

ADVANCES IN >> HYDROTHERMAL CONVERSION OF INDUSTRIAL BIOGENIC RESIDUES INTO INTERMEDIATE BIOENERGY CARRIERS

RESULTS FROM THE **F-CUBED PROJECT**



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 884226.



FUTURE DIRECTIONS FOR
F-CUBED & TORWASH IN
INDUSTRY





F-CUBED Process



Paper sludge



Olive pomace



Orange peels



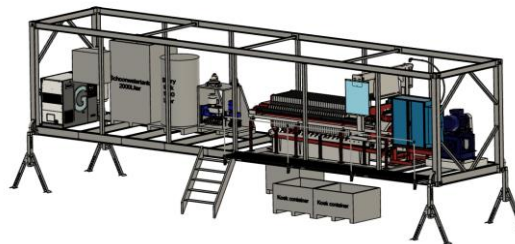
TORWASH®



Effluent



Mechanical Dewatering



Liquid fraction



Solid cakes



Anaerobic digestion to produce biogas

Nutrient Recovery

Solid fuel for boiler





On-site testing at Industrial locations



- ✓ Pilot-scale, continuous
- ✓ 30 kg/hr Torwash
- ✓ Filter press dewatering
- ✓ Pelletization of solids
- ✓ Digestion testing of liquids





F-CUBED Process Effects

Wet biogenic feedstock
(2% - 6% d.s.)



TORWASH® effluent



Filter cake
(38% - 58% d.s.)



TORWASH® Filtrate



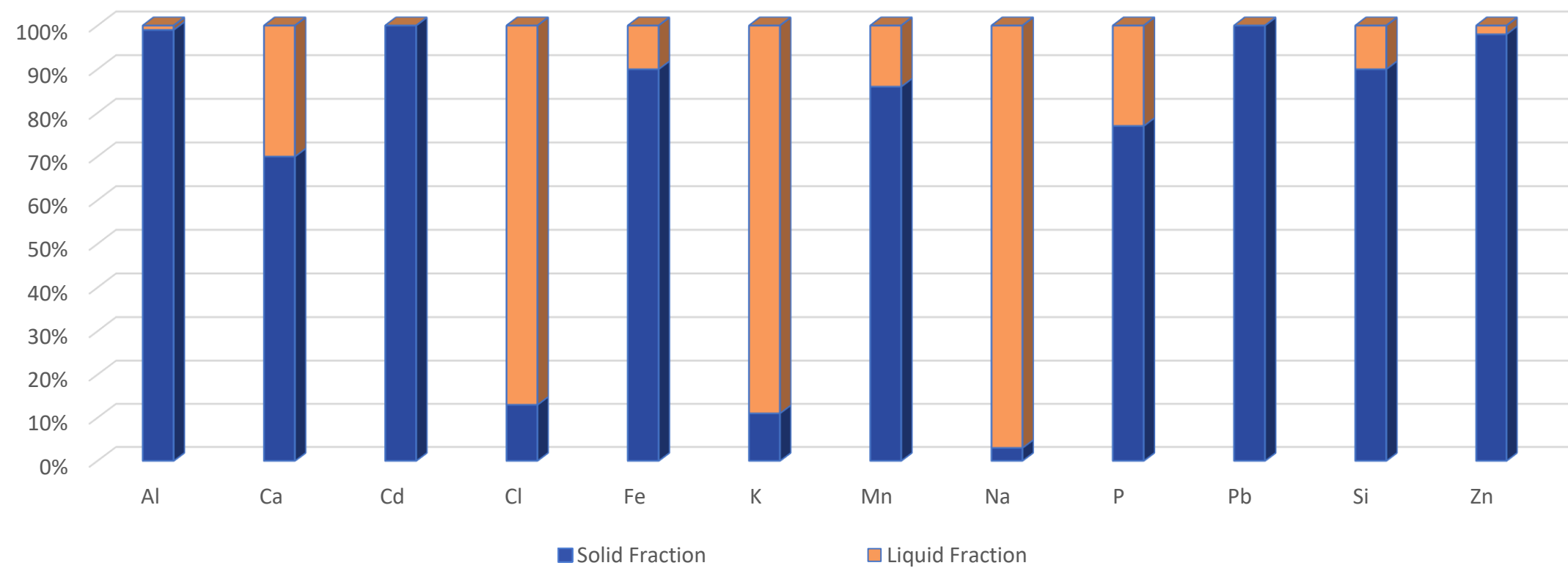


F-CUBED Process

Residue Stream	Volume Reduction with F-CUBED (%)	Moisture Reduction with F-CUBED (%)
Paper Sludge	98.7	99.2
Olive Pomace	83.0	90.9
Orange Peels	85.6	89.7



Partitioning of Elements





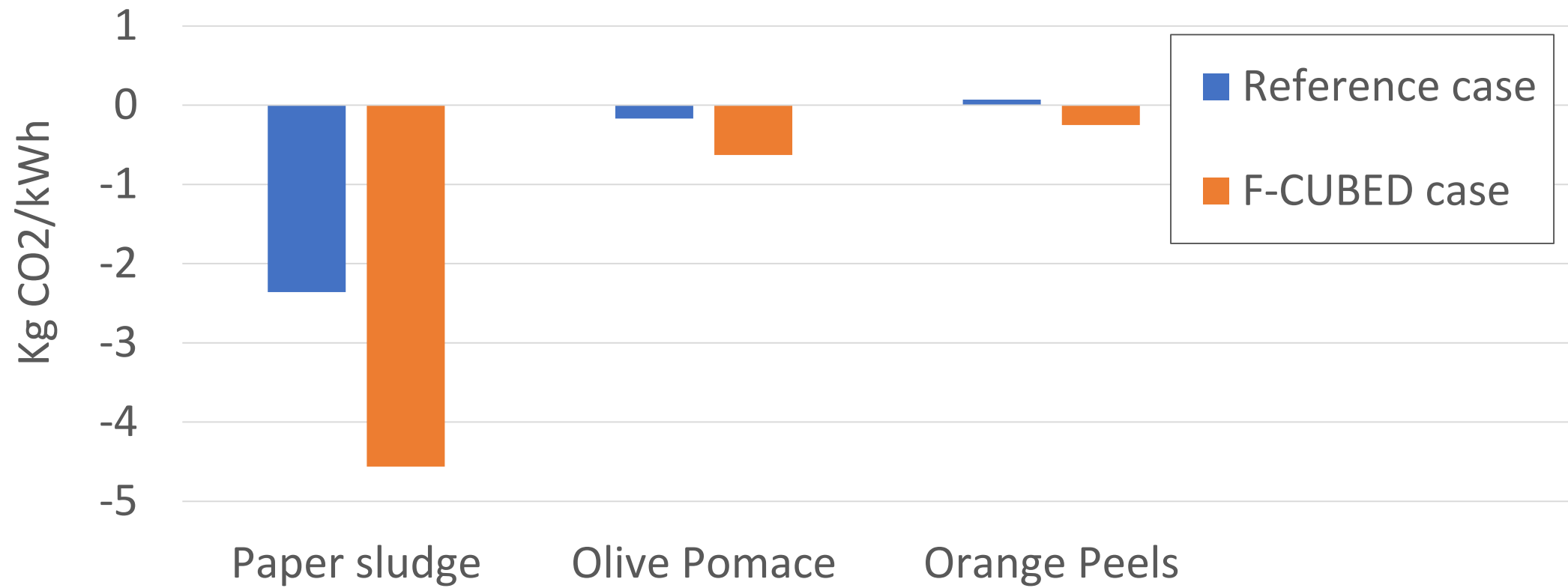
Energy

- All solids could be pelletized
- Pellets close to quality standards for non-premium biomass pellets, especially olive pomace and orange peel pellets
- Pellets suitable for syngas production; obtained char also valuable
- Liquid fraction suitable for nutrient recovery (struvite precipitation) and biogas production
- F-CUBED process more efficient than reference processes





Environmental Impacts





Economic and Value Chain Considerations

- Best business case is for paper sludge feedstock
- Considering the total value chain, use of hubs for downstream processes is economically advantageous
- Increasing operational hours for seasonal feedstocks (multiple feedstocks/process flexibility) is advantageous
- Custom cases for target industries/residue streams can improve efficiency
- Potential value associated with GHG savings (carbon credits)

Torwash

What's Next?

- Demonstration plant (at WWTP, 500 kg/h)
- Improving flexibility of the process
- Expanding feedstocks and process conditions
- Torwash as pre-treatment for downstream processes
- Further investigation – nutrient recovery, use of hydrochar in steelmaking

- We are always open to collaboration !



THANK YOU

www.f-cubed.eu



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