

Thursday 6 May 2021

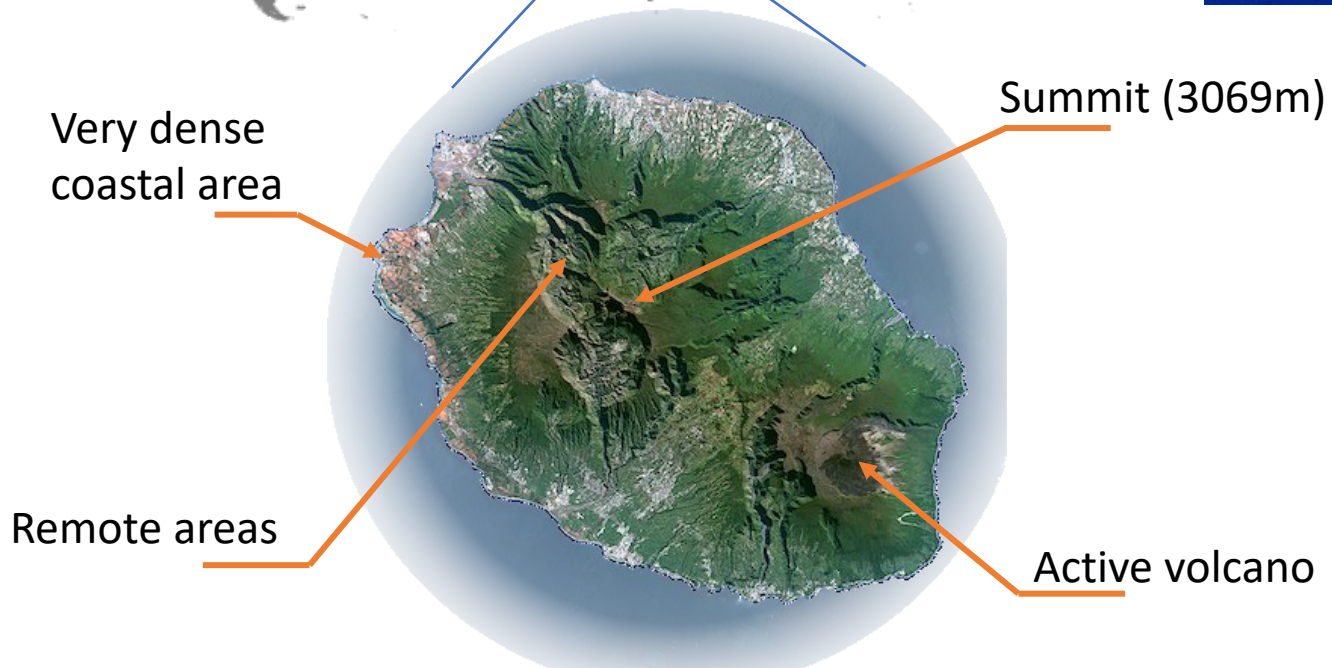
Webinar: Scaling Up High - PV and Renewables Penetration Scenarios

High PV penetration on the insular grid of Reunion Island

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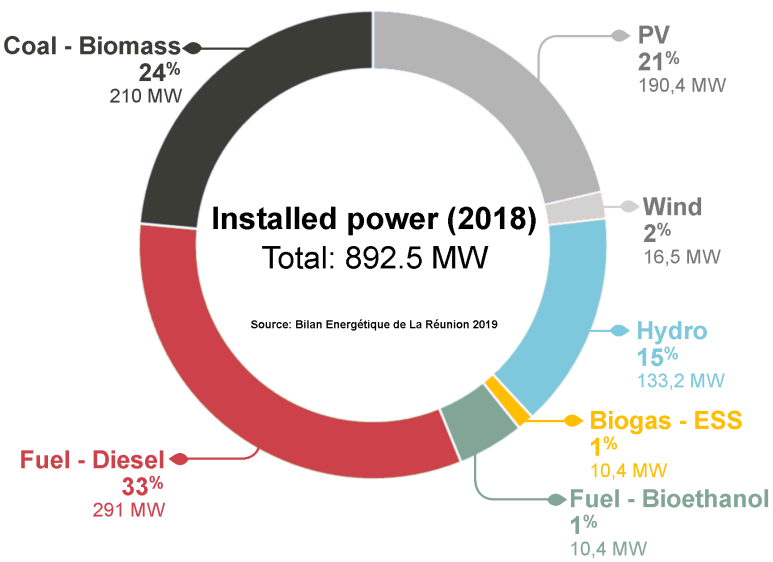
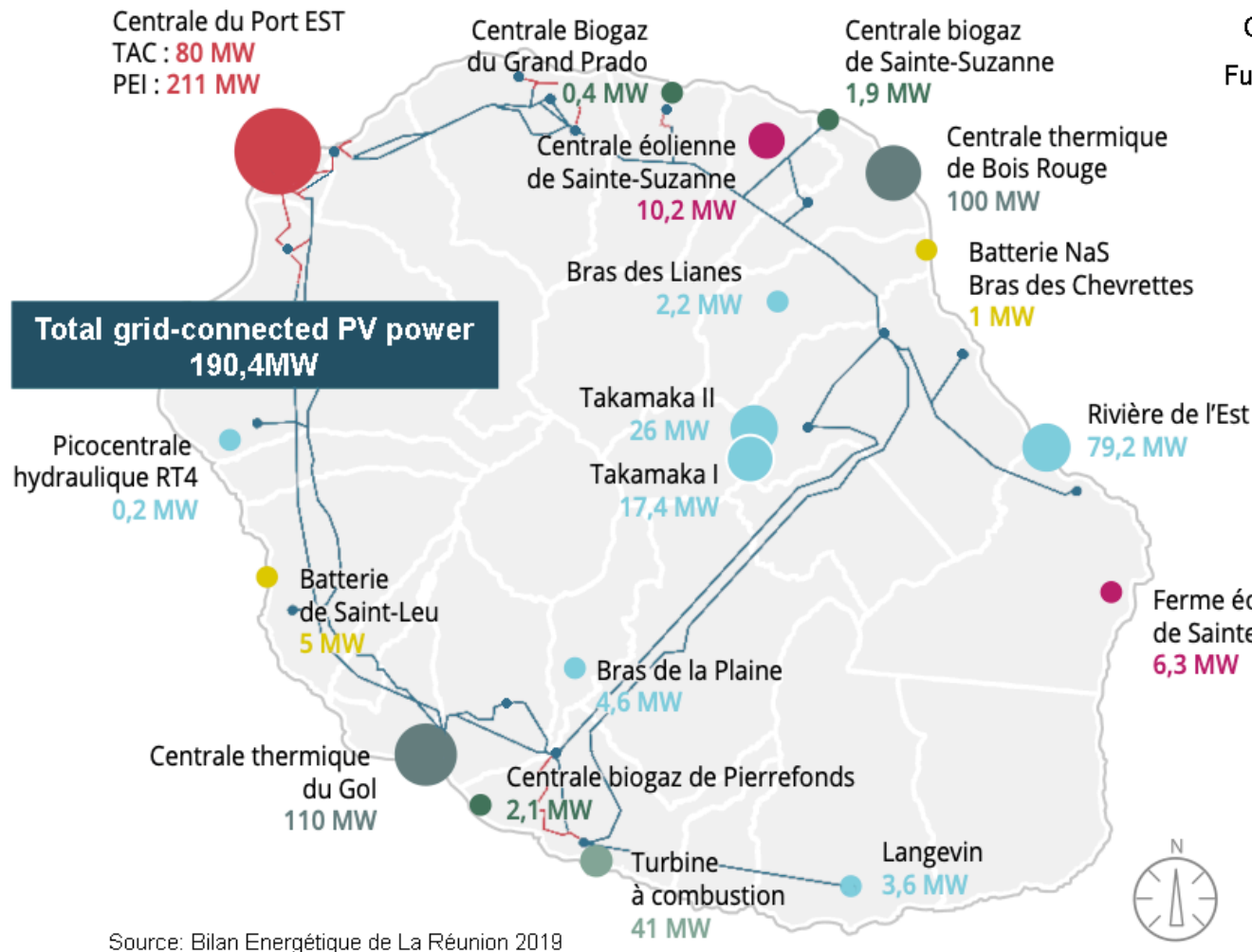
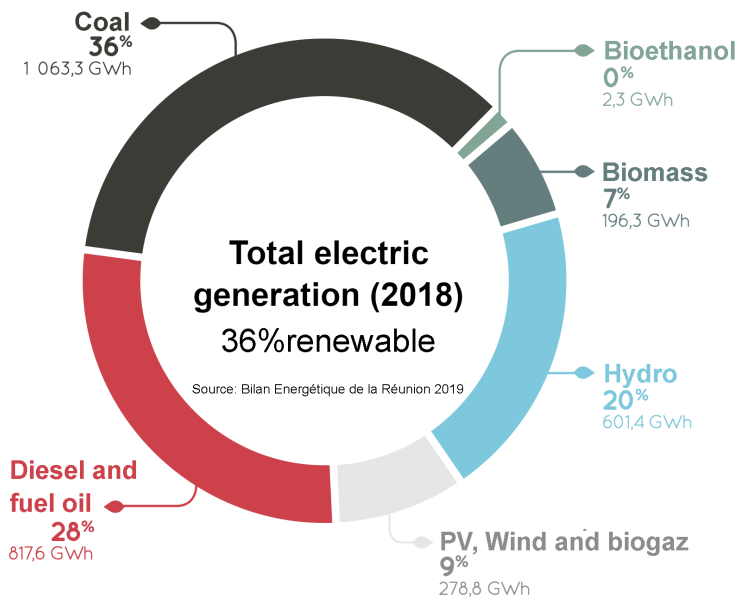




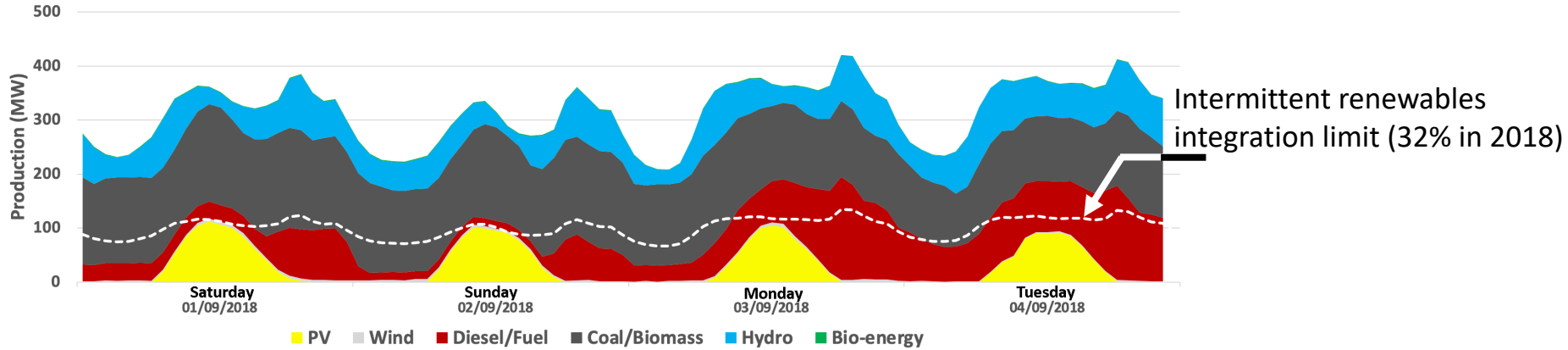
Key features

- French Overseas Territory and European Outermost Region
- 60 km of diameter (2,512 km²)
- 860 000 inhabitants (2017)
- Reunion is a UNESCO world heritage area

Electric grid and current renewable penetration



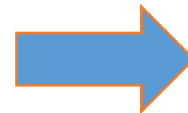
100% renewable generation expected by 2030



○ Increase of the intermittent renewables integration limit

- Mitigate the ramping events of PV (smoothing)
- Integrate more PV generation
- Balance the supply and the demand with increasing PV penetration

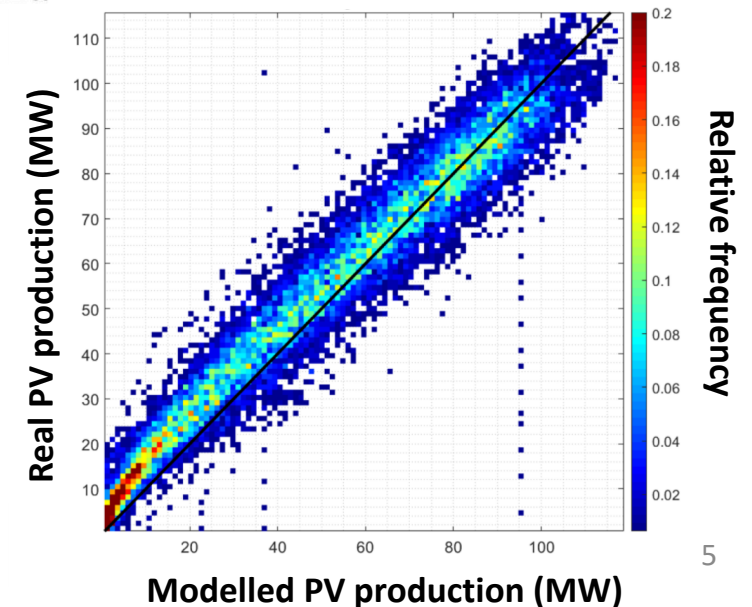
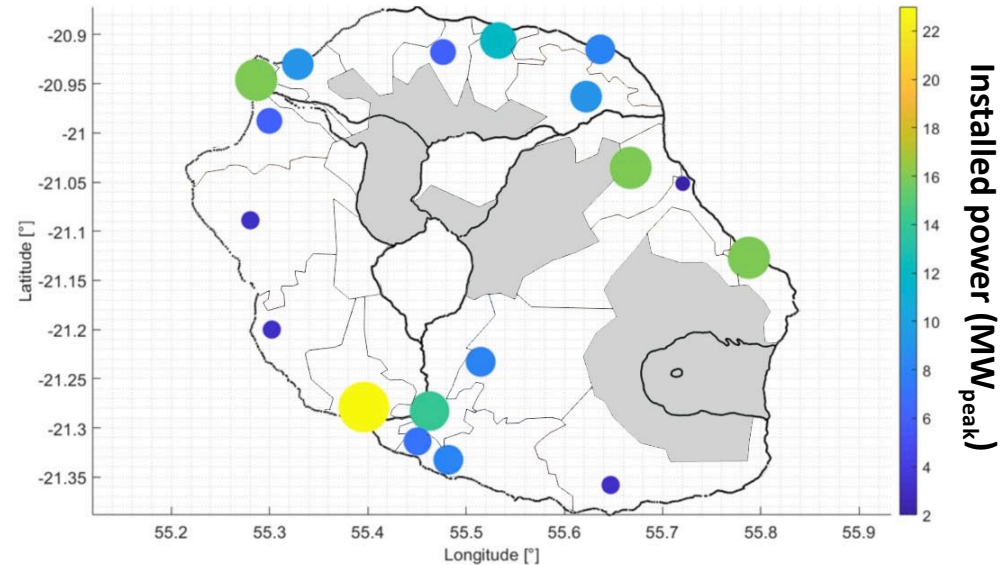
Project: PEPS Réunion



- Mitigation of ramp events with spatial distribution
- Forecasting of PV production
- Energy storage systems (ESS)
- Overbuilding PV capacity

Main model assumptions

- **Solar irradiance and weather parameters**
 - Satellite estimates (1 km – 15 min)
 - Ground measurements (34 stations – 1 h)
- **Digital terrain model with available surfaces** (IGN 25cm)
- **Installed PV power**
 - 190.4 MW_{peak} (2018)
 - 23 distinct areas (distribution networks)
- **Simplified PV model**
- **Model calibration with real data** (15min time step)
- **Overall model accuracy** (2018)
 - MBE (bias) = -1,2%
 - RMSE (square error) = 17,1%

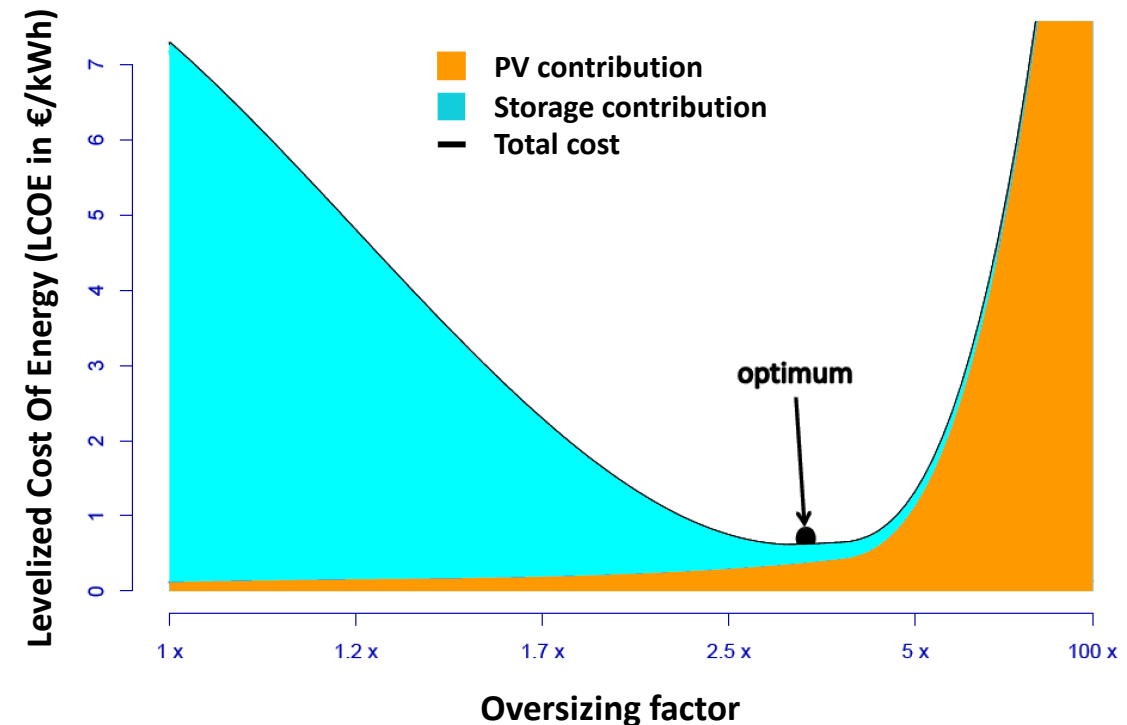


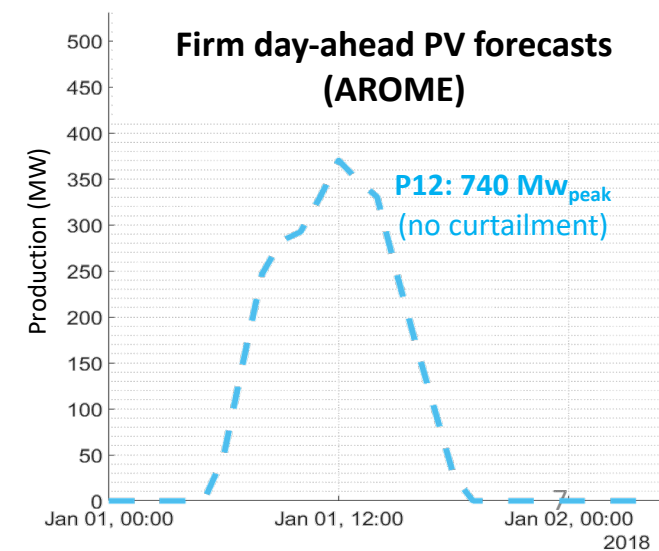
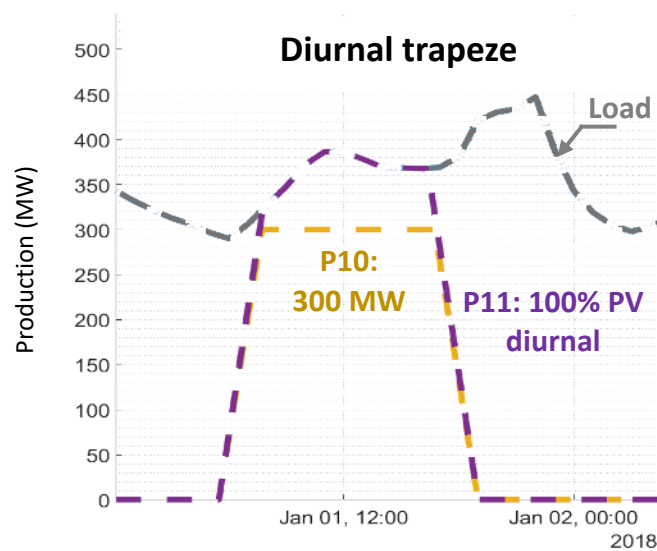
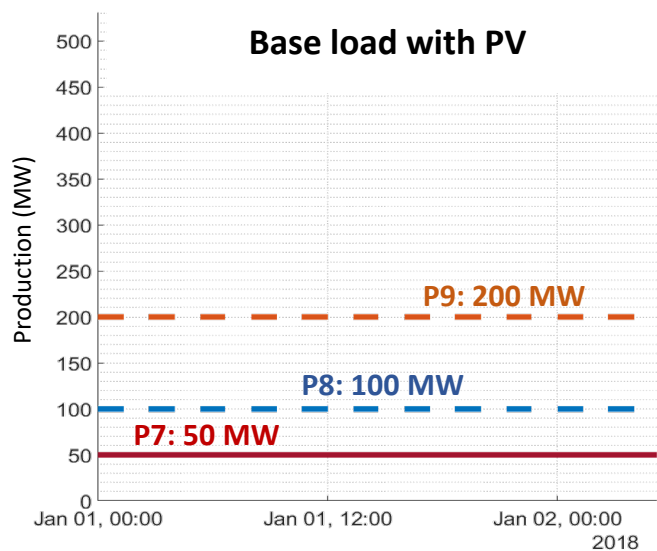
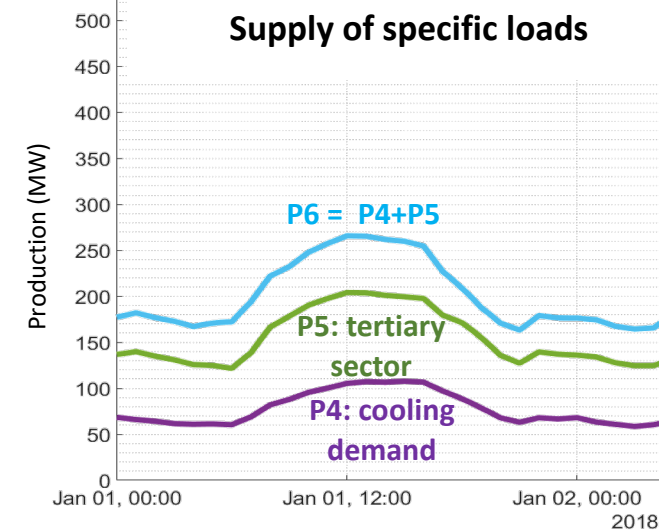
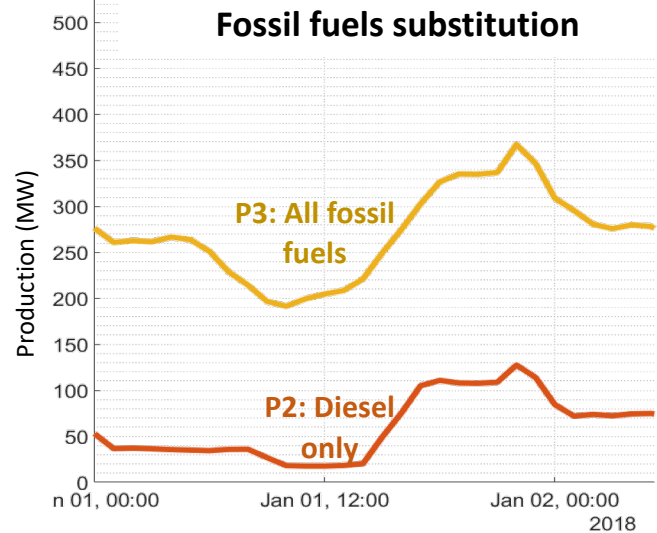
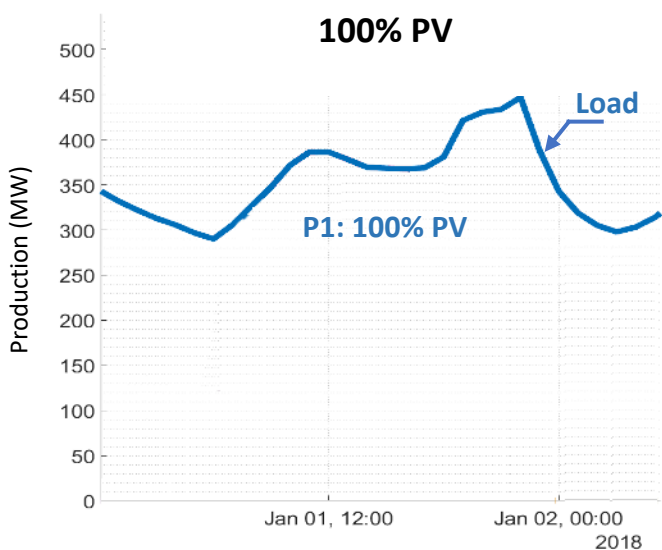
○ Definition of 12 scenarios

- Replace fossil fuels with PV (2 scenarios)
- Base load with PV (3 scenarios)
- Supply of specific loads with PV (3 scenarios)
- Firm day-ahead PV forecasts (1 scenario)
- Diurnal trapeze (2 scenario)
- 100% PV generation (1 scenario)

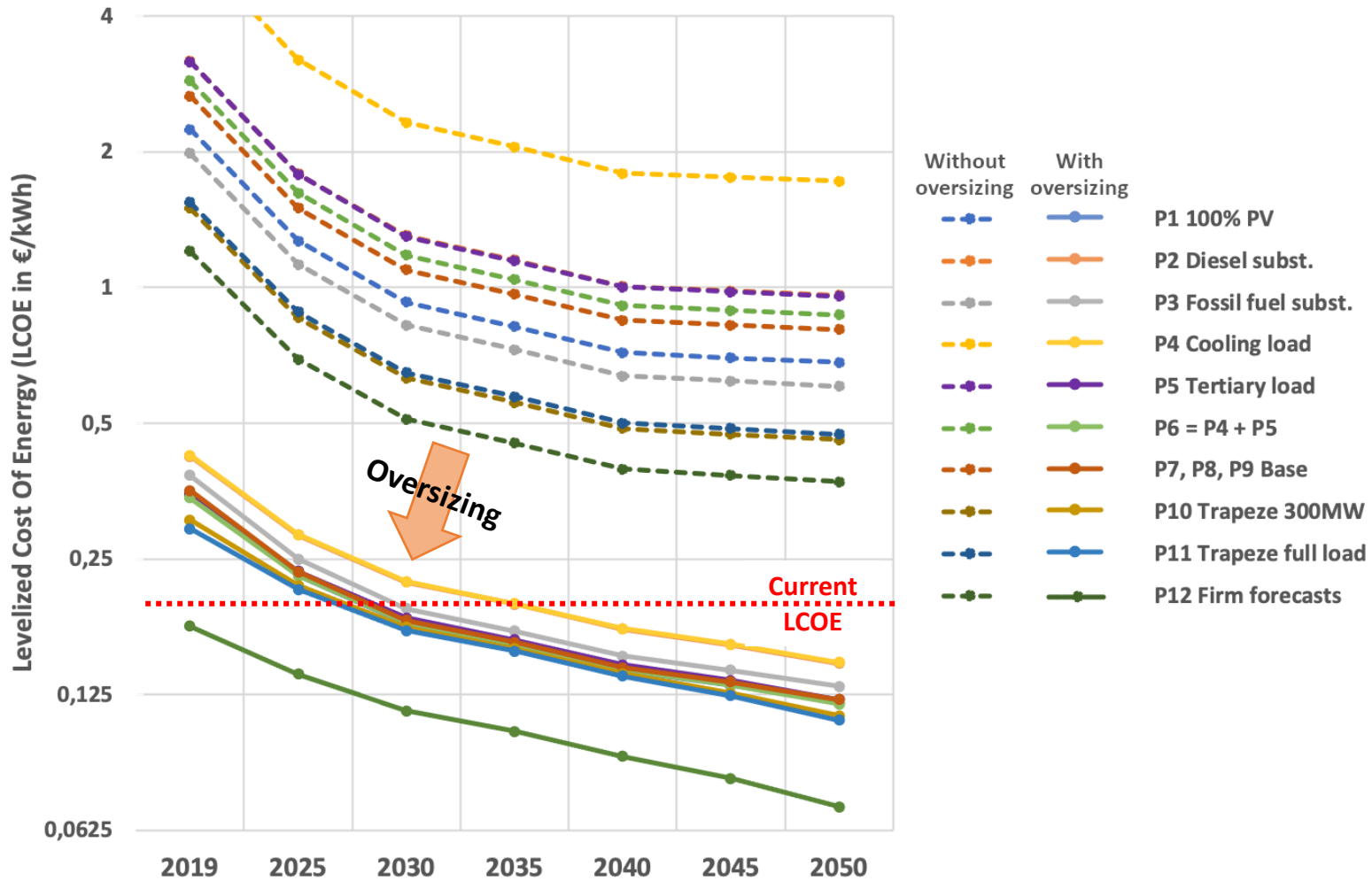
○ Minimize the LCOE for every scenario

- Mark Perez's method
- Optimal combination of storage (Li-ion) and overbuilding PV capacity
- Consideration of PV and storage prices evolution up to 2050



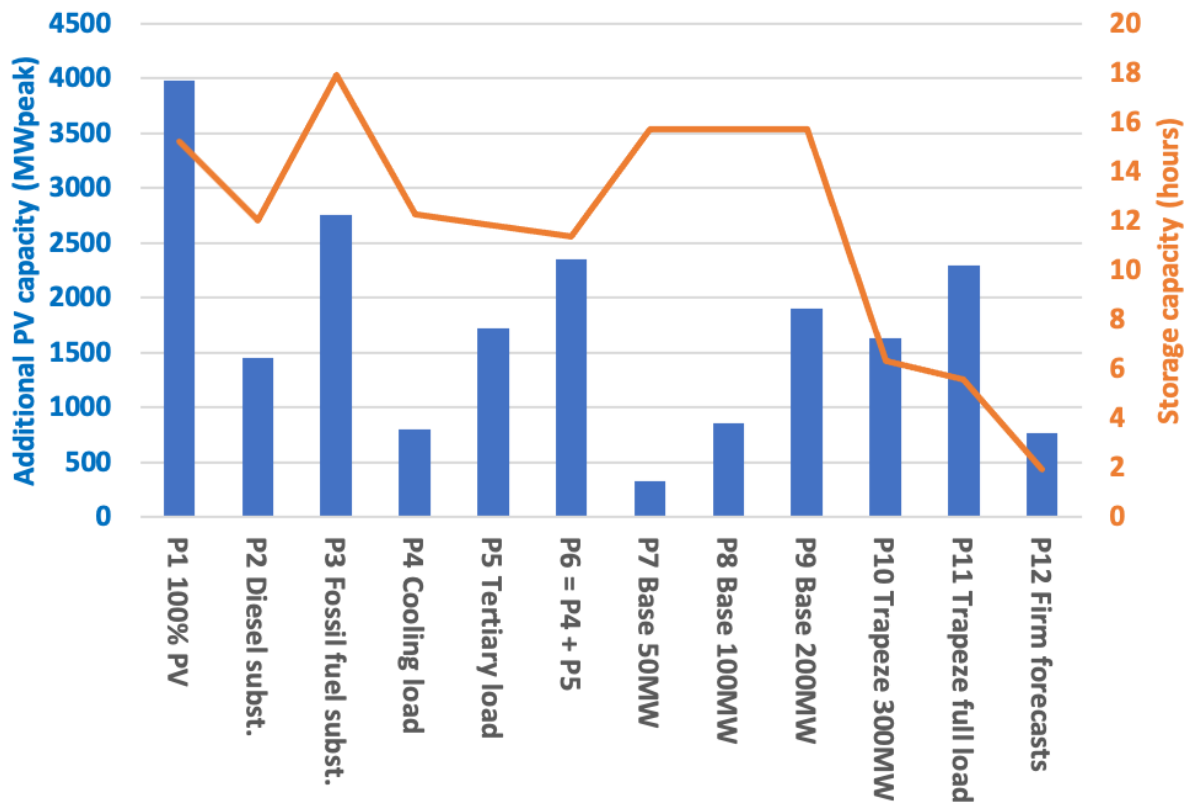


Importance of overbuilding PV capacity



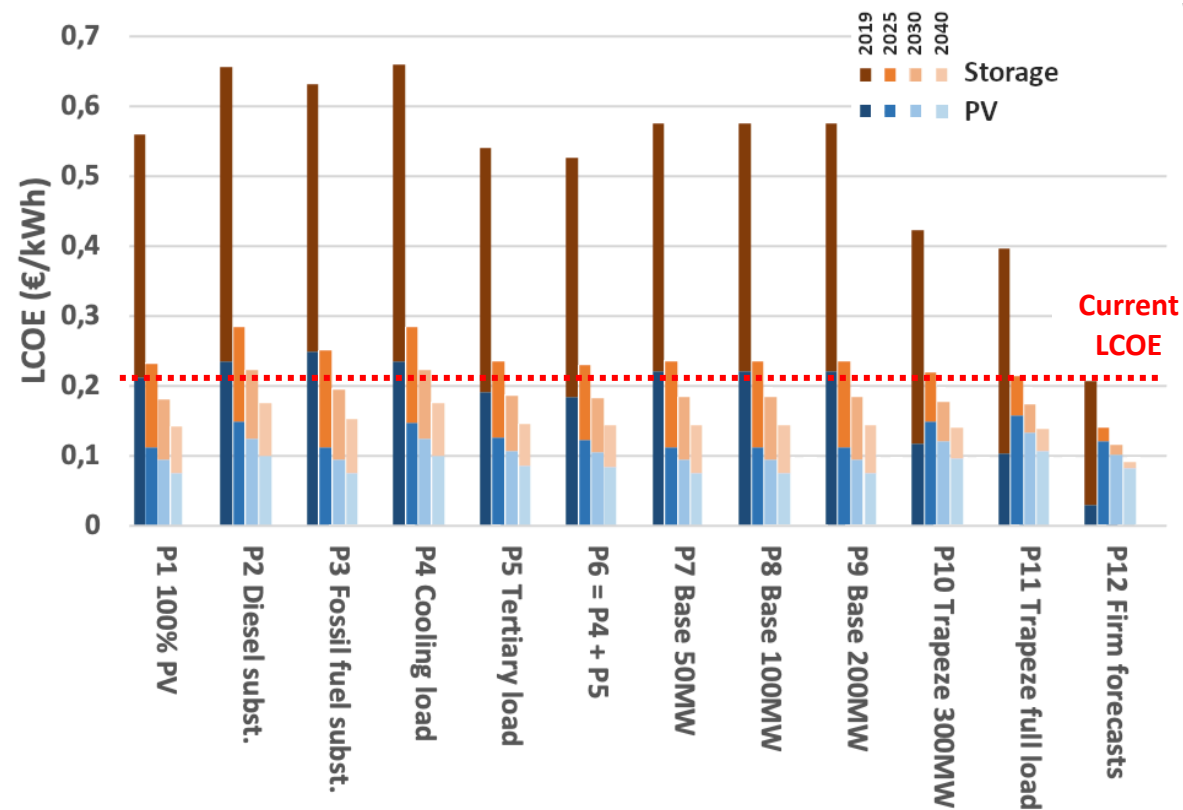
Oversizing the PV capacity is a key feature to achieve affordable energy supply with high PV penetration.

Technical sizing resulting from the LCOE minimization



- Negligible influence of the variation of the CAPEX and OPEX along the years on the technical sizing

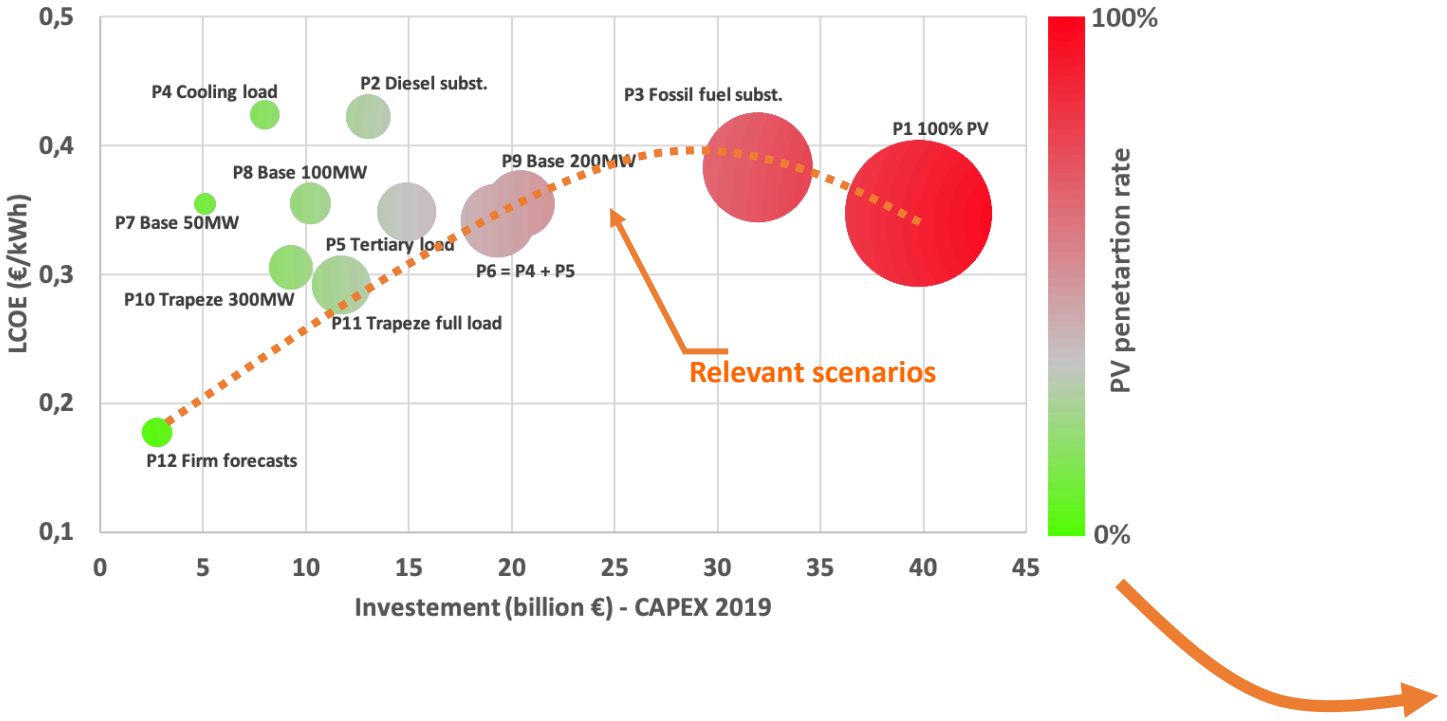
Evolution of the LCOE up to 2050



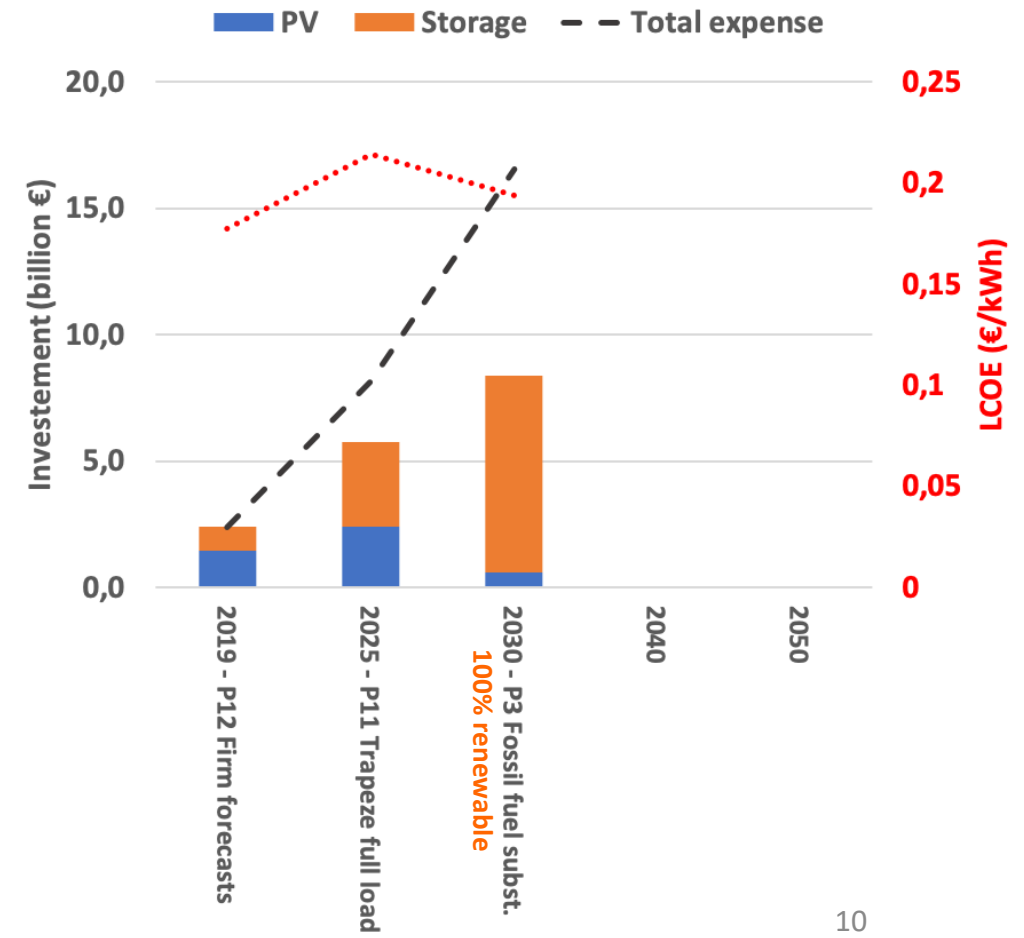
- Compared to the current situation, high PV penetration should decrease the LCOE

A path toward high PV penetration

Selection of the most relevant scenarios

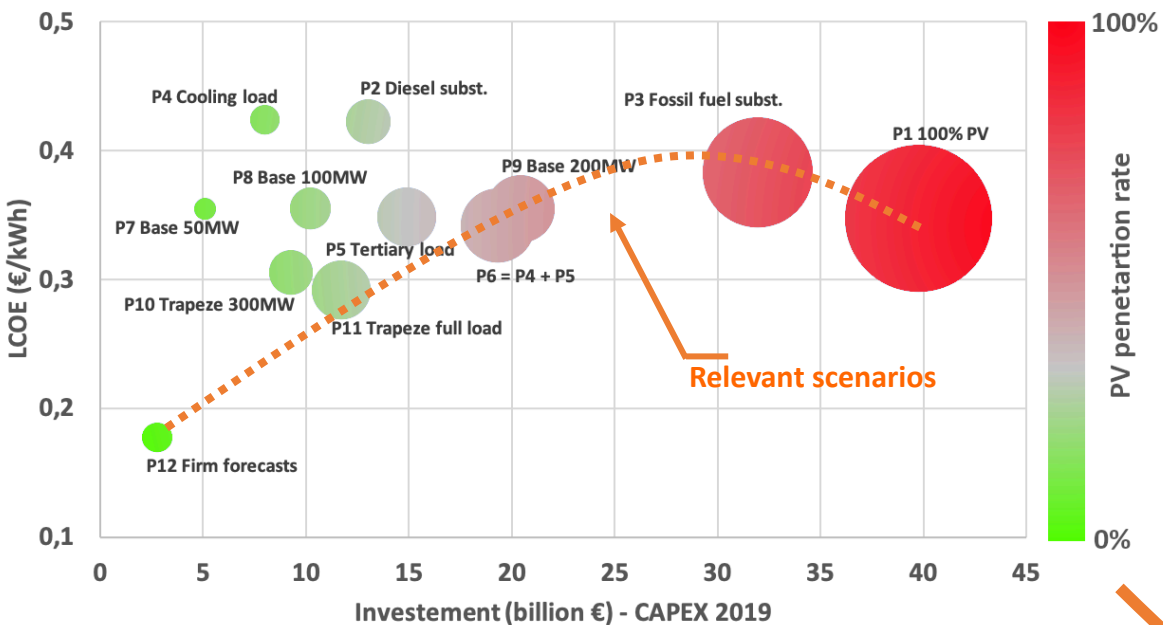


A path toward 100% renewable generation by 2030 (75% PV)

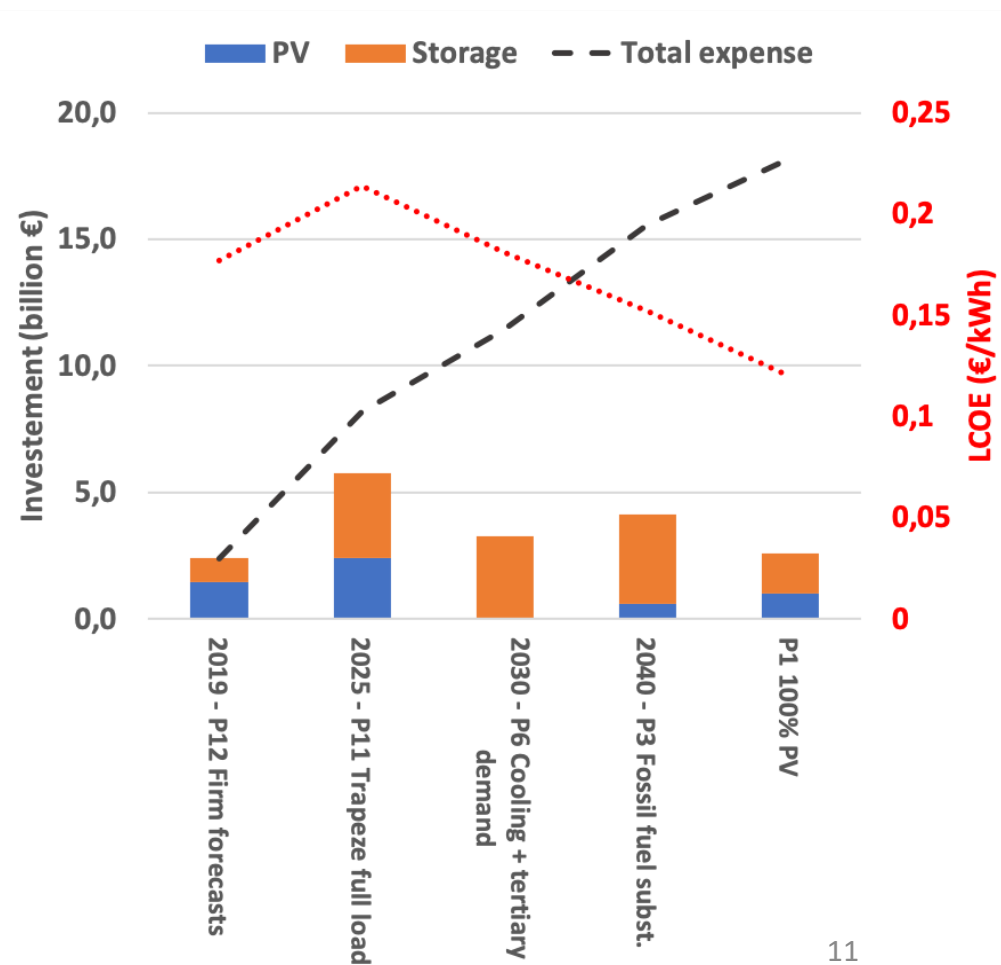


A path toward high PV penetration

Selection of the most relevant scenarios



A path toward 100% PV generation by 2050



Thanks for your attention !

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