

Decarbonising the Emirates: A System-Optimised Roadmap for Net-Zero by 2050

Roghayeh Yousef^{1,2} and Niall Mac Dowell^{1,2}

¹ Centre for Environmental Policy, Imperial College London

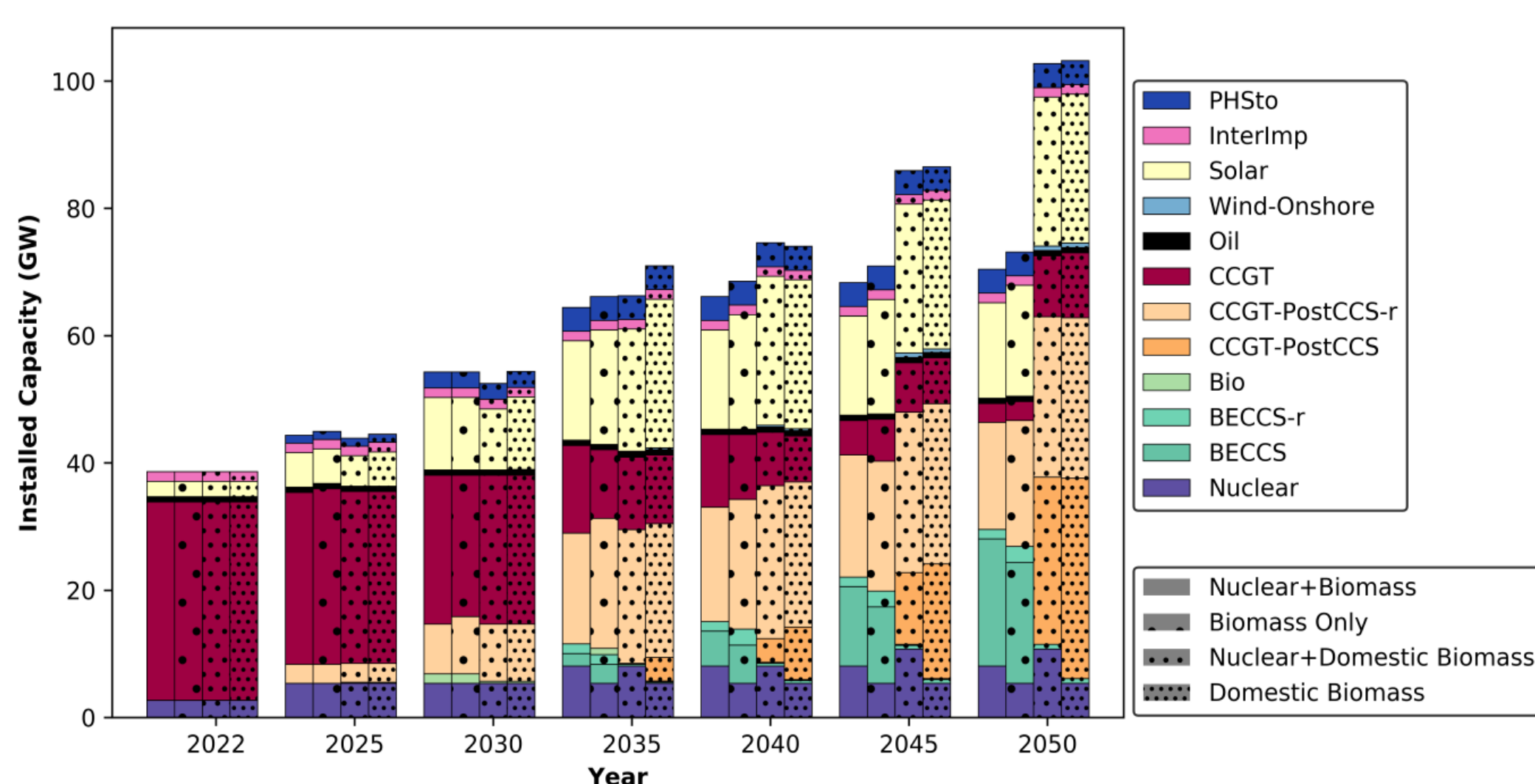
² Sargent Centre for Process Systems Engineering, Imperial College London

UAE can reach net-zero while sustaining exports—but it requires early CCS, hydrogen-enabled industry and large-scale DAC when biomass is limited.

- **Power:** CCGT-CCS enters 2025; solar grows 10× by 2050.
- **Industry:** Refineries require CCS post 2035; aluminium, H₂ & NH₃ by 2030.
- **Transport:** Full road electrification by 2040 is the least-cost
- **DAC:** Biomass scarcity drives 84 Mt DAC in 2050.

POWER SYSTEM: Nuclear + Solar + CCGT-CCS define the lowest-cost path

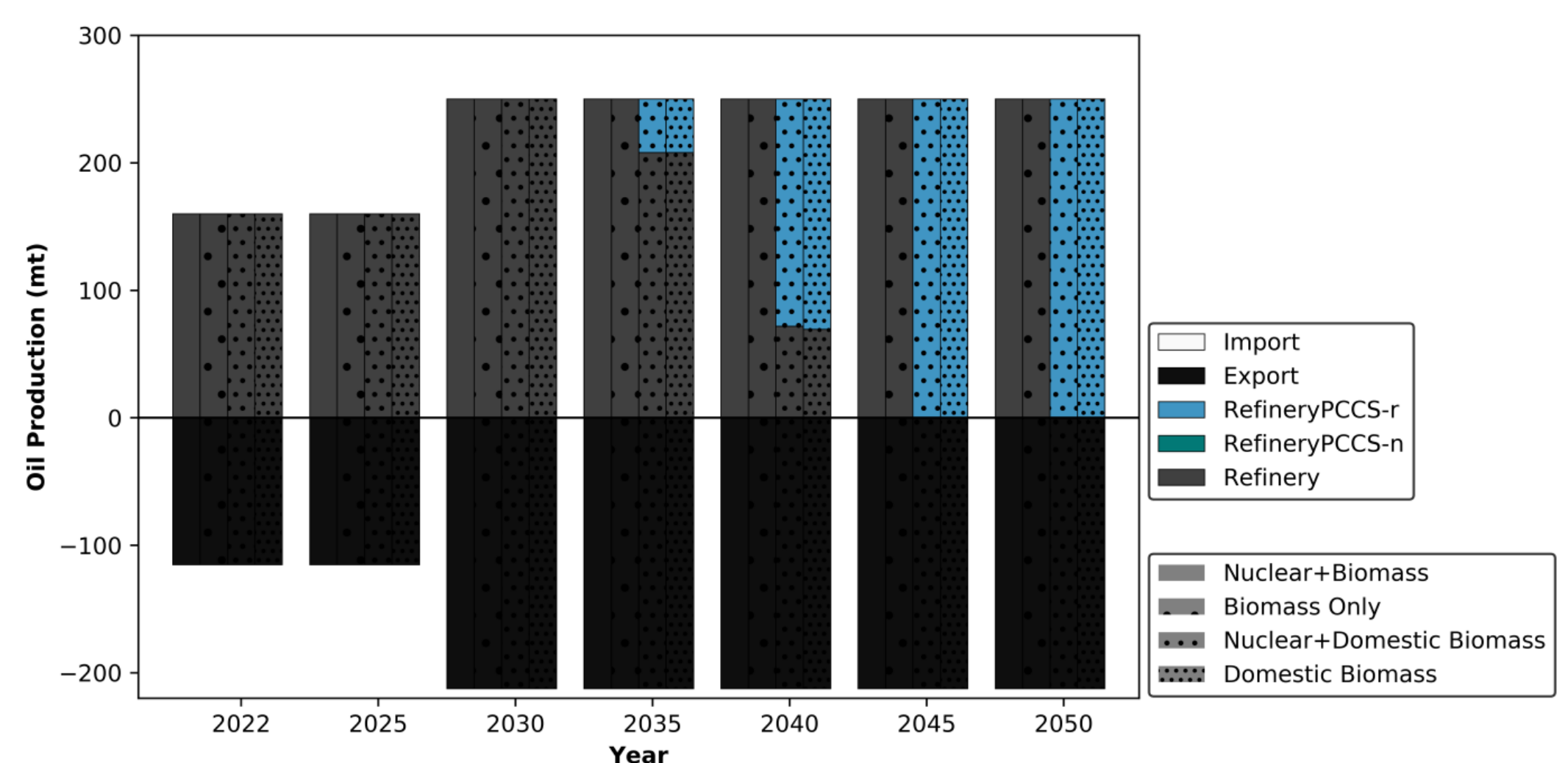
Optimization results show firm low-carbon power (nuclear + CCS) is essential to stabilise the system while scaling solar 4–10×.



EXPORT-CRITICAL SECTORS: CCS timing + H₂ blending are decisive.

- All oil refining must be abated by 2045 under domestic biomass.
- LNG consistently shifts to E-LNG + LNG-CCS by 2050 across all scenarios.
- Steel transitions to DRI-CCS with 30% H₂ blend, where cement requires CCS by 2035

- H₂ & NH₃ retrofits required by 2030 → aligns with initiated blue NH₃ exports.



CARBON REMOVAL: Biomass scarcity pushes system toward DAC

- Decarbonisation adds £115 bn over BAU; 1.3% of national GVA annually.
- BECCS only competitive if biomass < £70/MWh_{th} and reliably imported.

