

PARIS REINFORCE



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Multi-objective Evaluation of Renewable Technology Subsidy Portfolios Under Covid19 Recovery Packages

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1. Context of study

- EU Recovery Plan

2. Methods

3. Overview of results

- Portfolios €100 billion
- Portfolios €150 billion
- Portfolios €200 billion

4. Main findings – Discussion

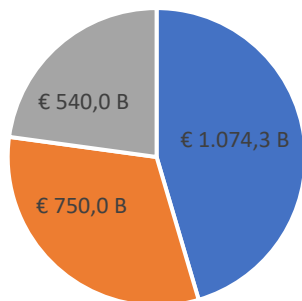
- Interesting dynamics



Context of study - EU Recovery Plan

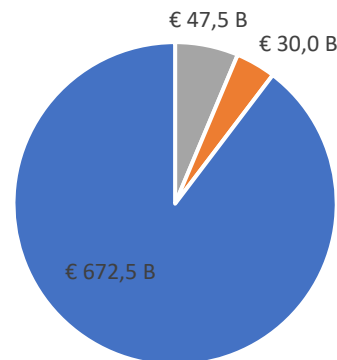
In line with the European Green Deal Targets (30% of all financial plans should focus on green transition)

Recovery Plan



- Multi-Financial Framework 2021-2027
- NextGenerationEU
- Safety Nets for workers, businesses and member states

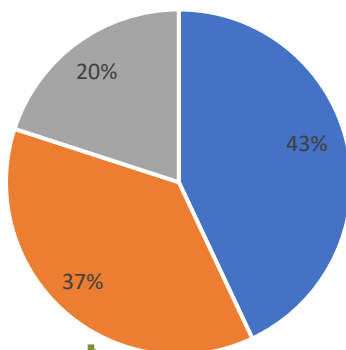
NextGenerationEU



- ReactEU
- Additional Fundd to othe EU Programs
- Recovery and Resilience Facility

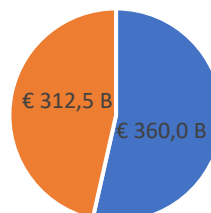
Recovery and Resilience Facility

- National Economic Policy Challenges
- Green Transition
- Digital Transition



Recovery and Resilience Facility

- Loans
- Grants



€250 billion towards green transition

RES
Sustainable Transport
Energy Efficiency

€100-200 billion*

*Depending on National Plans

The PARIS REINFORCE project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 820846.



Input data for the multi-objective optimization

Integrated Assessment model

GCAMPerformance of the 8 technologies to the 2
optimization criteria**8 Technologies:**

- Biofuels
- Solid Biomass
- CSP
- Geothermal
- Photovoltaics (PV)
- Electric Vehicles
- Wind
- Biogas

Multi-objective portfolio optimization

2 optimization criteria

Maximize (a) further emissions cuts, (b) new jobs from the transition, on top of CP scenario

Optimization with AUGMECON – R

- Successful in finding the exact Pareto set of a problem
- Powerful algorithm for solving multi-objective integer programming (MOIP) problems
- Highly reduced computation time

Robustness Analysis

Monte Carlo Simulations

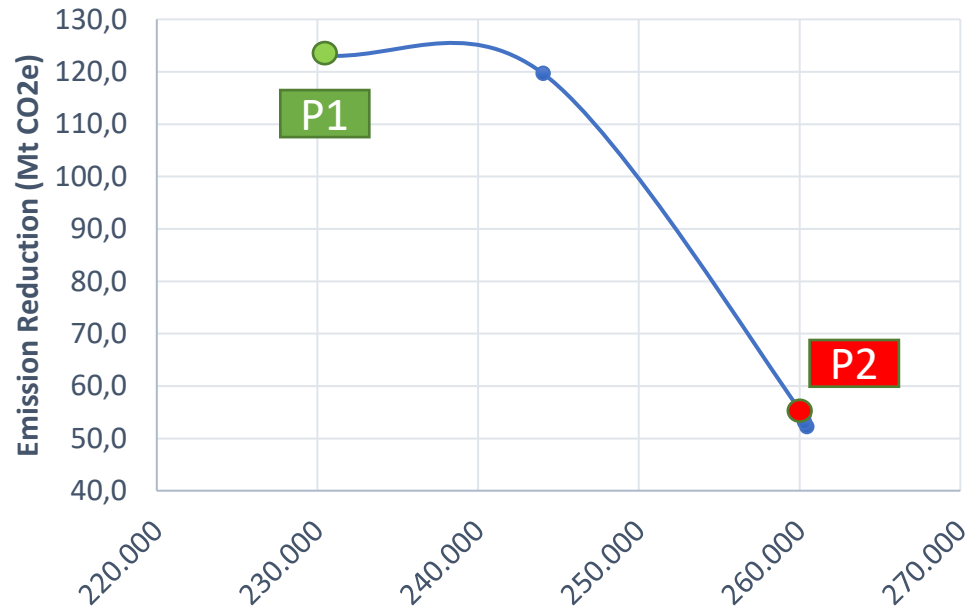


Portfolio Budget	Jobs Created (2025)	Emissions Cuts (2030)	Technologies
€100 billion	230-260 thousand	50-123 Mt CO ₂ equivalent	Combinations of: <ul style="list-style-type: none"> • Wind • Biogas • Biofuels • Geothermal
€150 billion	300-350 thousand	134-160 Mt CO ₂ equivalent	
€200 billion	415-432 thousand	154-233Mt CO ₂ equivalent	



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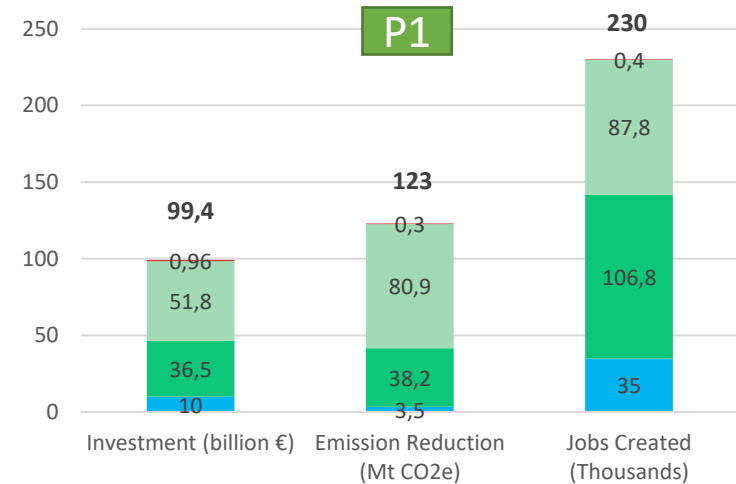
Portfolios €100 billion



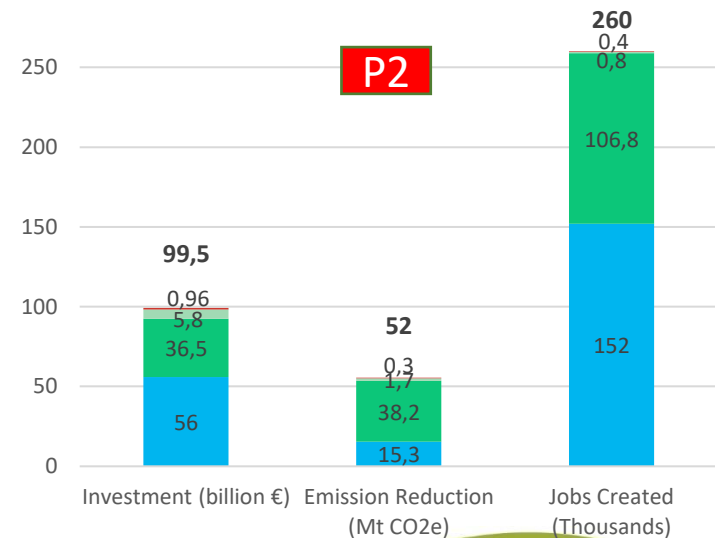
Jobs created



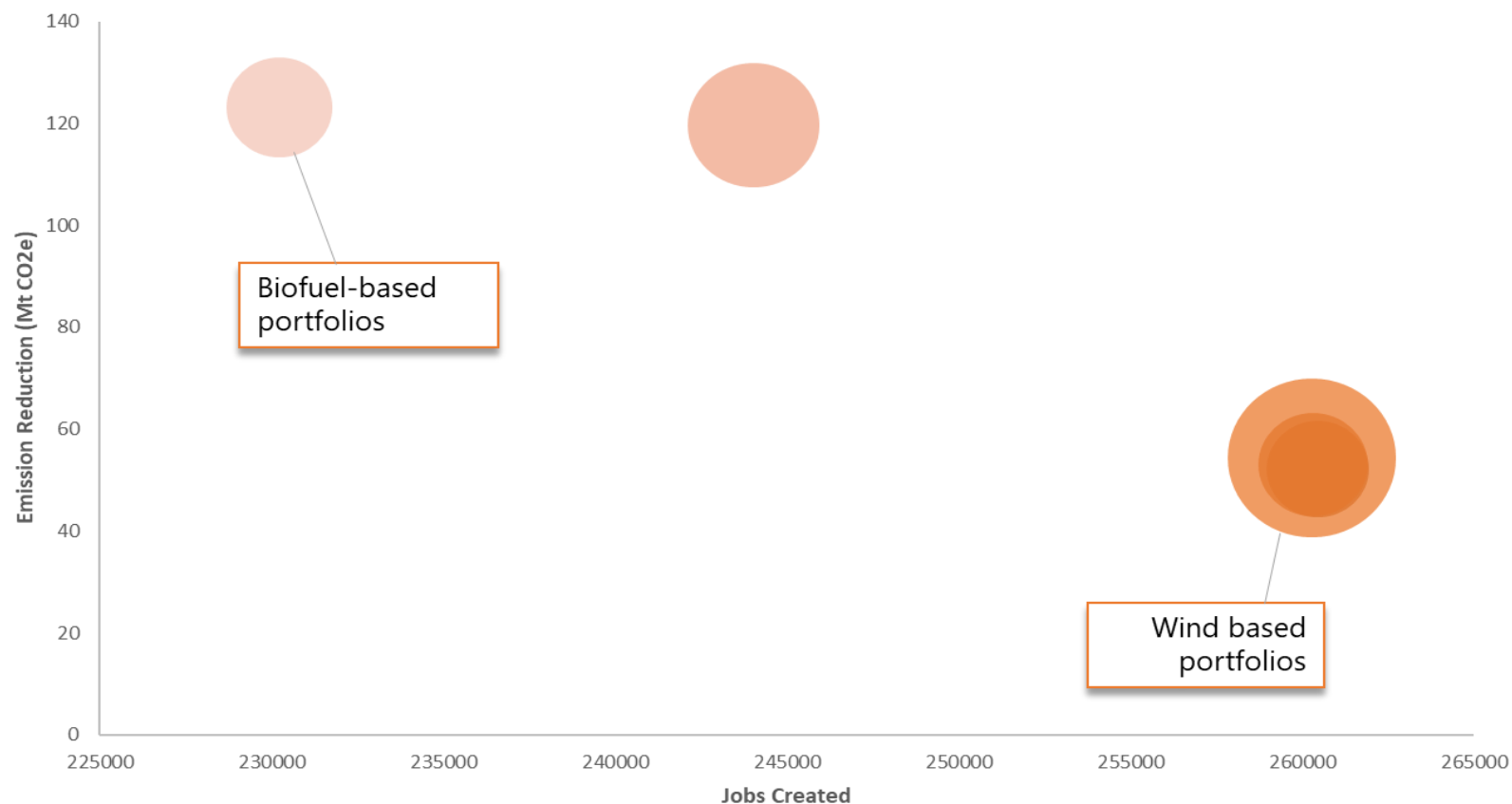
Move from P1 to P2 there is a shift from **biofuel to **wind** investments which increases jobs but limits emission reduction**



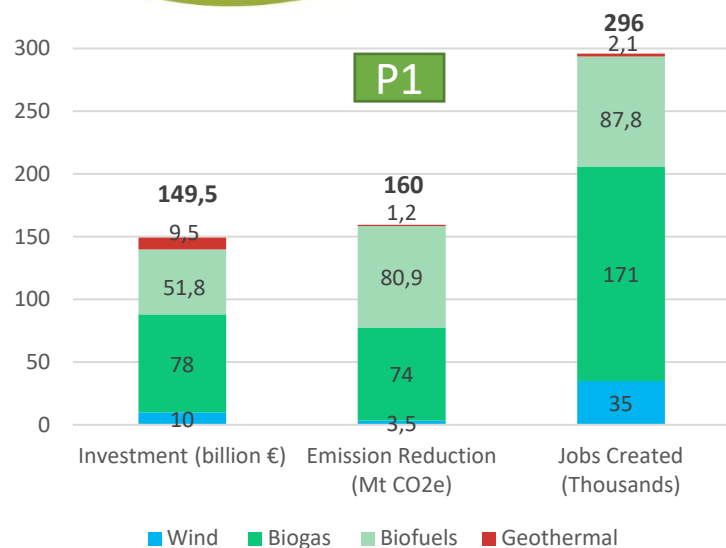
Wind Biogas Biofuels Geothermal



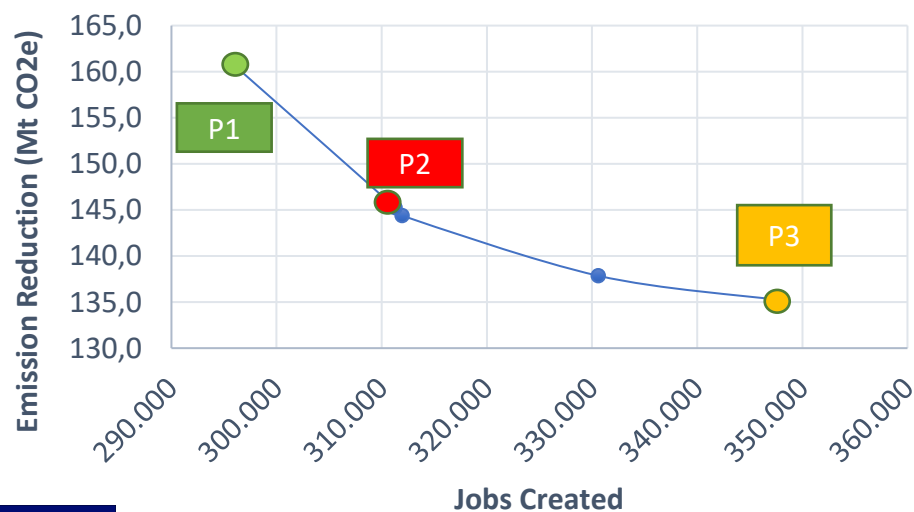
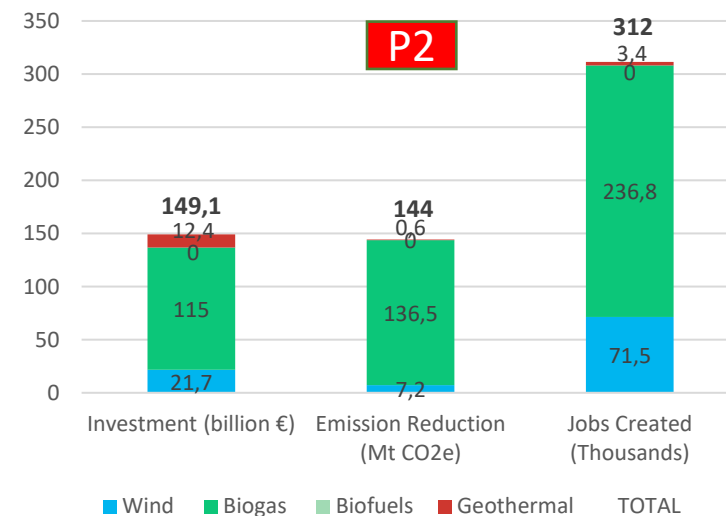
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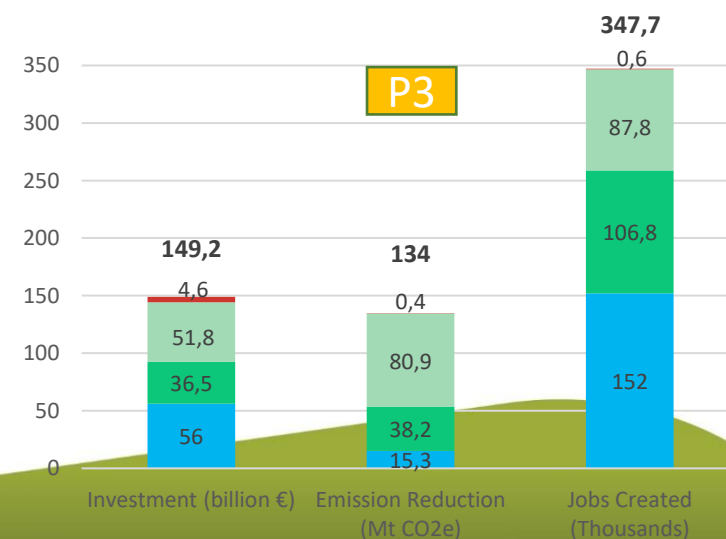
Portfolios €150 billion



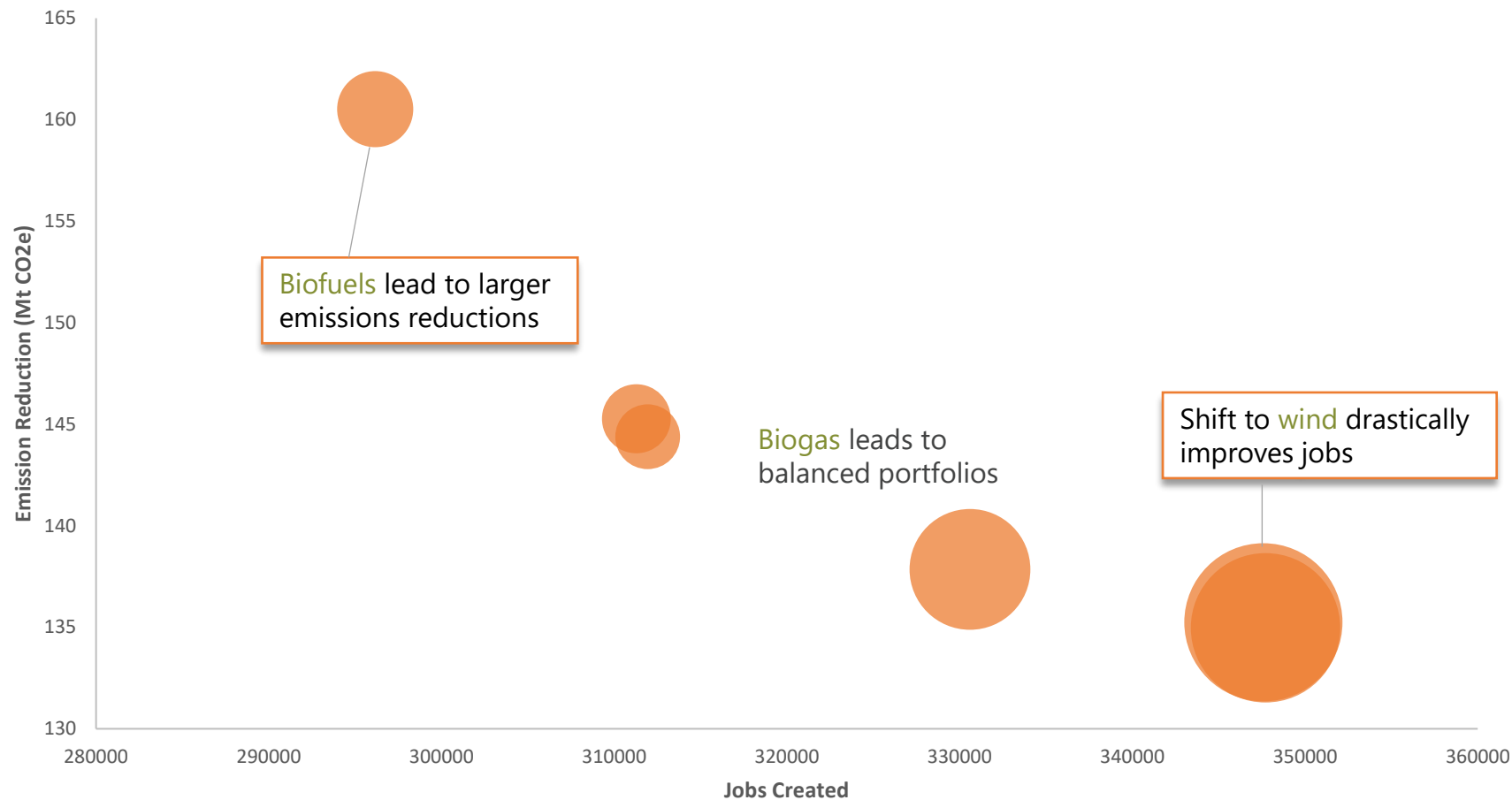
Replacement of
biofuel investment
increases jobs, limits
emission reduction



Shift to wind drastically improves jobs



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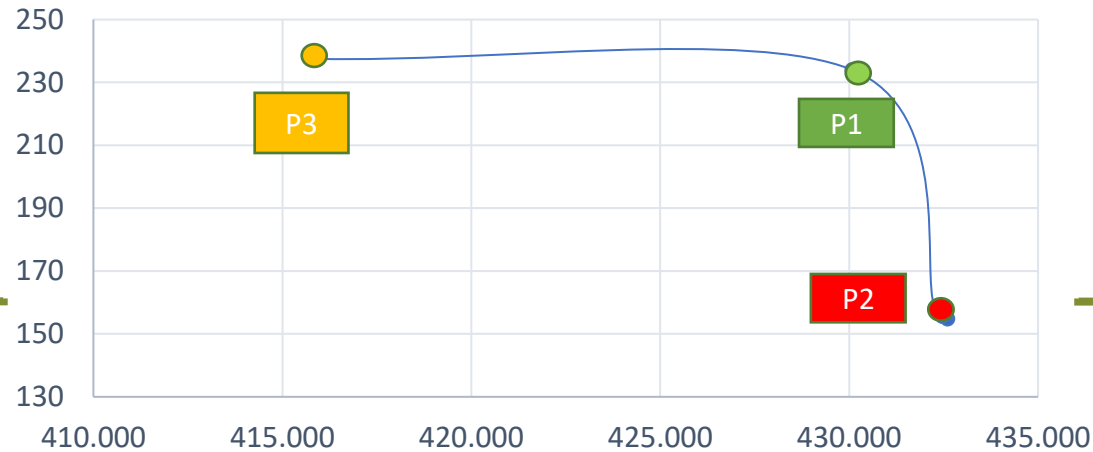


Portfolios €200 billion



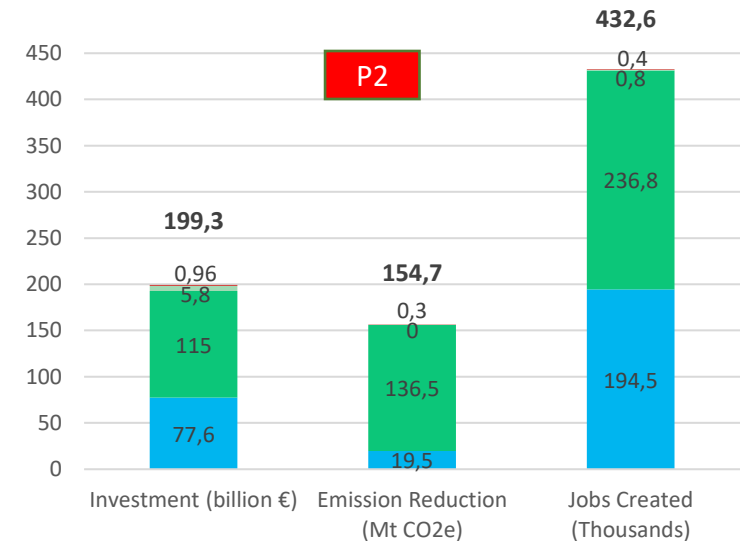
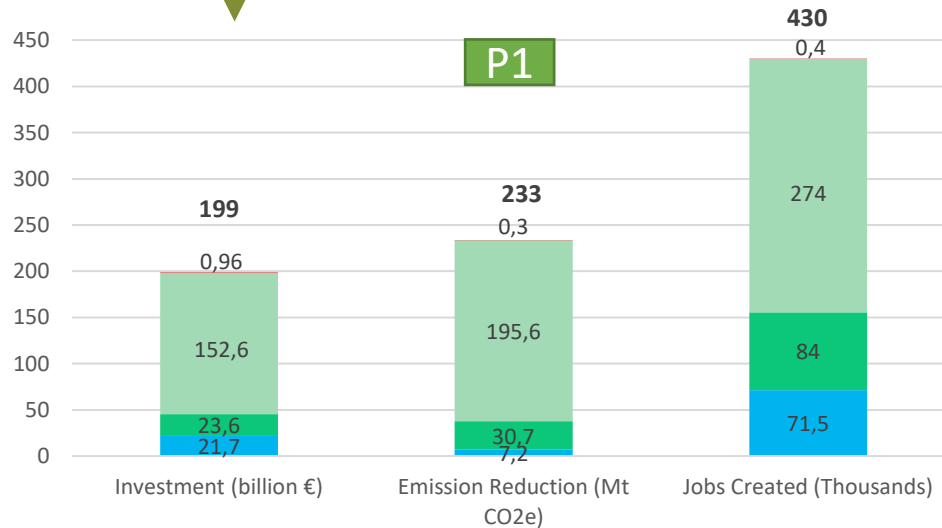
Efficient Portfolio:
Large investments in
biofuels

High emission
reductions and
many new jobs



Alternative:
Smaller biofuel
investment and larger
wind & biogas

Sacrifice in
emission reduction



Wind Biogas Biofuels Geothermal

Wind Biogas Biofuels Geothermal

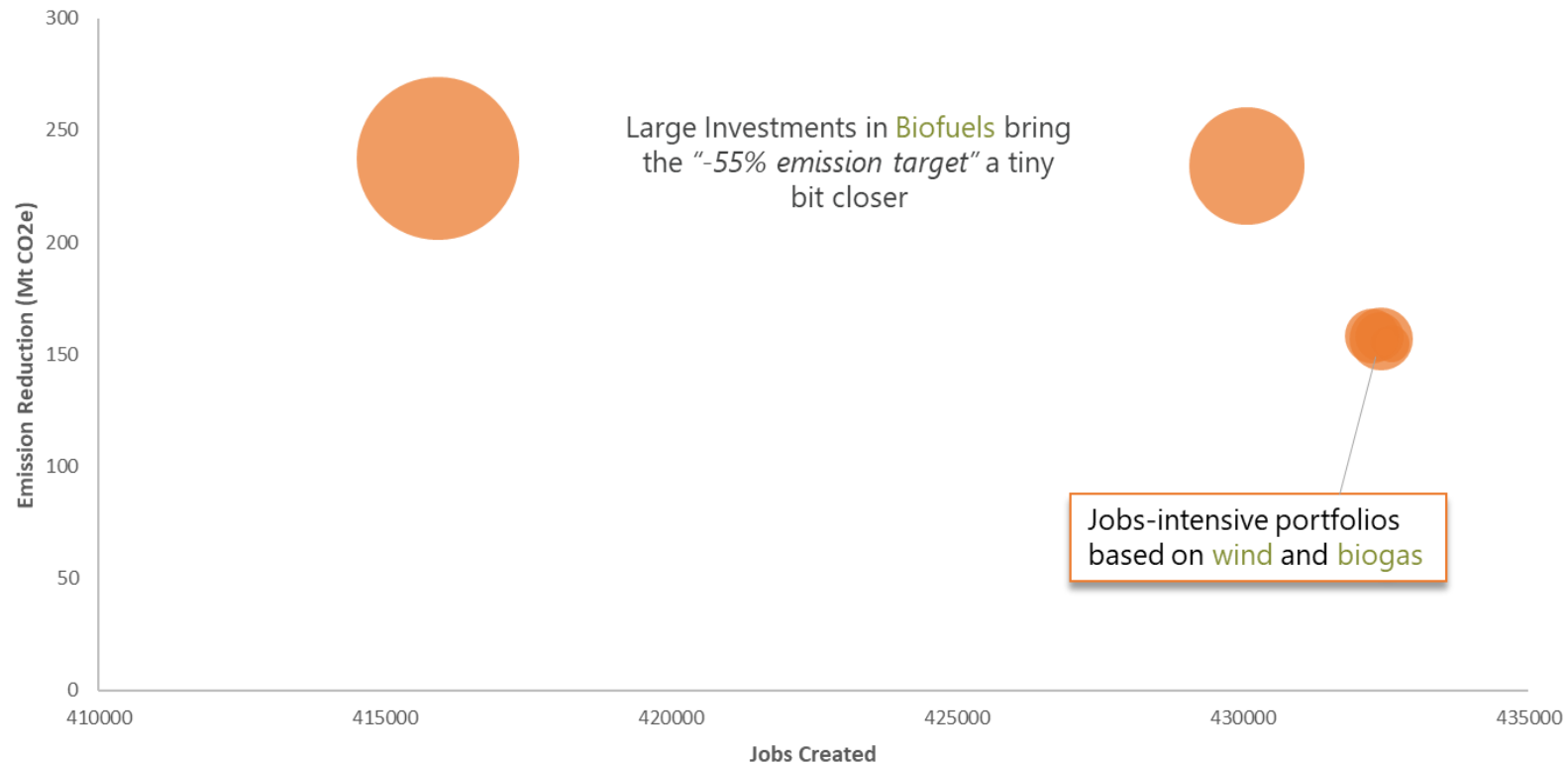
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P3

Small shift in investments from wind to biogas compared to P1 causing reduction of jobs created



Robustness Analysis (€200 b.)



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- Recovery plan potential to **support employment** in green transition
 - 230k – 432k new jobs (2025) in energy sector
- Support package could also bring EU a bit closer to new 2030 climate target, cheap
 - Up to 233 Mt CO_{2e} cumulative emissions cuts (2030)
 - ~0.2-1% cut on top of Current Policies (cumulative CO₂), depending
 - BUT: gaining on investments: **pushing down costs** of existing EU climate policies
- Overall optimal (against both criteria):
 - **Biogas, biofuels, wind**
 - Uncertainty shocks play out differently depending on budget
- CP already good job in cutting emissions in power (ETS, decreasing capital costs), much less in transport/buildings, in which subsidies turn out more cost-effective



- Emphasis on emissions (biofuels): significant **LUC** emissions outside EU?
- **Small geothermal** investments complementary
- Solar:
 - already **high penetration of solar in CP** electricity mix
 - additional subsidies increase emissions (gas for balancing grid load)
- EVs: expensive emissions cuts, negligible job impact
- Same subsidies (EU), different dynamics globally:
 - wind/solar improve
 - contrary to biofuels/biogas





Thank you!

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