Techno-economic analysis

Eco-Feed
Tomato side streams

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Presentation overview

Practical question:

How to come to a promising business?

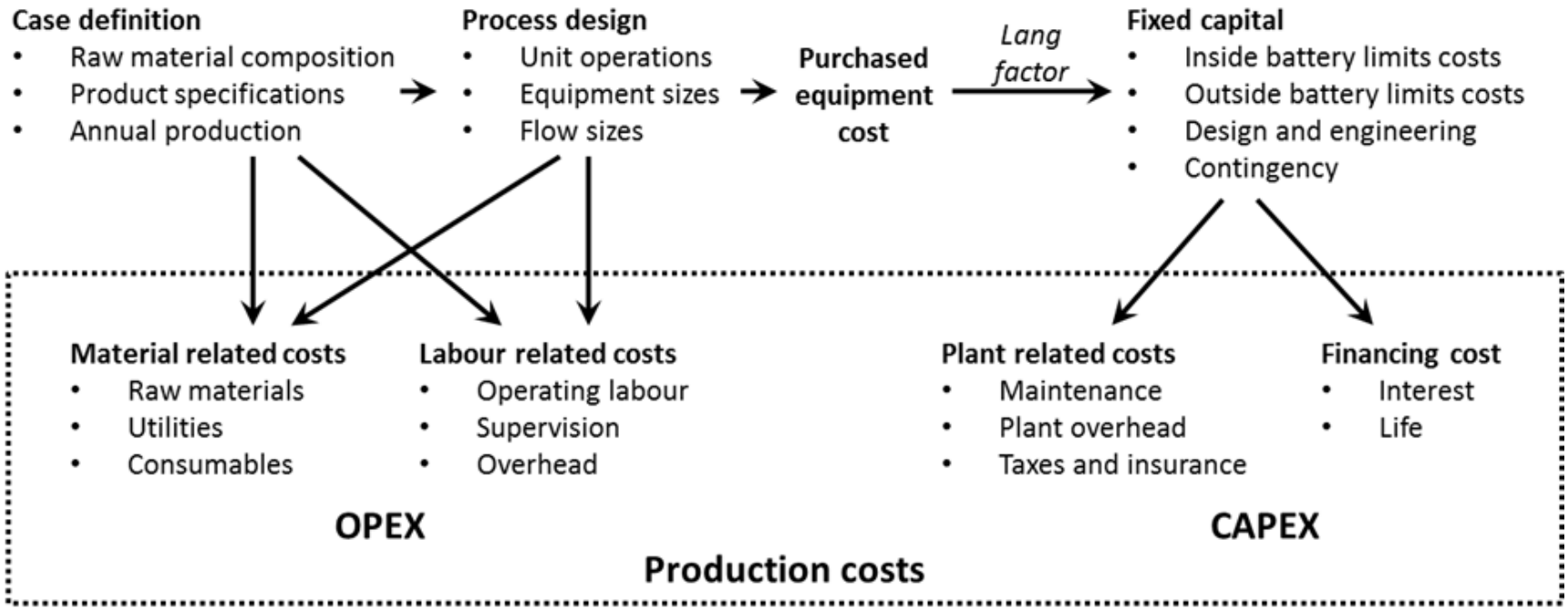
Cases:

1. Low-tech for low value: mixed food waste to animal feed
2. Medium-tech for moderate value: tomato paste
3. High-tech for high value: tomato extracts

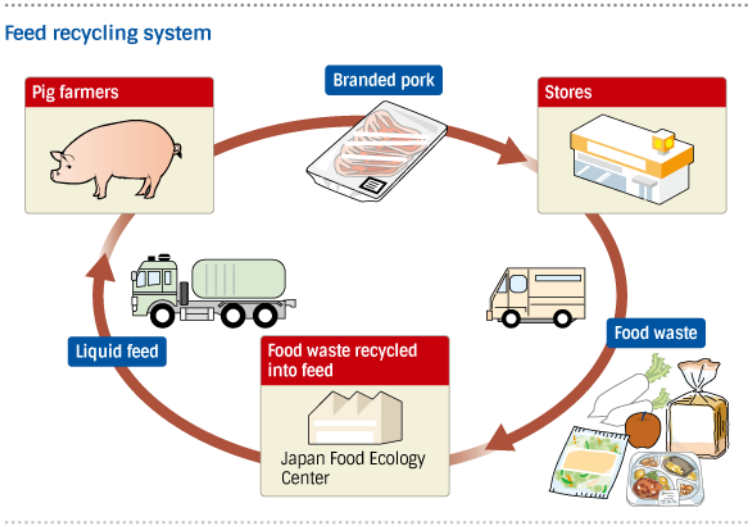
Techno-economic analysis

- Specify the intended processing chain: unit operations
- Choose appropriate equipment types
- Choose appropriate dimensioning for intended practical scale
- Derive cost estimates for equipment
- Correct for annual price variations
- Estimate other capital costs
- Estimate variable costs (labour, energy, etc.)
- Estimate scale size dependencies

Techno-economic evaluation

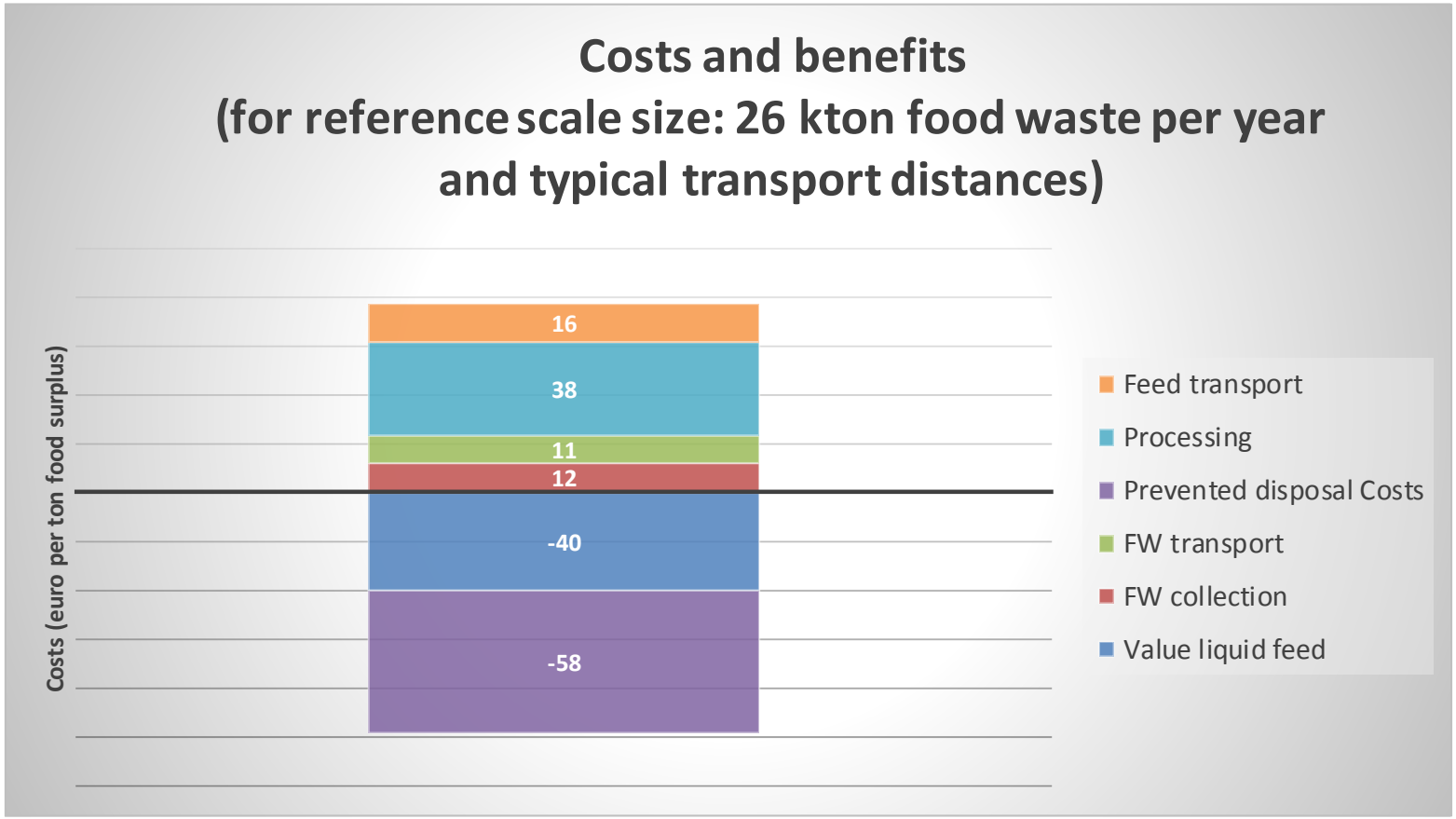


“Eco-Feed”

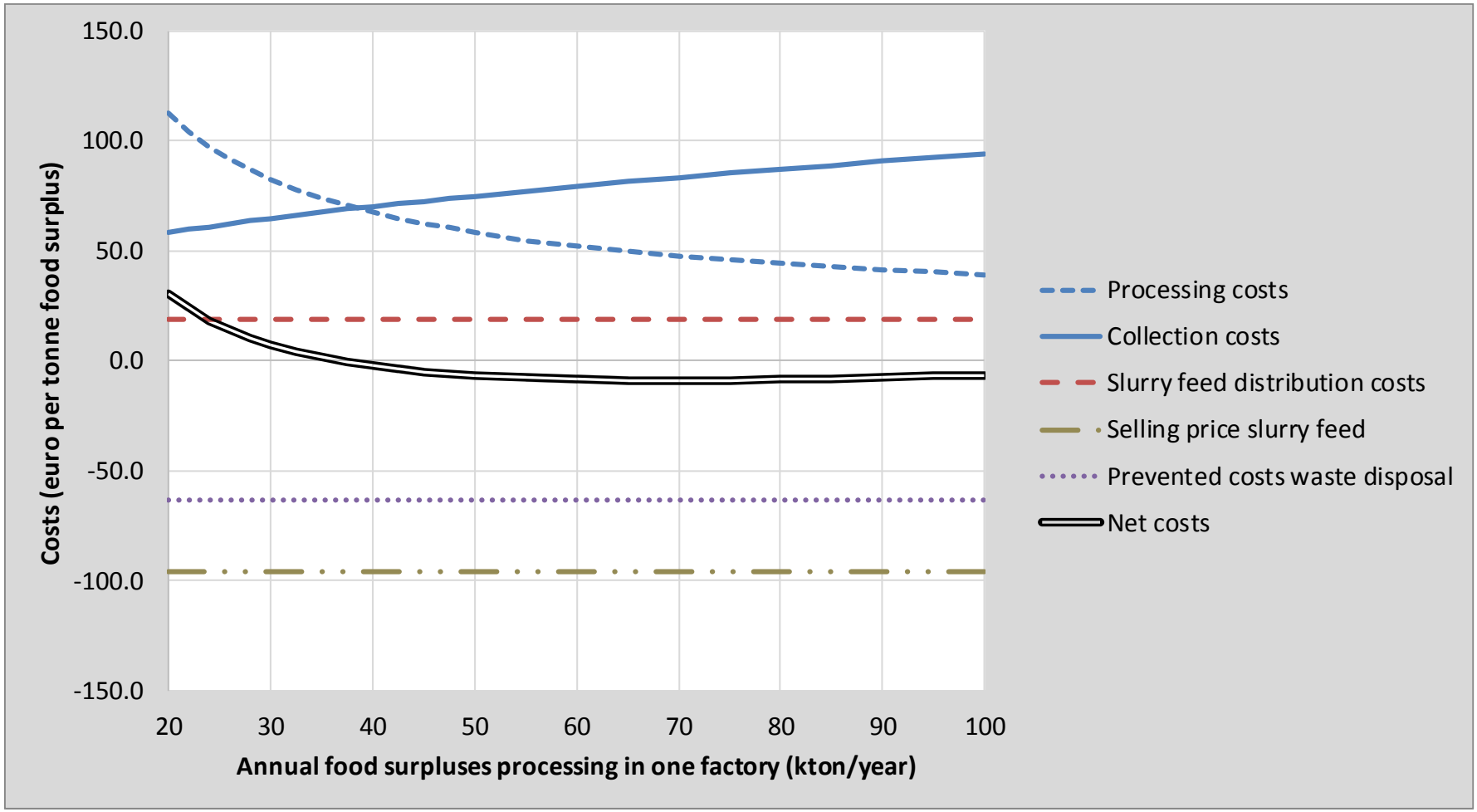


- Feed-grade former food waste handling
- Refrigerated collection transport
- Processing:
  - hygienic processing
  - milling/homogenisation
- Safe storage
- Distribution transport

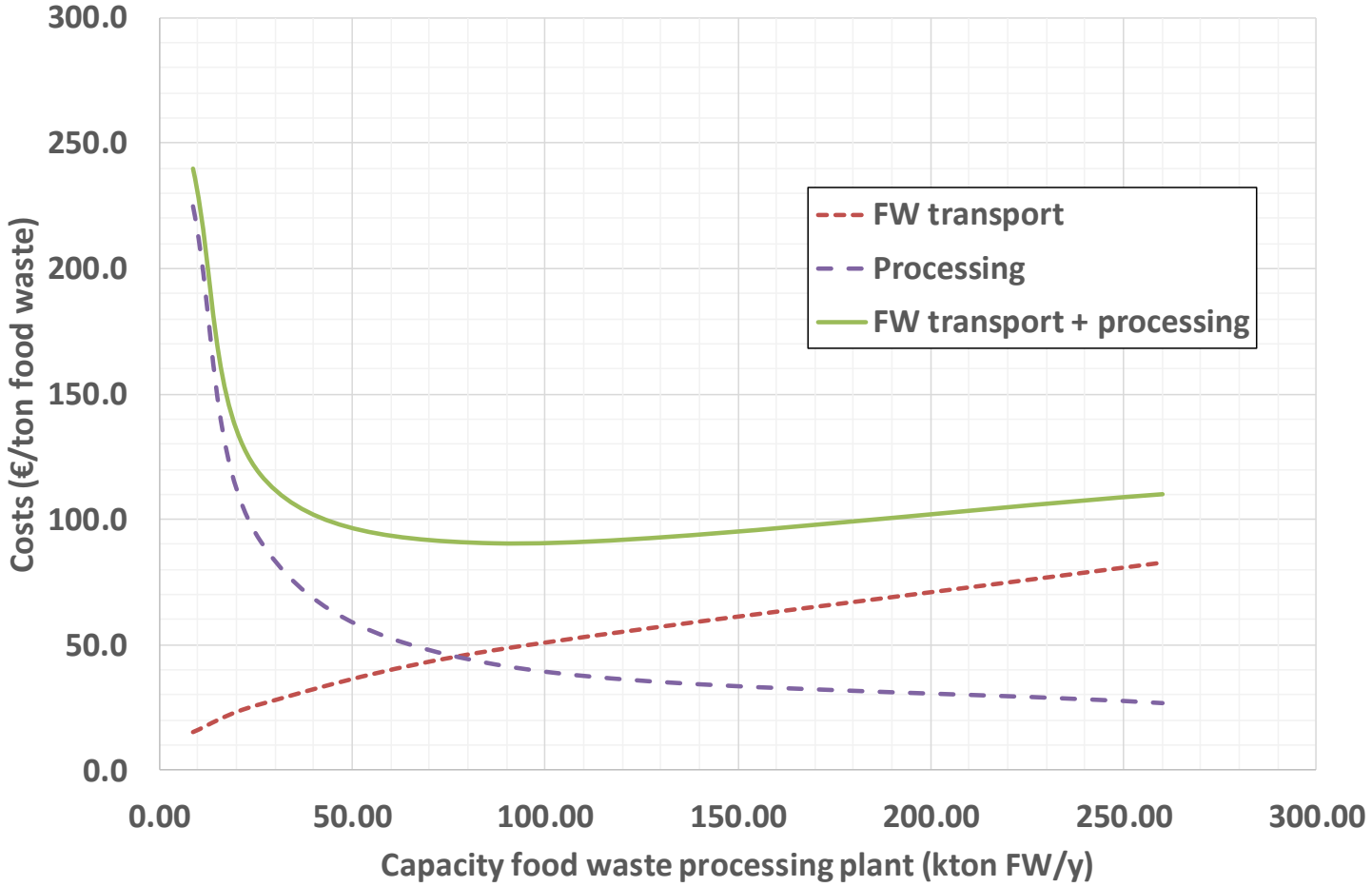
Typical result



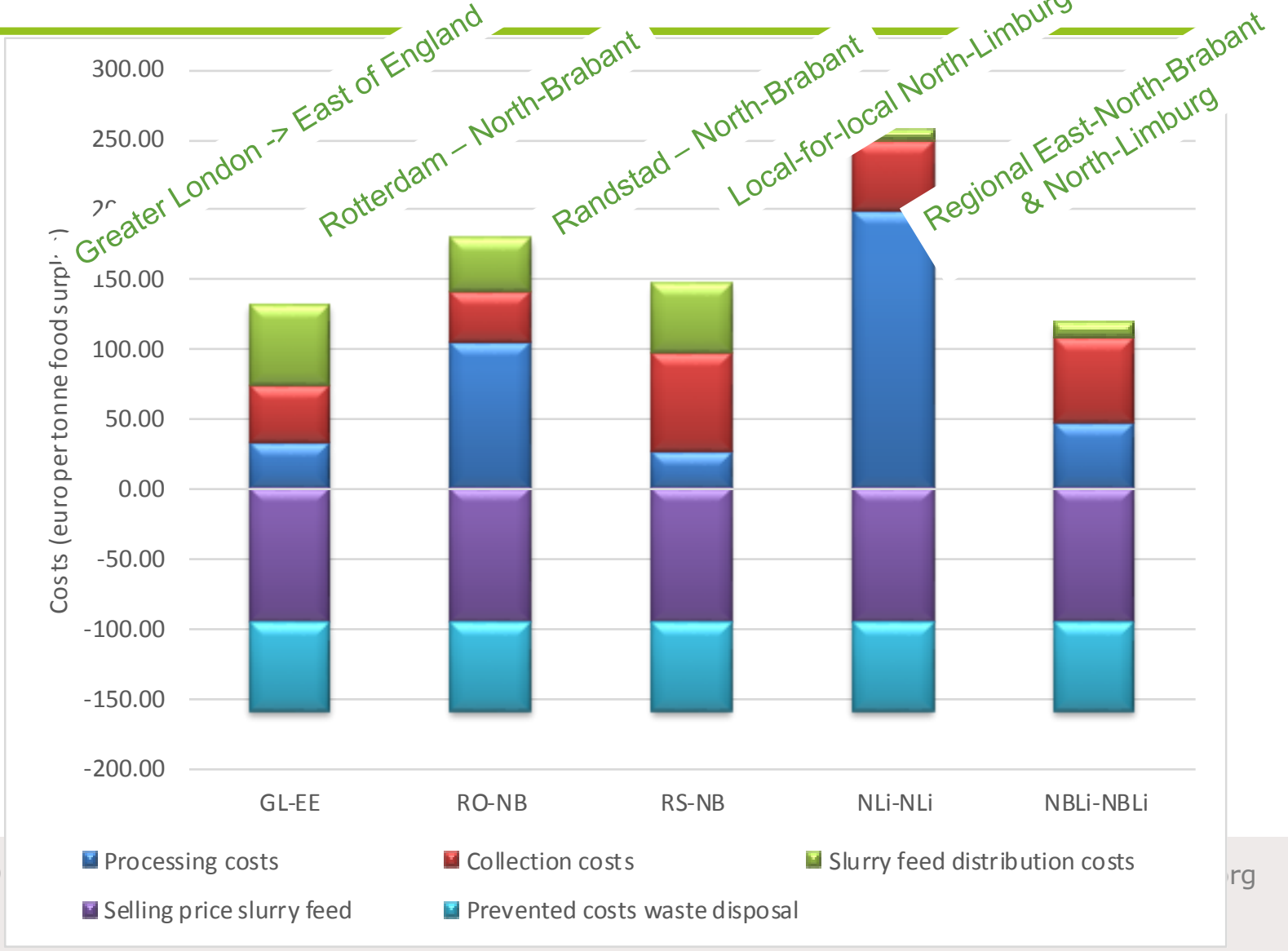
Effects of scale size on individual cost



Optimisation



Different geographic scenarios



Conclusions valorisation for feed

- Relatively low-tech
- Strong trade-offs between logistic costs and processing economies of scale
- Most promising in areas with sufficient supply + local market

- May fail at too small scale!

Medium-tech: Tomato paste

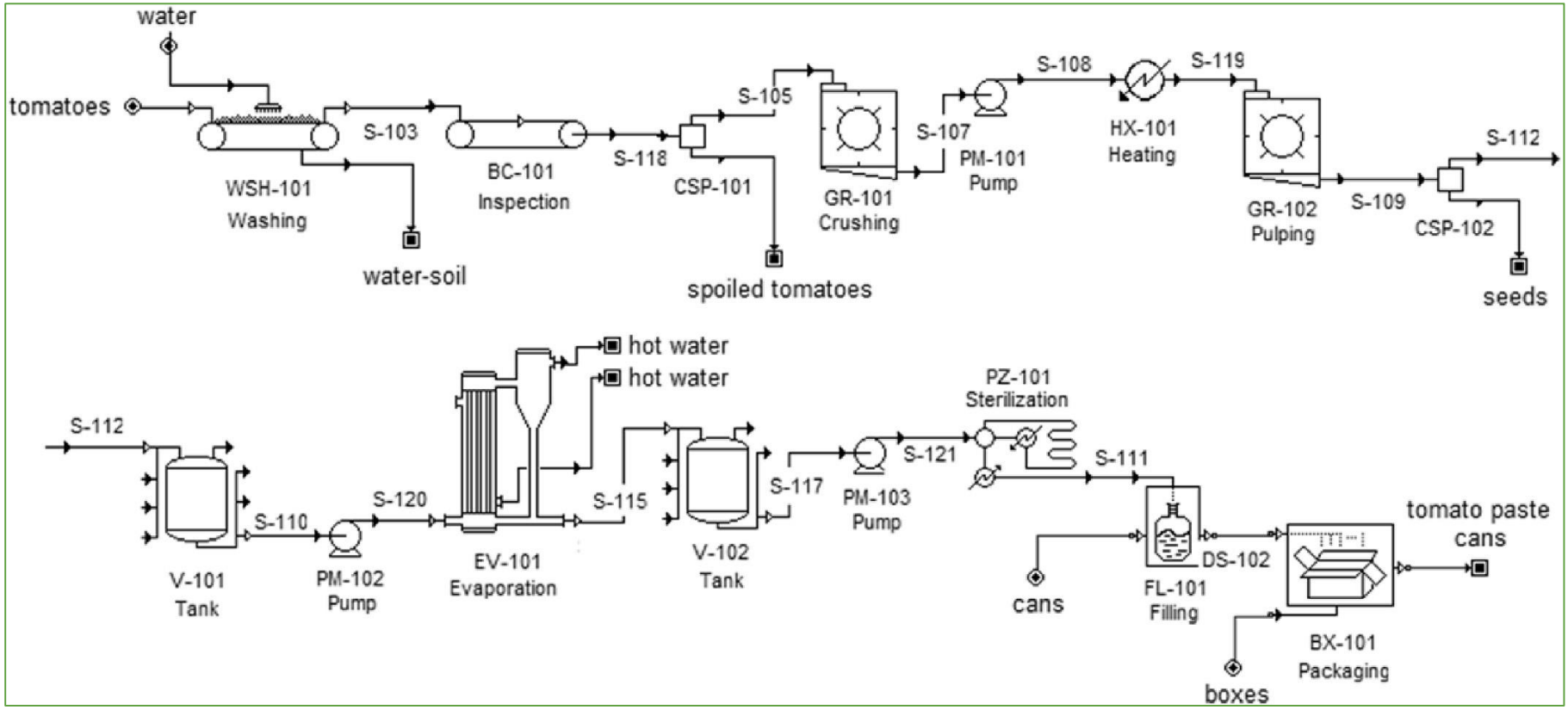
Food waste valorisation:

- Small scale factory, using reject and surplus tomato (150ha greenhouse)
- Medium scale: from 1500ha greenhouses

Reference:

- Large scale factory, using tomato specifically produced for this purpose

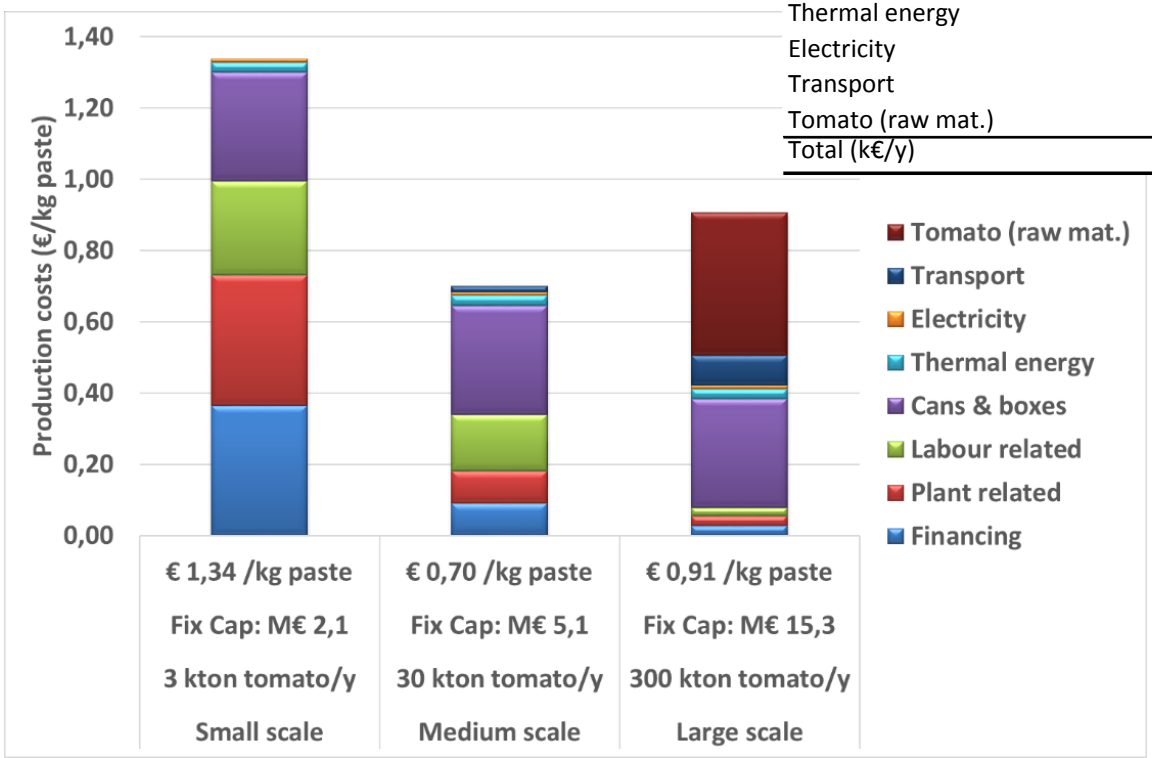
Typical factory layout



(Angeles-Martinez et al., 2018)

Tomato paste r

	Small scale	Medium scale	Large scale
Plant capacity (kton tomato/y)	3,0	30	300
Production (kton paste/y)	0,56	5,6	56
Processing (h/d)	8	16	24
Operating hours (h/y)	2667	5333	8000
Shift positions (#)	0,33	2	3
Transport distance (km)		20	100
Purchased equipment costs (k€)	391	975	2922
Fixed capital (k€)	2055	5117	15302
Financing	206	512	1530
Plant related	206	512	1530
Labour related	149	891	1337
Cans & boxes	171	1715	17149
Thermal energy	16	160	1601
Electricity	5	53	531
Transport		96	4800
Tomato (raw mat.)			22500
Total (k€/y)	752	3939	50978



Competitive if:

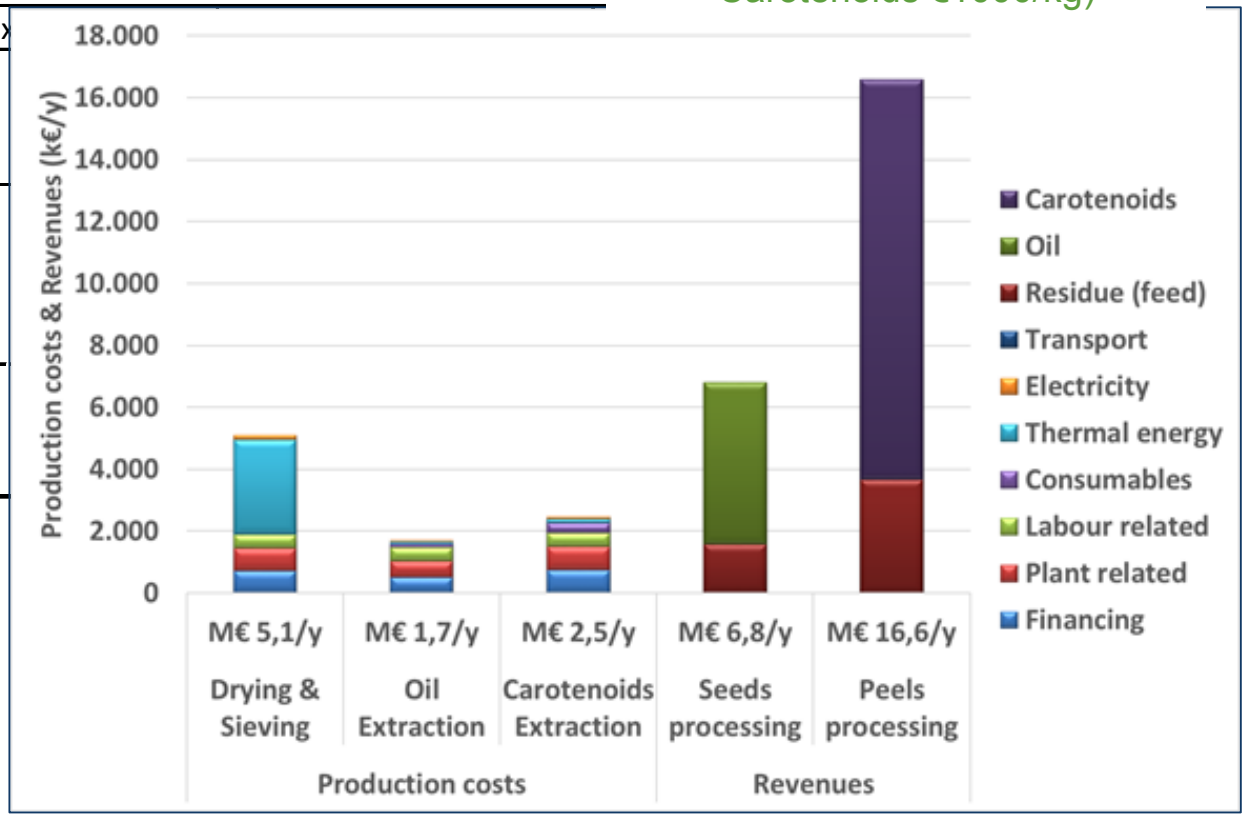
- sufficient scale size
- continuity over the year

High-tech: Oil Extraction & Carotenoids Extraction from seeds+peels

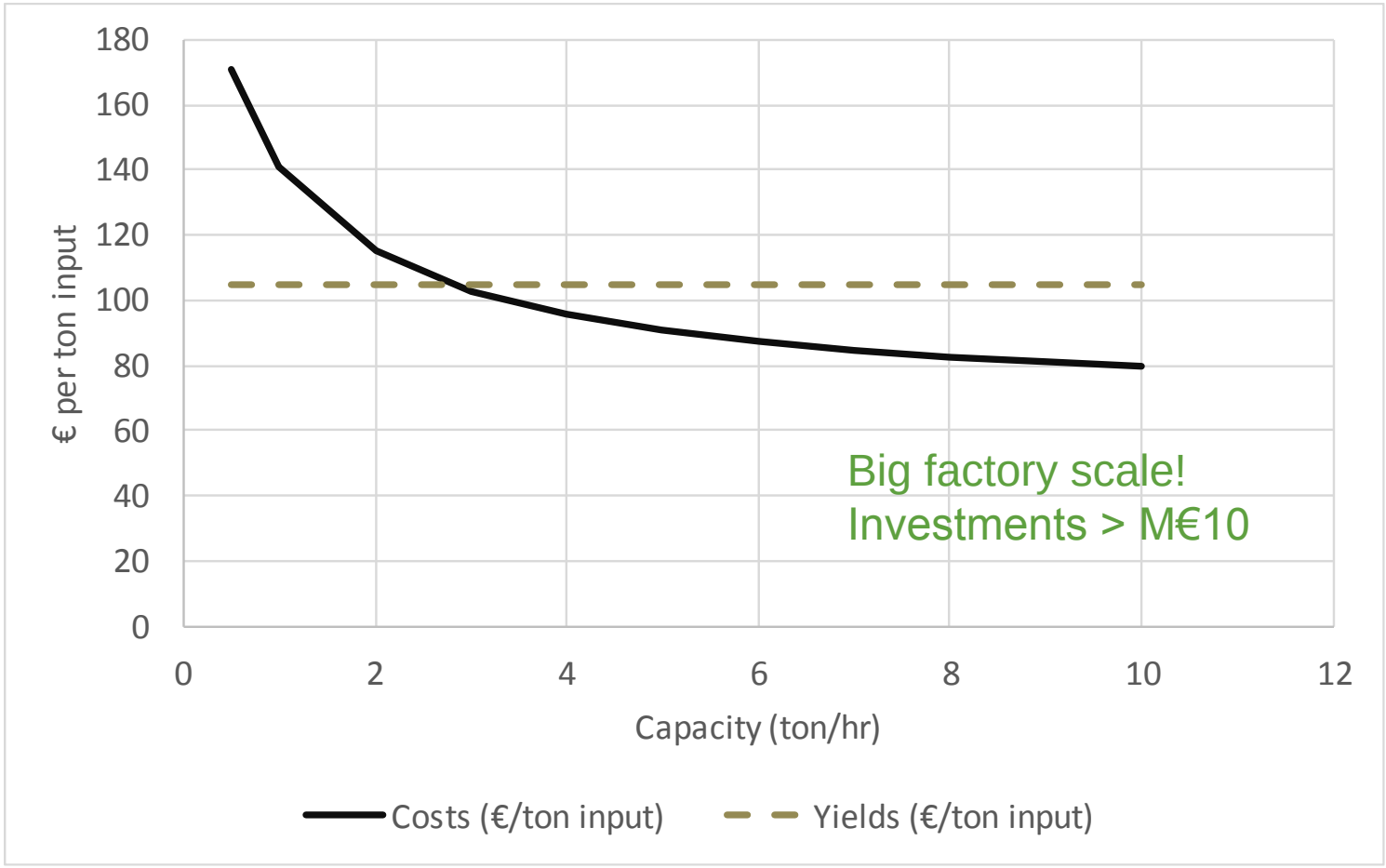
“European scale” factory

Price assumptions:
oil €3/kg
Carotenoids €1000/kg)

Operating hours	8000	h/yr
Drying & Sieving		Oil Ex
Input	26%	Input
Pulp	10,8	Seeds
	86,6	
Output		Output
- Seeds	90%	- Crude Oil
	1,1	
	8,9	
- Dried Peels	90%	- Residue
	2,0	
	16,3	



Scale size analysis



Concluding remarks

- High added value valorisation:
  - high-tech, capital intensive processes
  - most beneficial at large scale
  - located near waste generation plant

- Low-tech valorisation:
  - lower capital requirements
  - logistic costs are relatively high

    -> location near waste concentration + end-users

- All solutions require sufficient scale size
- Not competitive at too small scale size

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