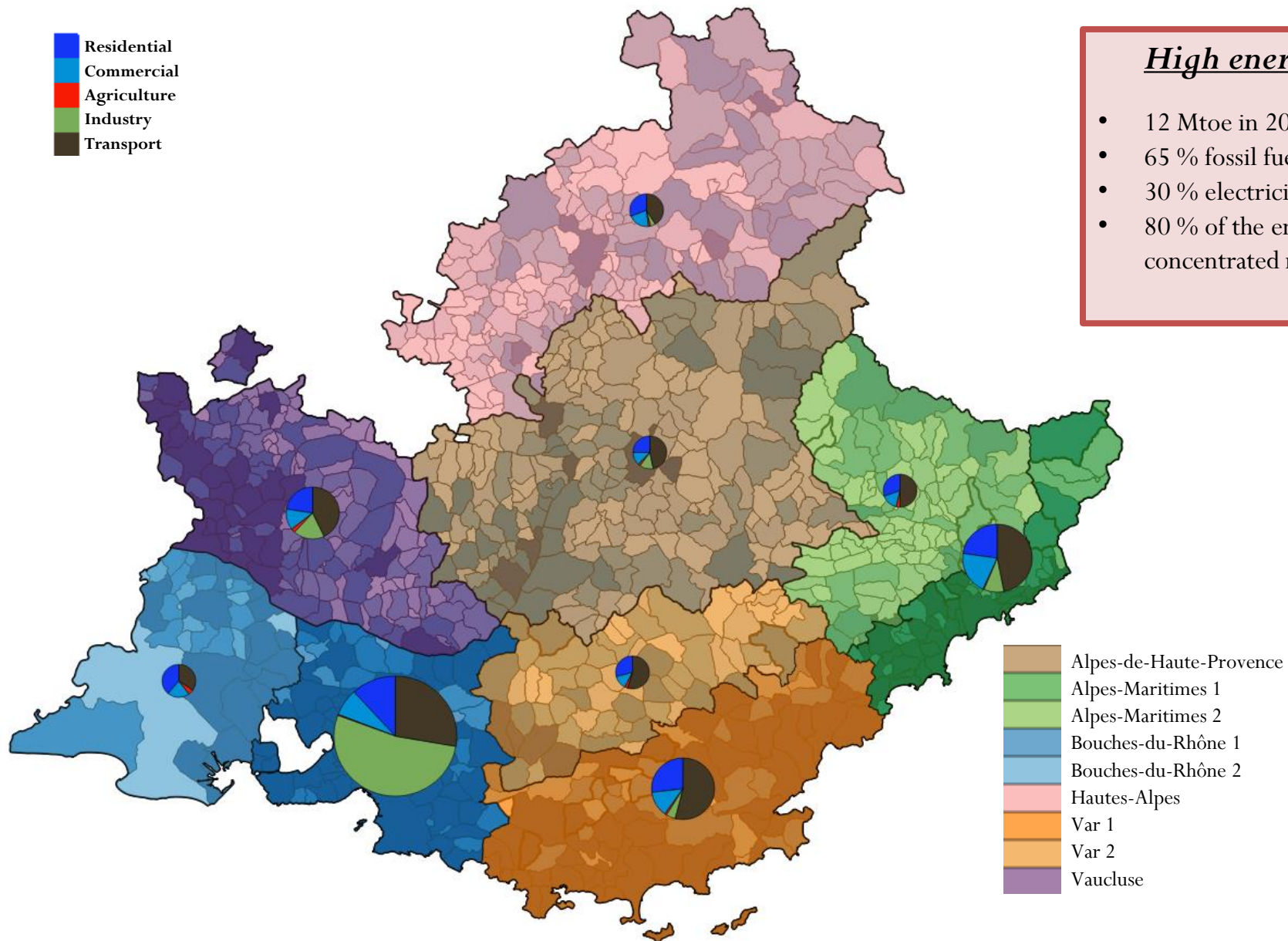


Energy demand

■ Residential
■ Commercial
■ Agriculture
■ Industry
■ Transport

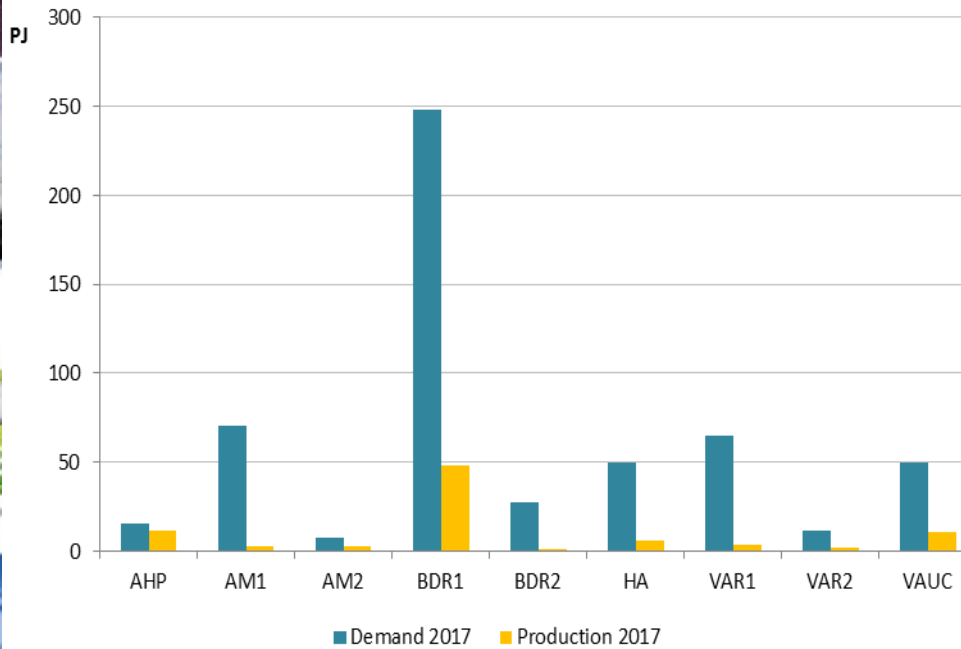
High energy consumption

- 12 Mtoe in 2017 (4th in France) (509 PJ)
- 65 % fossil fuels
- 30 % electricity
- 80 % of the energy consumption concentrated next to the littoral

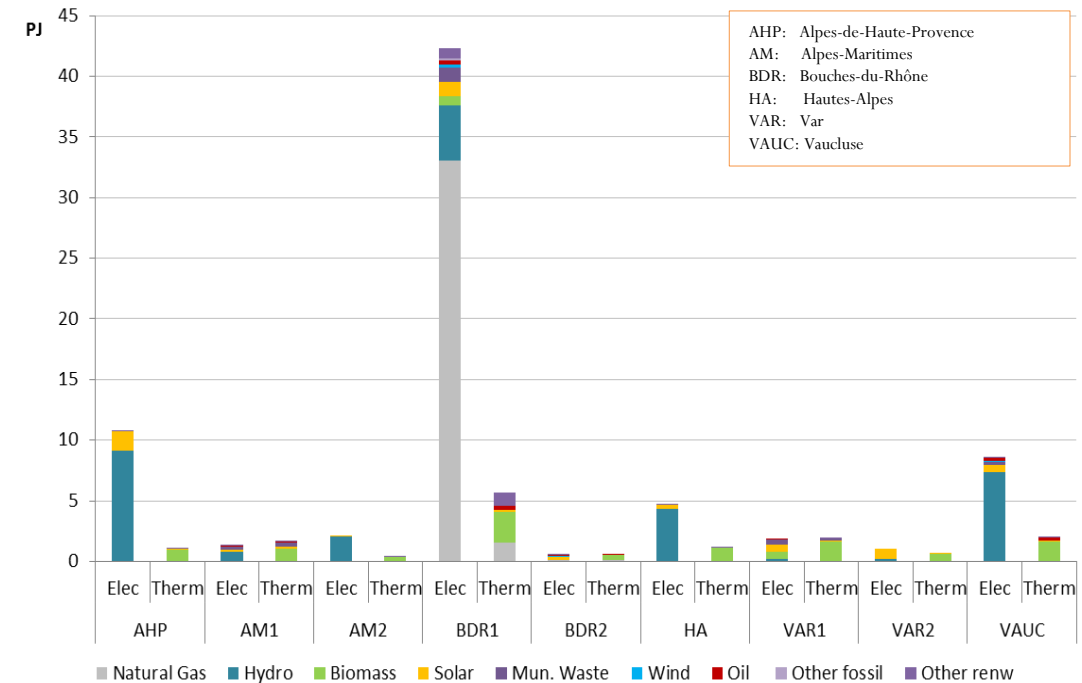


Final energy production by department of the SUD PACA Region in 2017

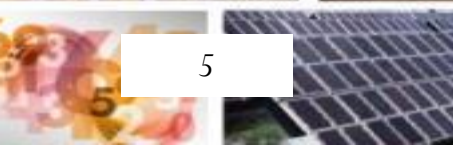
Departments' production vs demand



Final energy production



- Low energy production compared to consumption (17% of the demand)
- Energy production mainly comes from fossil fuels (50%)
- Production concentrated in the BDR1 (54%)



Proposed energy transition by the Région SUD PACA

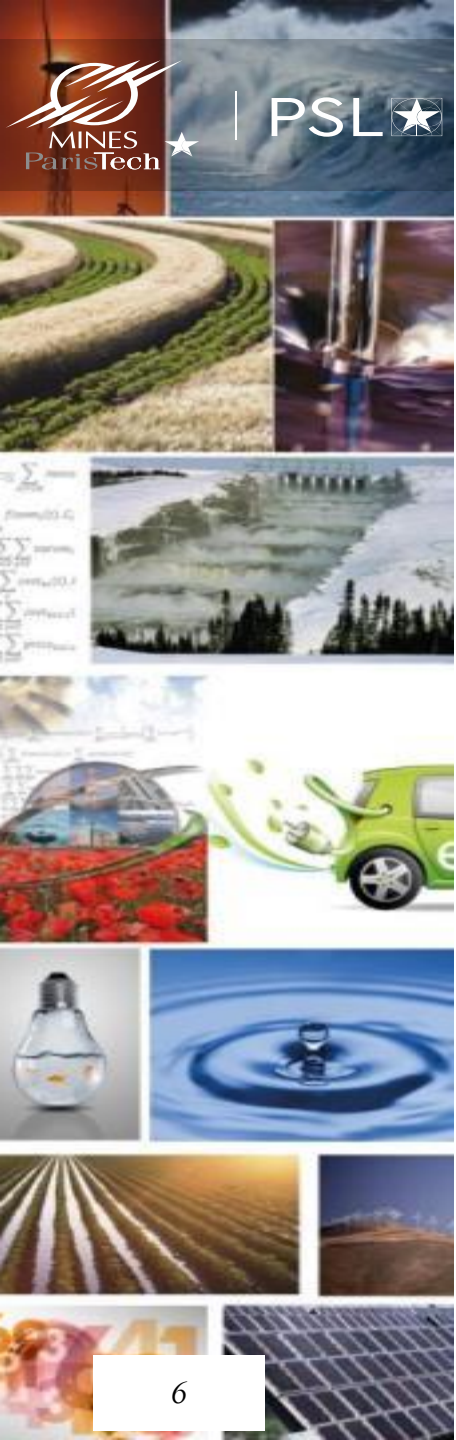
| Production (MW) | | 2020 | 2025 | 2030 | 2050 |
|-----------------|---------------|--------|--------|--------|--------|
| Electricity | Hydro | 3 756 | 3 929 | 3 956 | 4 100 |
| | Wind | 557 | 1068 | 1597 | 3305 |
| | Photovoltaic | 6912 | 9779 | 11730 | 46852 |
| | Biomass | 141 | 172 | 172 | 172 |
| Thermal | Thermal solar | 509 | 781 | 998 | 2065 |
| | Biomass | 352 | 514 | 650 | 1283 |
| | Methanisation | 71 | 162 | 267 | 570 |
| | Gasification | 55 | 153 | 267 | 586 |
| TOTAL | | 12 353 | 16 558 | 19 637 | 65 479 |
| DEMAND | | -8 % | -11 % | -15 % | -30 % |



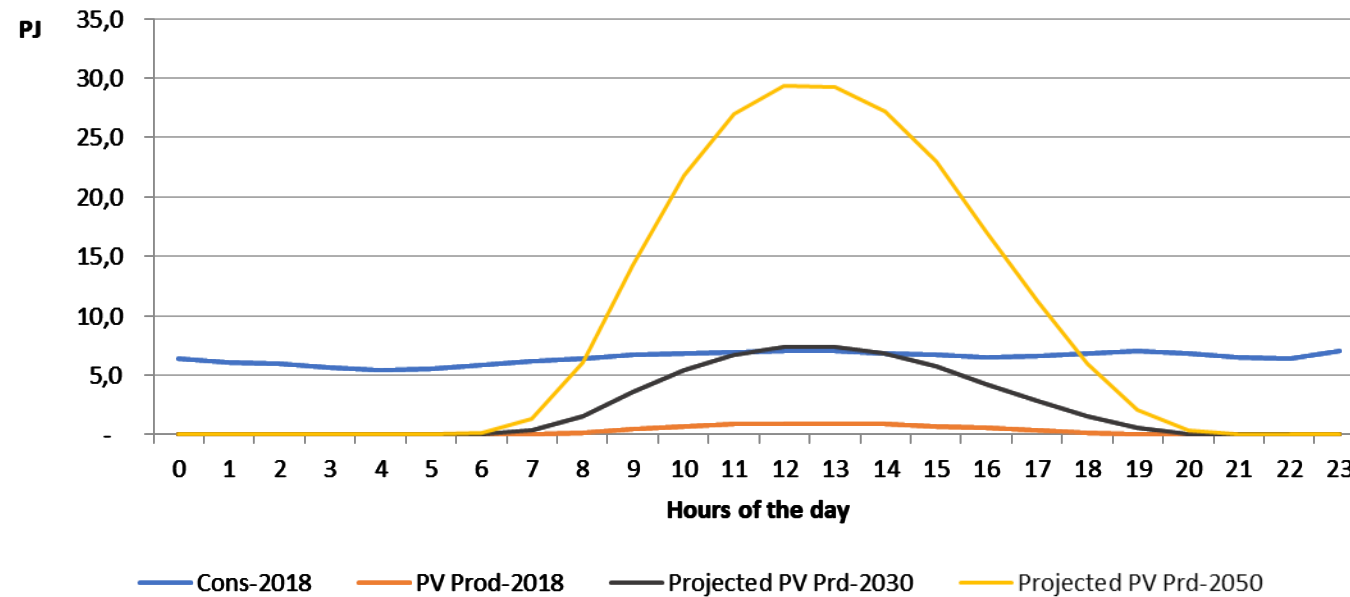
SRADDET Région SUD:
 Objectives concerning production
 and demand reduction

SRADDET: Schéma Régional d'Aménagement, de Développement Durable et d'Egalité des Territoires (**Planning, Sustainable Development and Territorial Equality Regional Scheme**)

In 2050, **86%** (47 GW) of the targeted developments comes from intermittent solar energy which would represent 73% of the electricity production of Region SUD



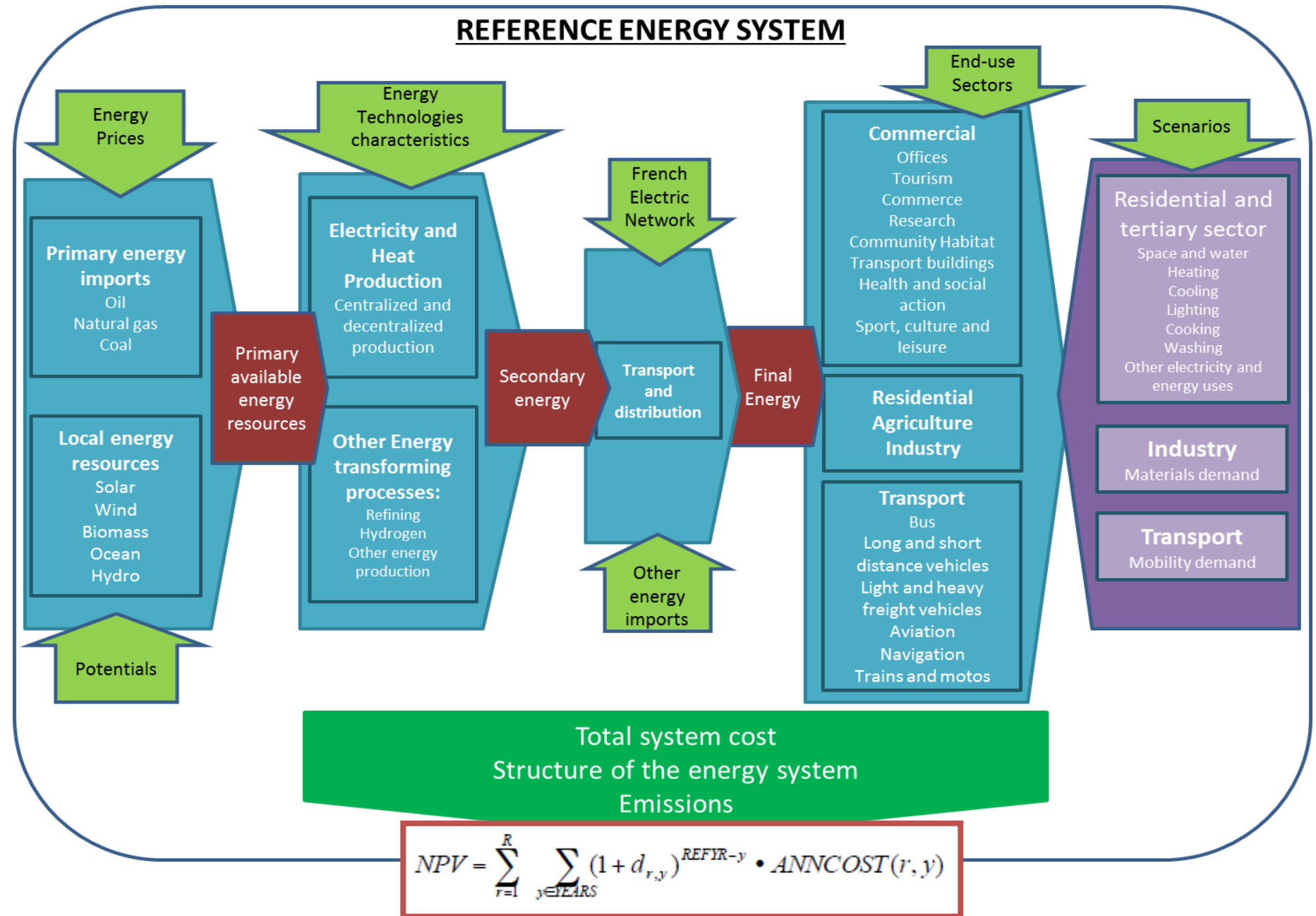
Electricity consumption vs PV solar production

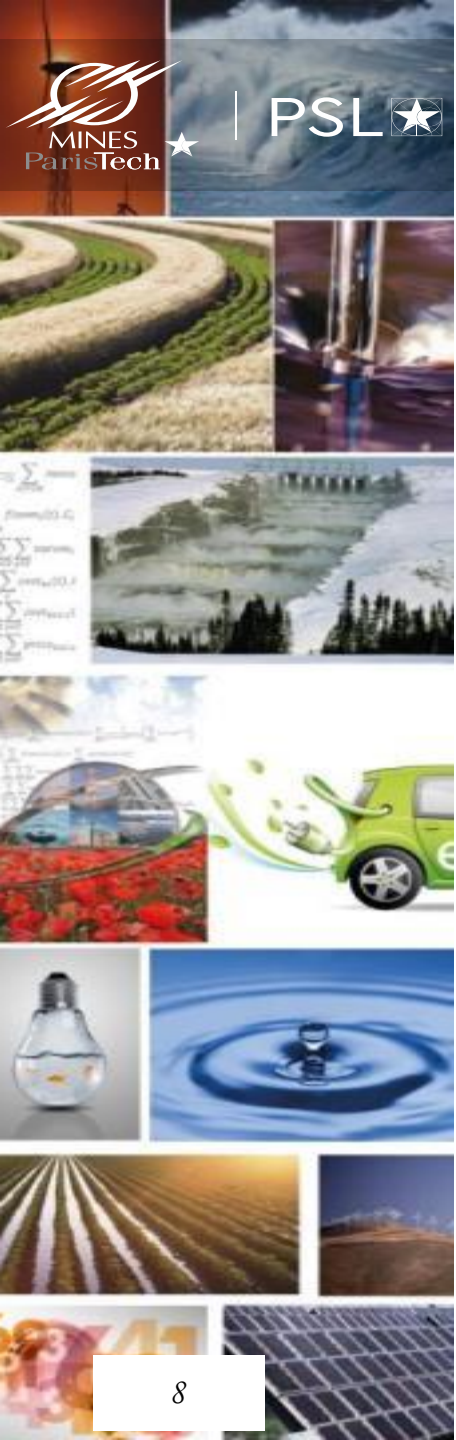


- In 2050, the solar production can cover more than 40% of the total final energy consumed in 2018
- During high solar irradiation periods, proposed solar production can cover up to 300% of the electricity consumption in 2018



The TIMES-SUD_{PACA} model





Scenarios

1. SRADDET :

- Production:
 - ✓ A minimum production for renewable technologies is applied
 - ✓ The maximum production is limited by the regional renewable energy potentials
- Demand is reduce by 30%

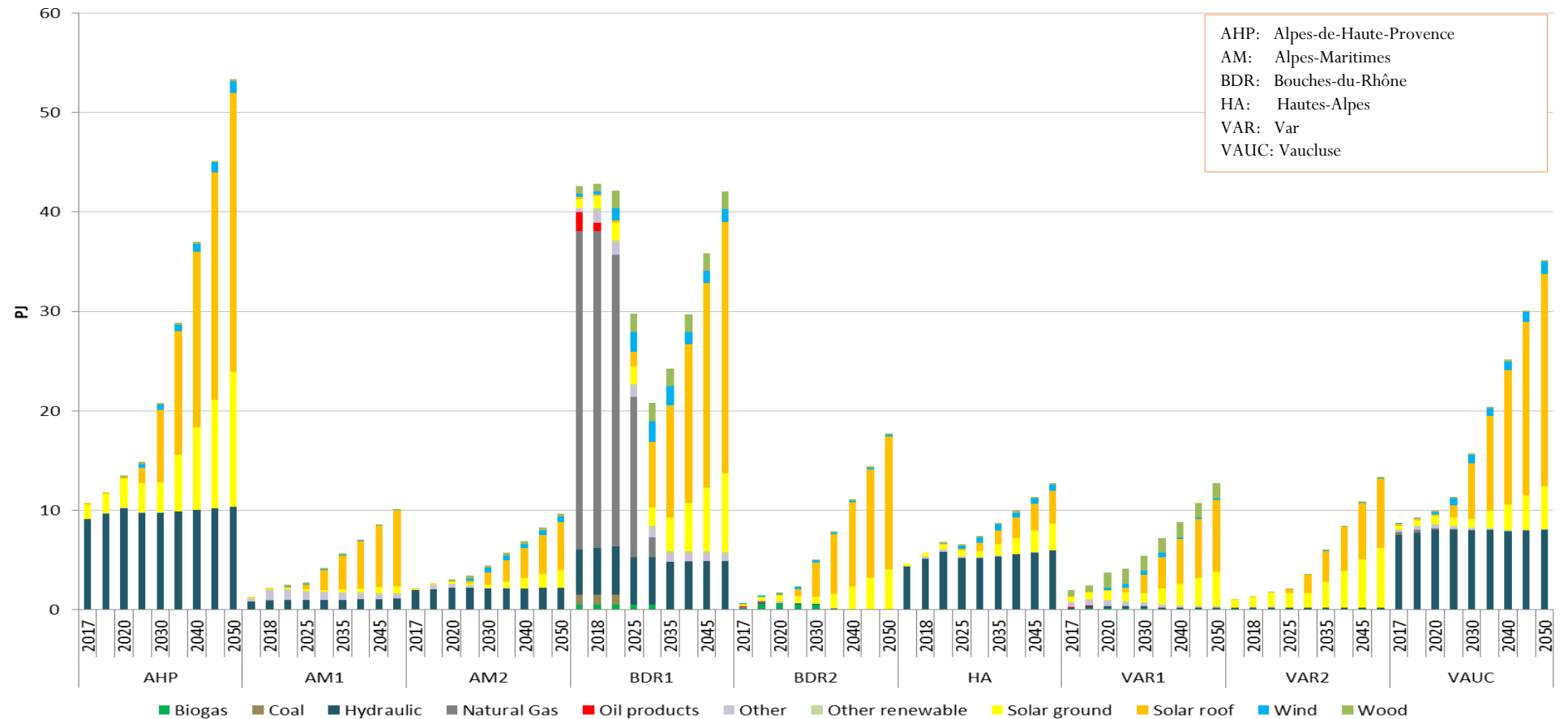
2. Hydrogen: How hydrogen can help the deployment of renewable technologies?

- Production and demand follow the same hypothesis as in the previous case
- Hydrogen can be blended into natural gas network: 6% in 2030 – 20% in 2050

| Production (PJ) | | 2017 | 2020 | 2025 | 2030 | 2050 |
|-----------------|---------------|-------|-------|-------|-------|--------|
| Electricity | Biomass | 1.41 | 2.88 | 4.42 | 4.42 | 4.42 |
| | Wind | 0.42 | 0.99 | 2.21 | 2.78 | 5.40 |
| | Hydro | 28.65 | 29.12 | 31.02 | 31.02 | 33.20 |
| | Solar ground | 5.51 | 6.27 | 8.90 | 6.57 | 29.47 |
| | Solar roof | | 1.30 | 6.47 | 20.47 | 78.57 |
| Thermal | Biomass | 9.92 | 6.67 | 3.79 | 4.79 | 9.38 |
| | Methanisation | 1.73 | 1.73 | 2.19 | 3.60 | 7.39 |
| | Solar thermal | 0.62 | 0.62 | 1.74 | 2.21 | 4.47 |
| TOTAL | | 48.27 | 49.57 | 60.74 | 75.85 | 172.30 |
| DEMANDE | | 0% | -8% | -11% | -15% | -30% |

Minimum production from
renewable resources

Results: Electricity production

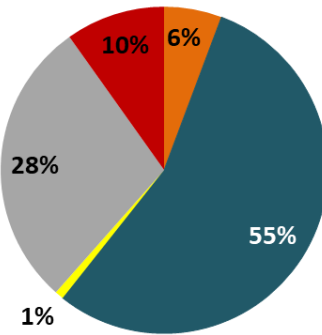


- From 2035, fossil fuels for electricity production are no longer used
- **75%** of the production comes from solar resources and **15%** from hydro resources
- **25%** of the electricity production comes from the AHP zone

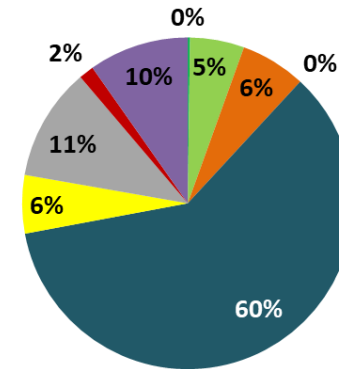
Energy consumption by sector

Buildings

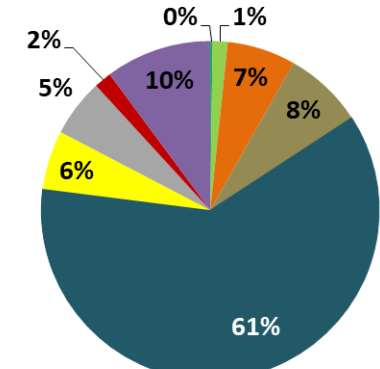
2017



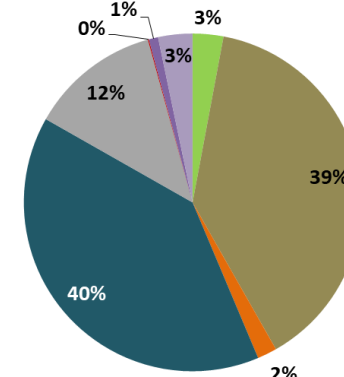
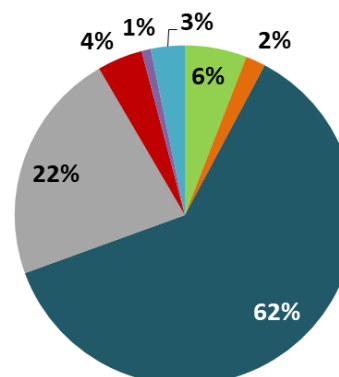
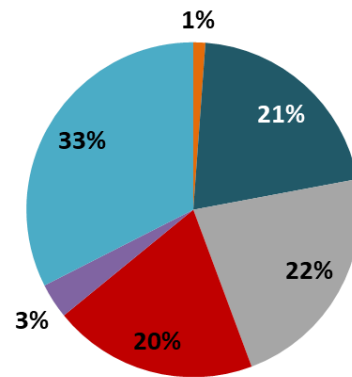
SRADDET



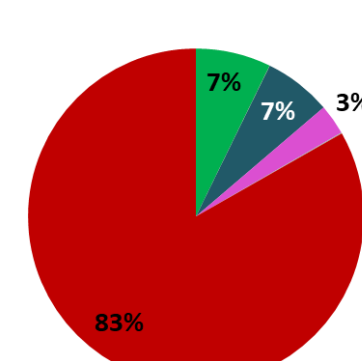
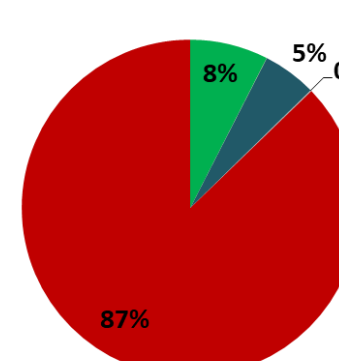
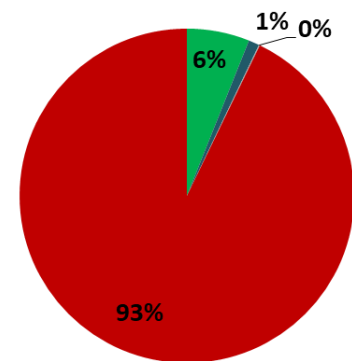
Hydrogen



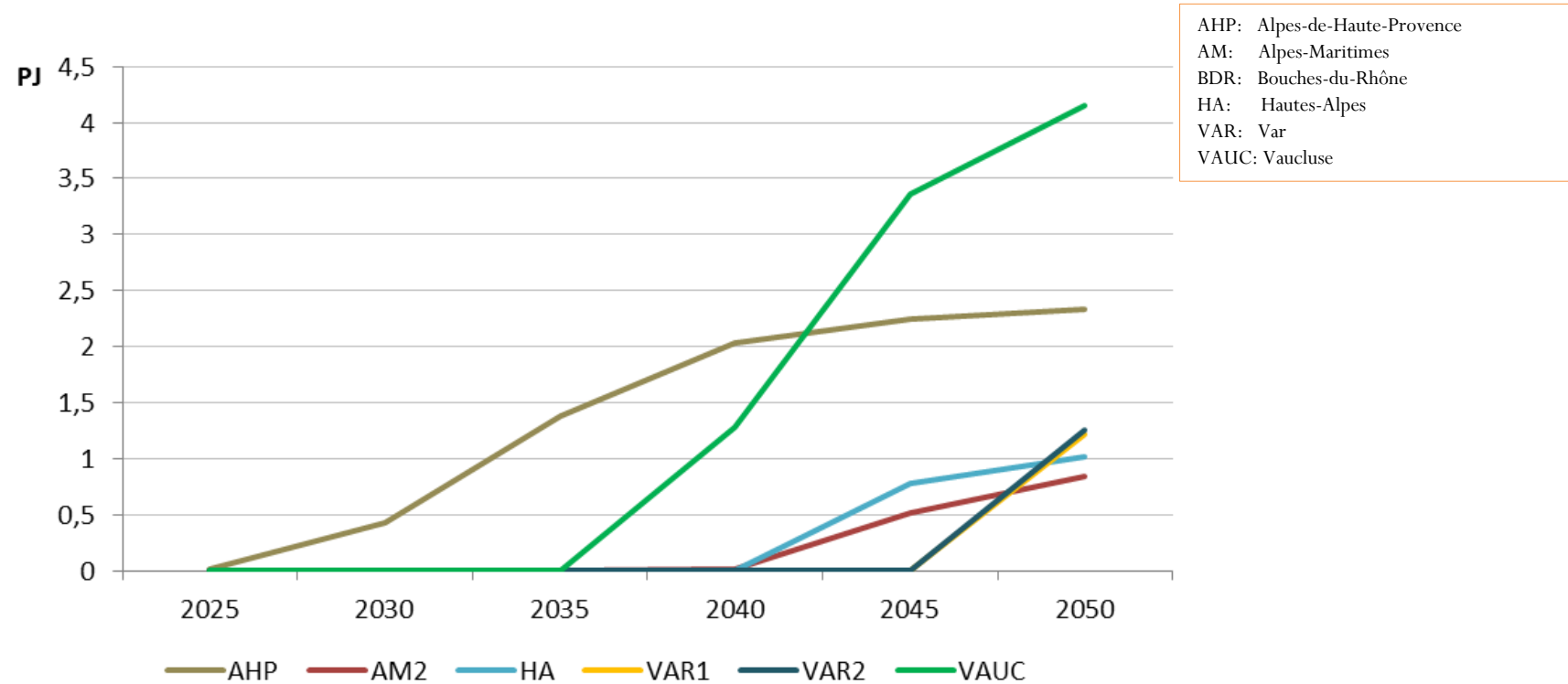
Industry



Transport



Hydrogen production



- In 2050, hydrogen has been produced in around 11 PJ, 90% of the production coming from electrolyzers, the rest from biomass reforming processes
- Hydrogen production comes mainly from low consumption zones

Conclusion

- In neither of the scenarios, the production coming from renewable resources reached the proposed objectives of the SUD PACA region
- Hydrogen has helped to decrease in 10% the consumption of fossil fuels
- Hydrogen production is mainly coming from low energy consuming zones
- Strong policies has to be implemented in order to create the necessary conditions allowing the access of hydrogen into the transport sector



THANK YOU FOR YOU ATTENTION

Carlos ANDRADE

carlos.andrade@mines-paristech.fr

PhD student

MINES ParisTech, PSL University, Centre for Applied Mathematics Sophia Antipolis

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