Integral valorization of grapevine shoots from the variety Grüner Veltliner: A techno-economic assessment

Sebastián Serna-Loaiza,

Laura Daza-Serna, Walter Wukovits,

Anton Friedl

Technische Universität Wien

Bioactive Doctoral College

Institute of Chemical, Environmental and Bioscience Engineering

Agenda

- Introduction
- What we did?
- Results
- Conclusion

Introduction

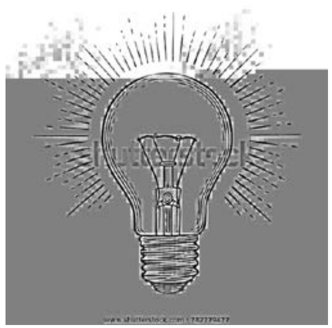
Context

A transition into sustainable societies is urgent!

Biorefineries ⟷  ⟷ Lignocellulosic Biomass

Key for shifting into a bioeconomy:

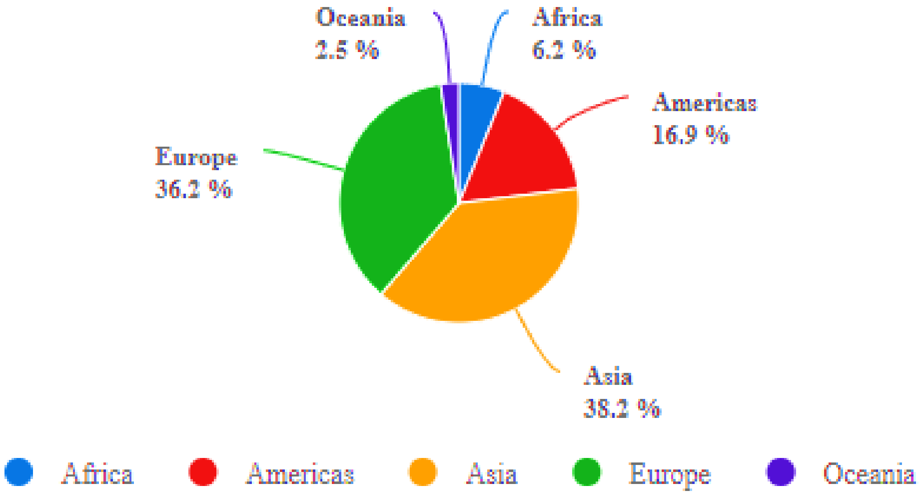
Focus on both products and energy/fuels used in industry and daily-life applications

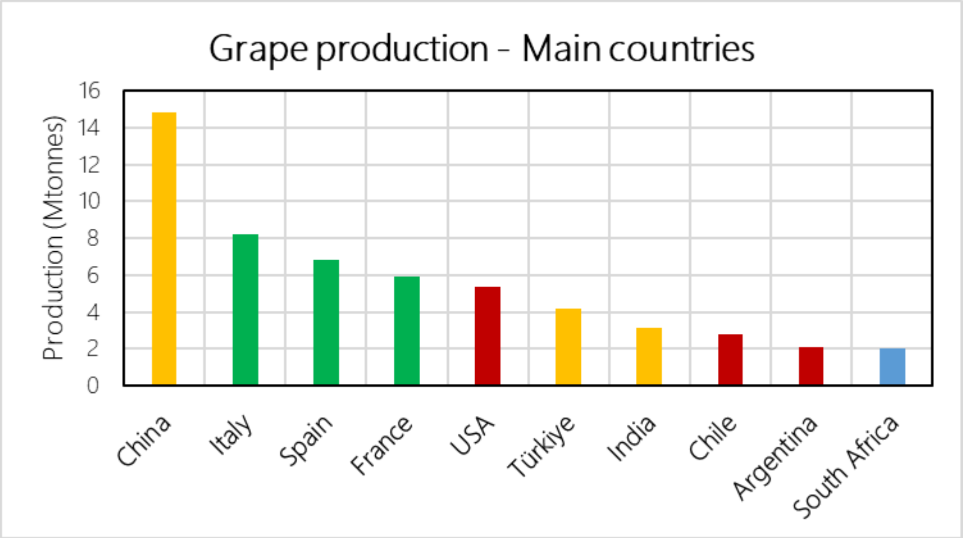


Introduction

Context

- Grape production
  - ~78 Mtonnes, 6.9 MHa (2020) (FAOSTAT)



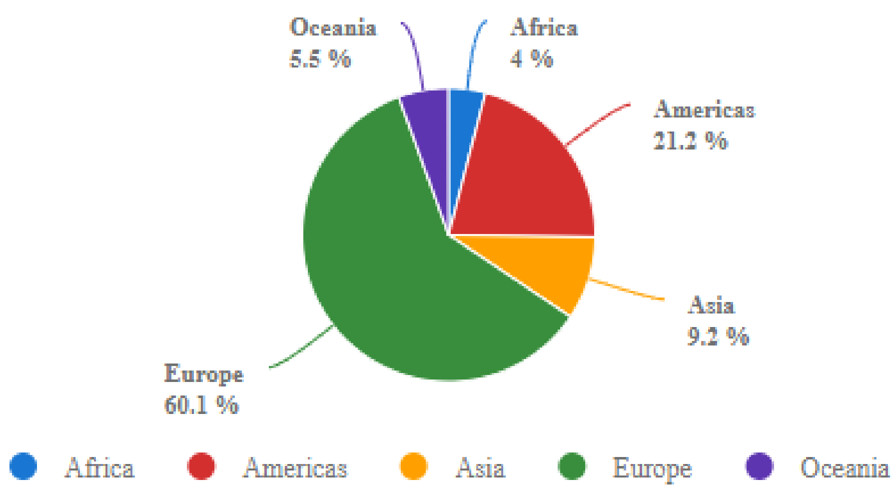


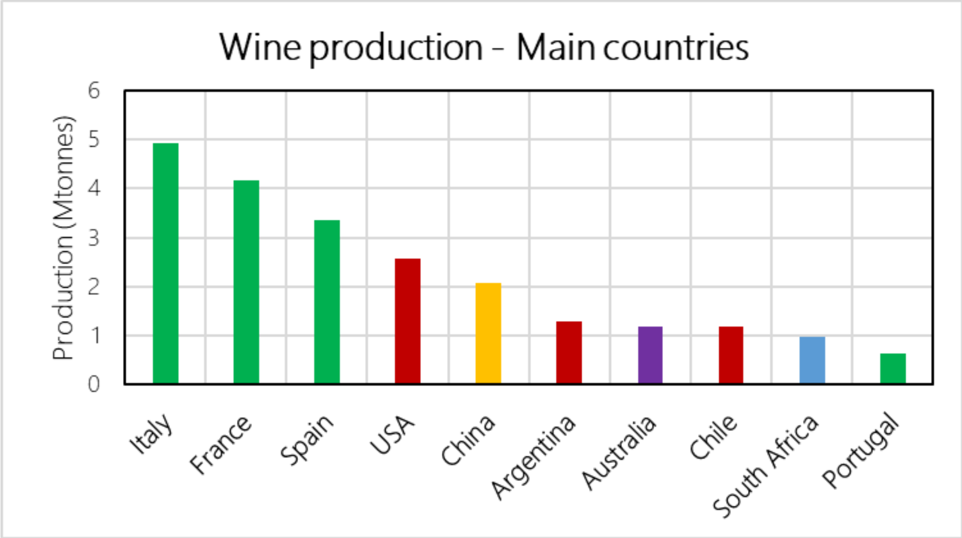
Data taken from: FAOSTAT (Consulted June 2022)

Introduction

Context

- Wine production
  - ~27 Mtonnes (2019) (FAOSTAT)





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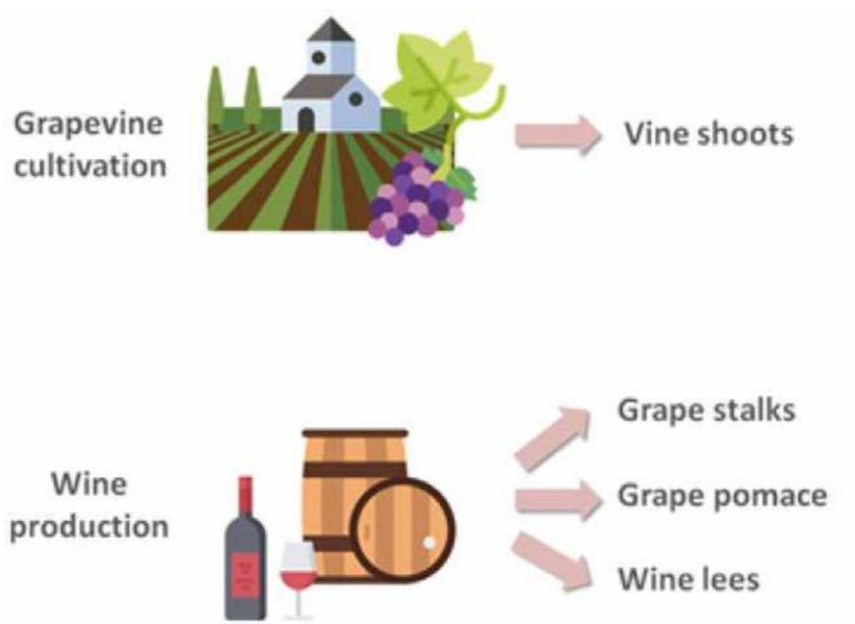
Introduction

Context

➢ Residues



Taken from: (Contreras *et al.*, 2022)

Food and Bioproducts Processing
Volume 134, July 2022, Pages 56-79

Residues from grapevine and wine production as feedstock for a biorefinery

María del Mar Contreras [a, b], Juan Miguel Romero-García [a, b], Juan Carlos López-Linares [a, b], Inmaculada Romero [a, b], Eulogio Castro [a, b]

- ~1-3 t/ha
- 1 t grape
  - 30-40 kg stalks
  - 130-200 kg pomace
  - 15-60 kg lees

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Introduction

Context

- Residues

Taken from: (Contreras *et al.*, 2022)

- ~1-3 t/ha

- Grapevine Shoots (GVS): Lignocellulosic residue
  - Results from the pruning of the grapevine
  - Multiple studies focusing on:
    - Bioactive substances
    - Biofuels
    - Biochemicals

Introduction

Context

➢ Residues

Taken from: (Contreras *et* al., 2022)

- ~1-3 t/ha

Single grapevine shoot branch

Introduction

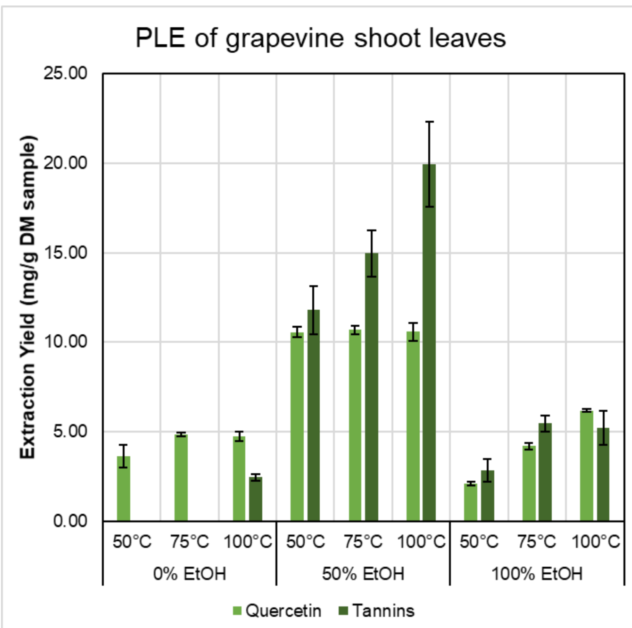
Problem Statement

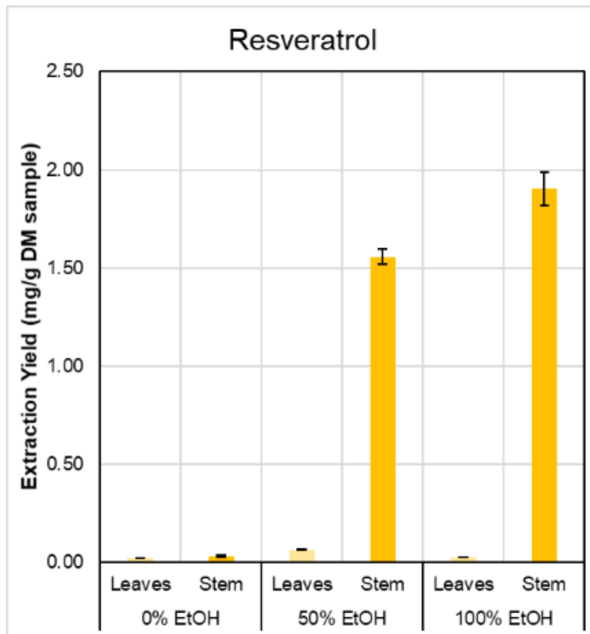
- Most of studies (in Europe) regarding GVS valorization have been done for Portuguese, Italian, French, and Spanish grape varieties
- Austria:
  - Grape production (2017): 330k tons
  - Variety: Grüner Veltliner – 48% wine area (15k ha)
- No differentiation between leaves and stem
- Evaluating possible integration scenarios and determining the techno-economic feasibility of a biorefinery to valorize the Grüner Veltliner's GVS is still necessary to be performed

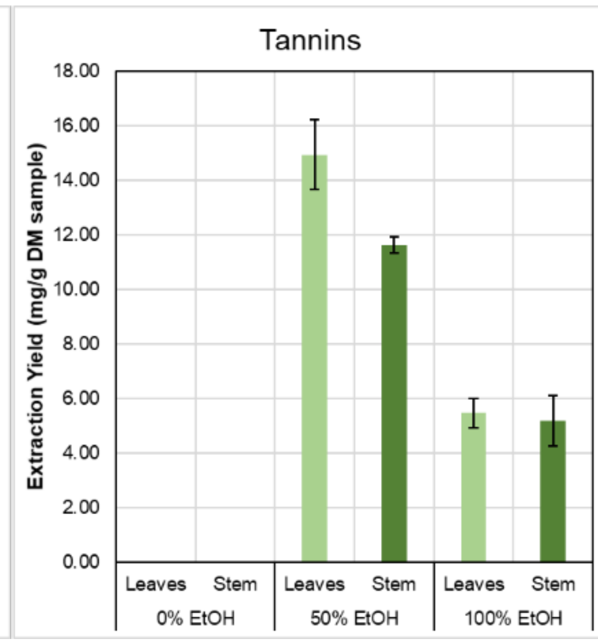
What we did

Previous Study: Grapevine Shoots - Leaves and Stem

Serna-Loaiza, S.; Kornpointner, C.; Pazzaglia, A.; Jordan, C.; Halbwirth, H.; Friedl, A. Biorefinery concept for the valorization of grapevine shoots: Study case for the Austrian variety Grüner Veltliner. *Food and Bioproducts Processing* 2022, In Press.







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What we did

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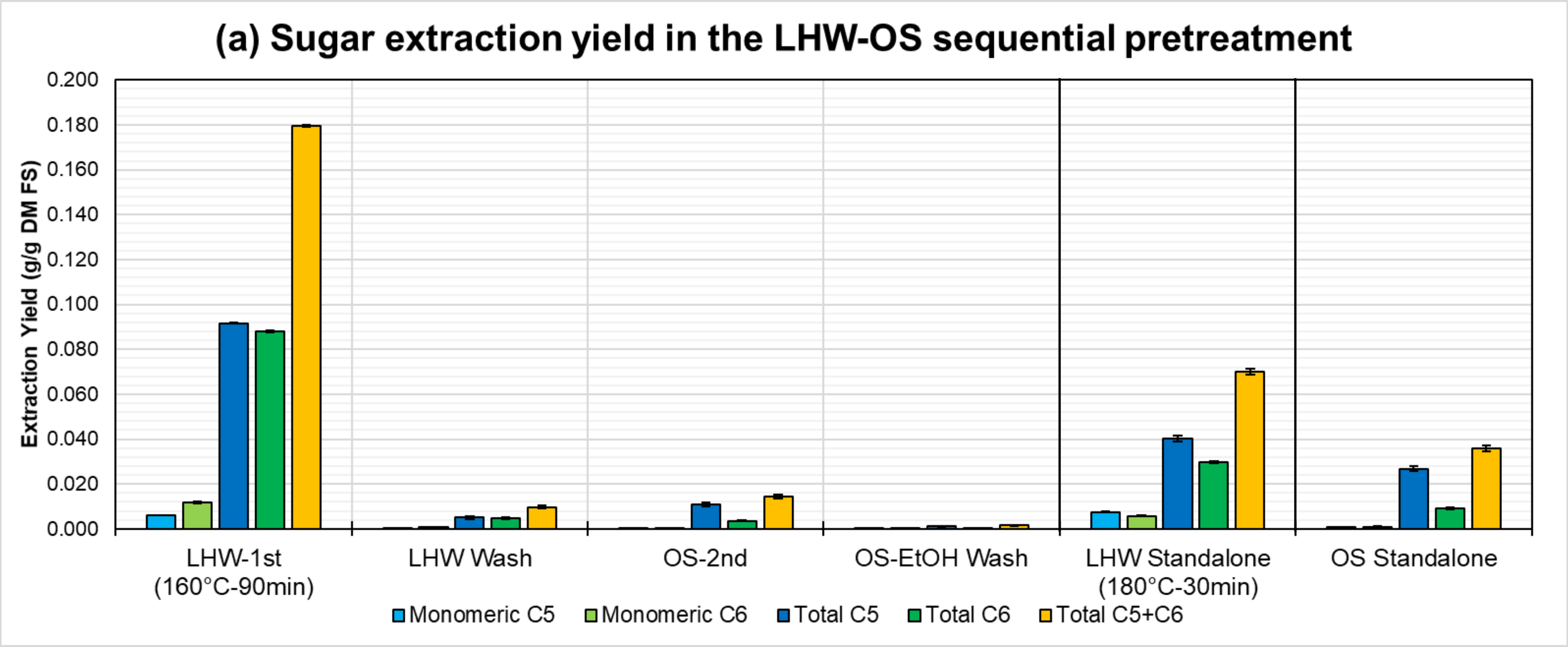

What we did

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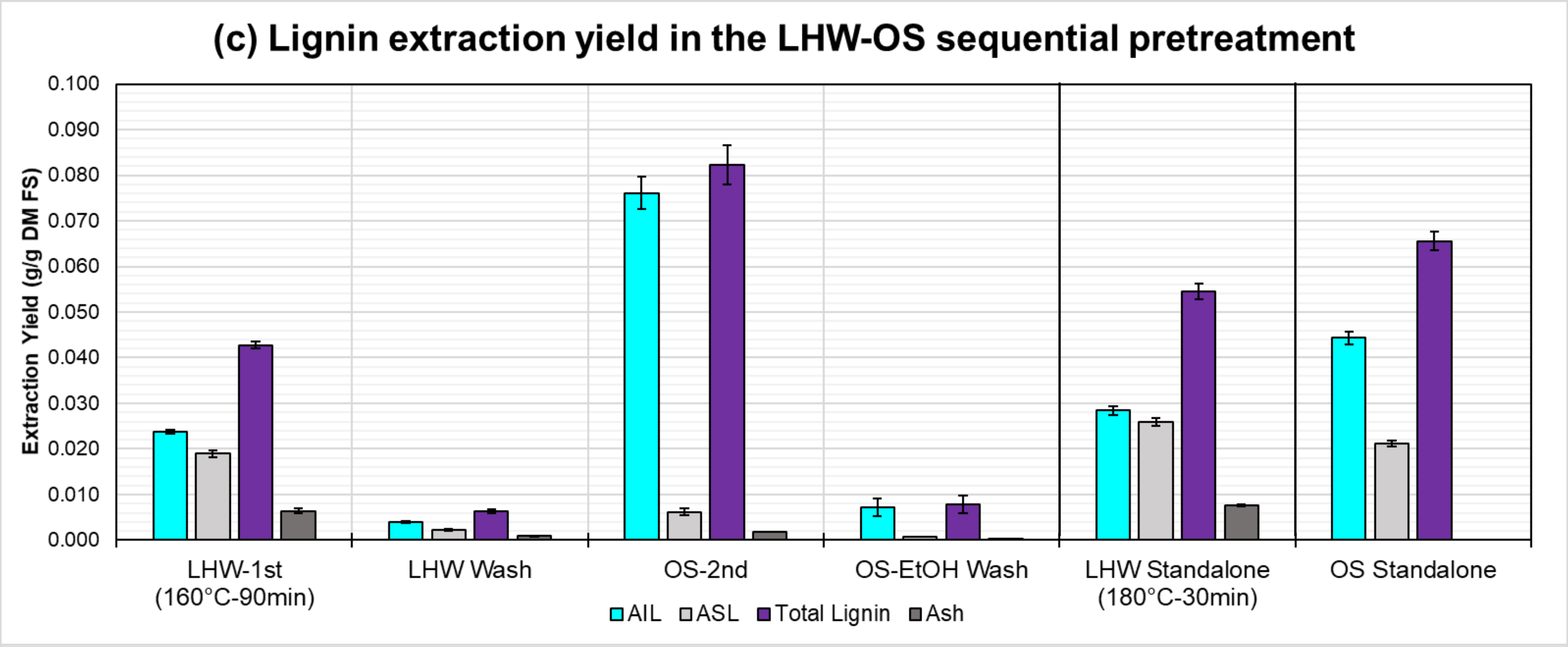
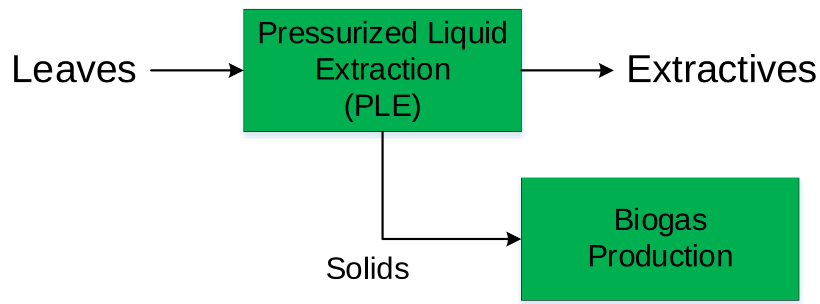


What we did

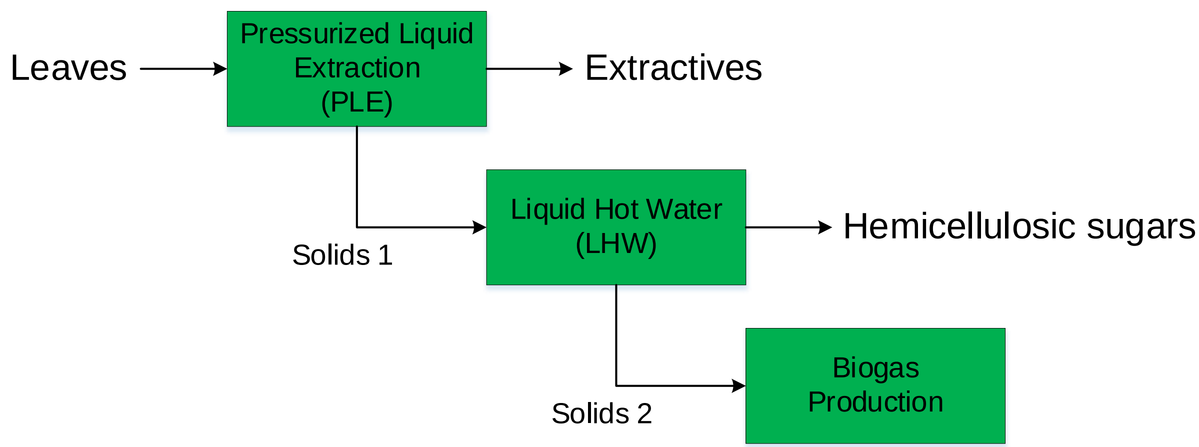
This Study: Scenarios and Techno-Economic Assessment

- Leaves

Sc. 1



Sc. 2

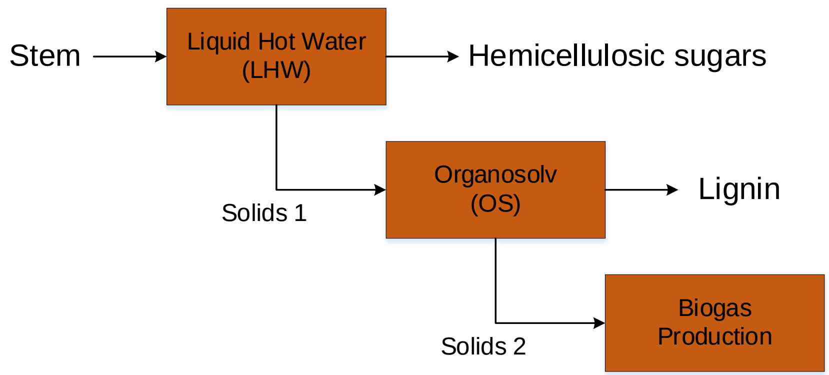


What we did

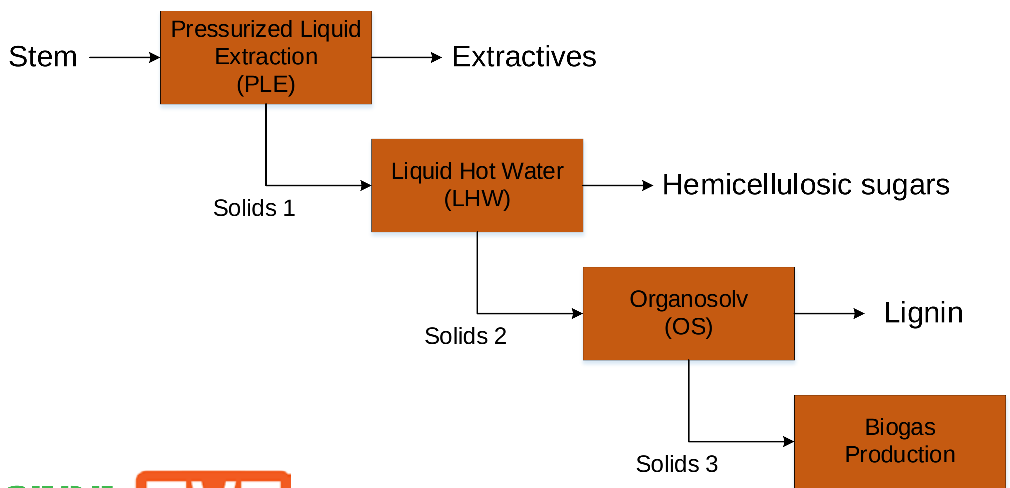
This Study: Scenarios and Techno-Economic Assessment

- Stems

Sc. 3



Sc. 4

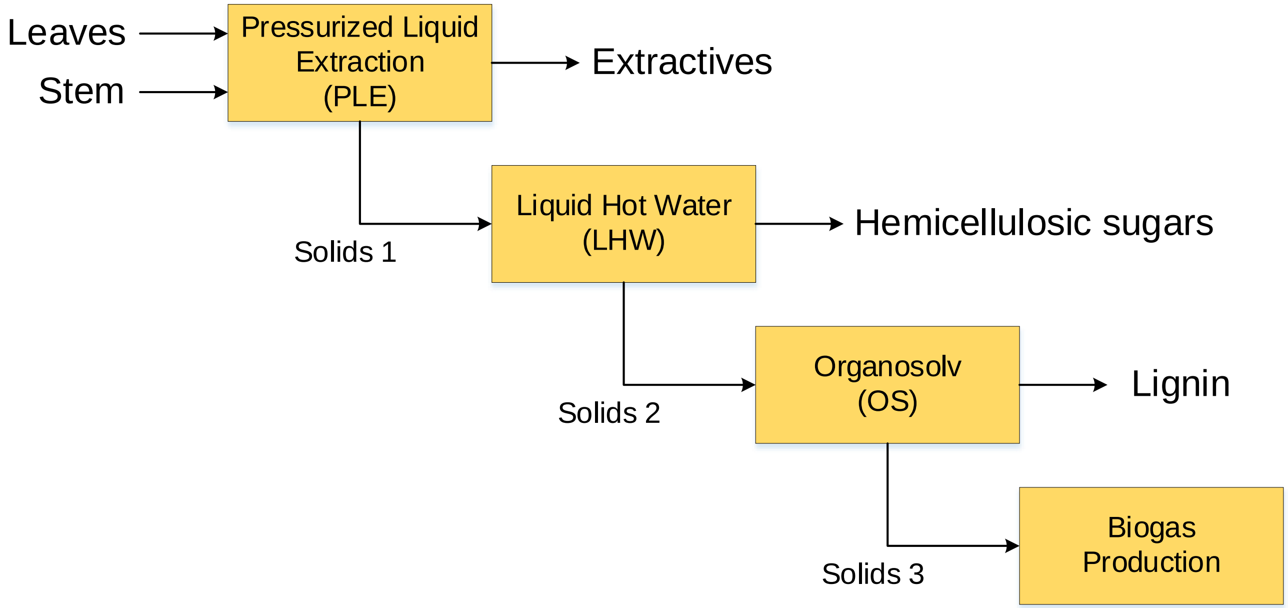


What we did

This Study: Scenarios and Techno-Economic Assessment

- Leaves + Stems

Sc. 5



What we did

This Study: Scenarios and Techno-Economic Assessment

➢ Feedstock flows

Vineyard residue production	Planted vineyards (Austria)	Estimated residue production	
ton/ha	*ha/year*	*ton/year*	*kg/h*
5	48000	240000	27379

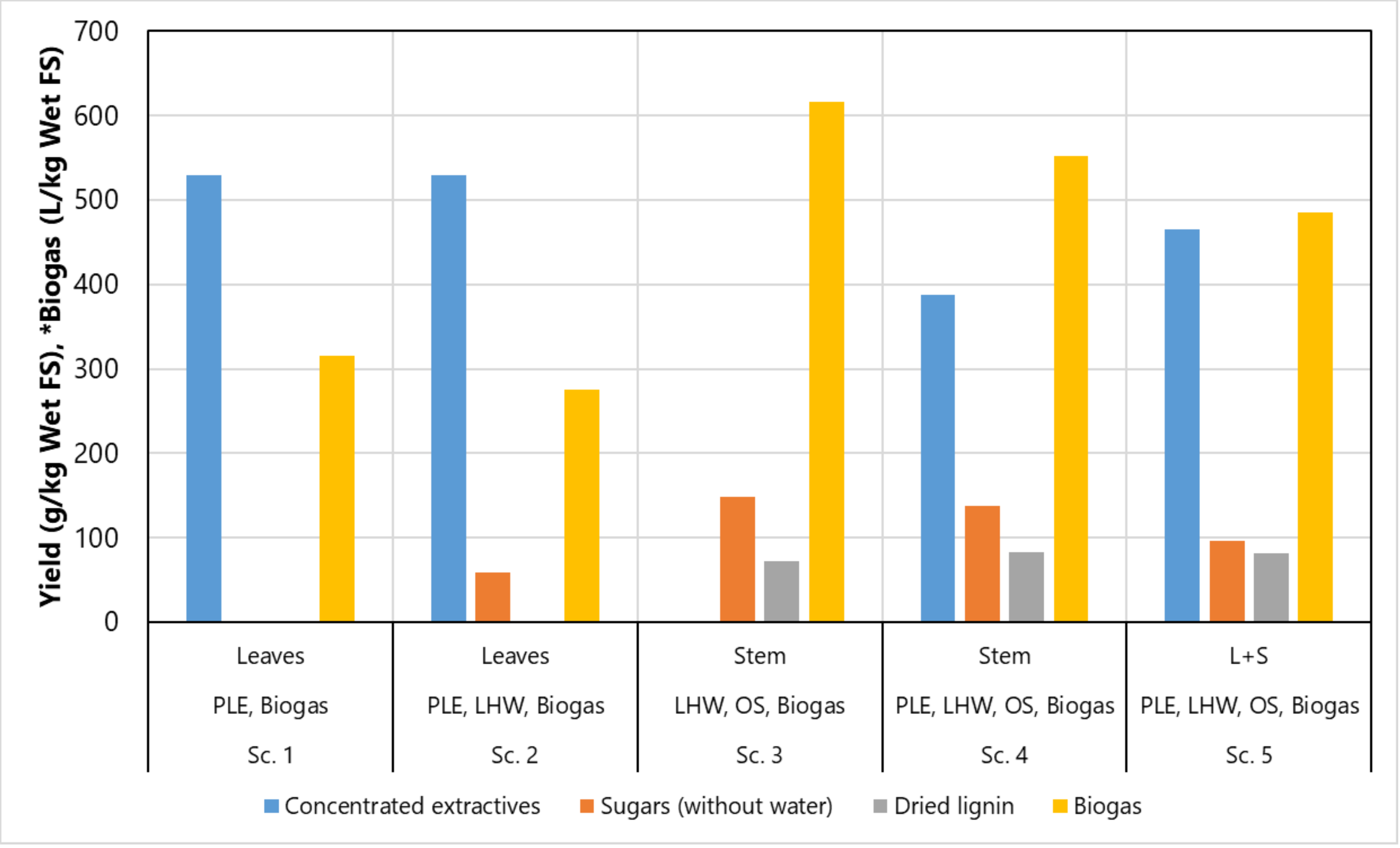
Assumed use of residue	Mass flow WET
(%)	*(kg/h)*
10%	2737.85

	Plant fraction WET	Mass flow WET	DM content	Mass flow DRY
	(%wt)	*(kg/h)*	*(%wt)*	*(kg/h)*
Leaves	60.5	1657.74	37.68	624.64
Stem	39.5	1080.11	47.48	512.84
			Total	**1137.47**

Aspen Process V10
AP Economic Analyzer

Results

Technical Assessment: Product streams



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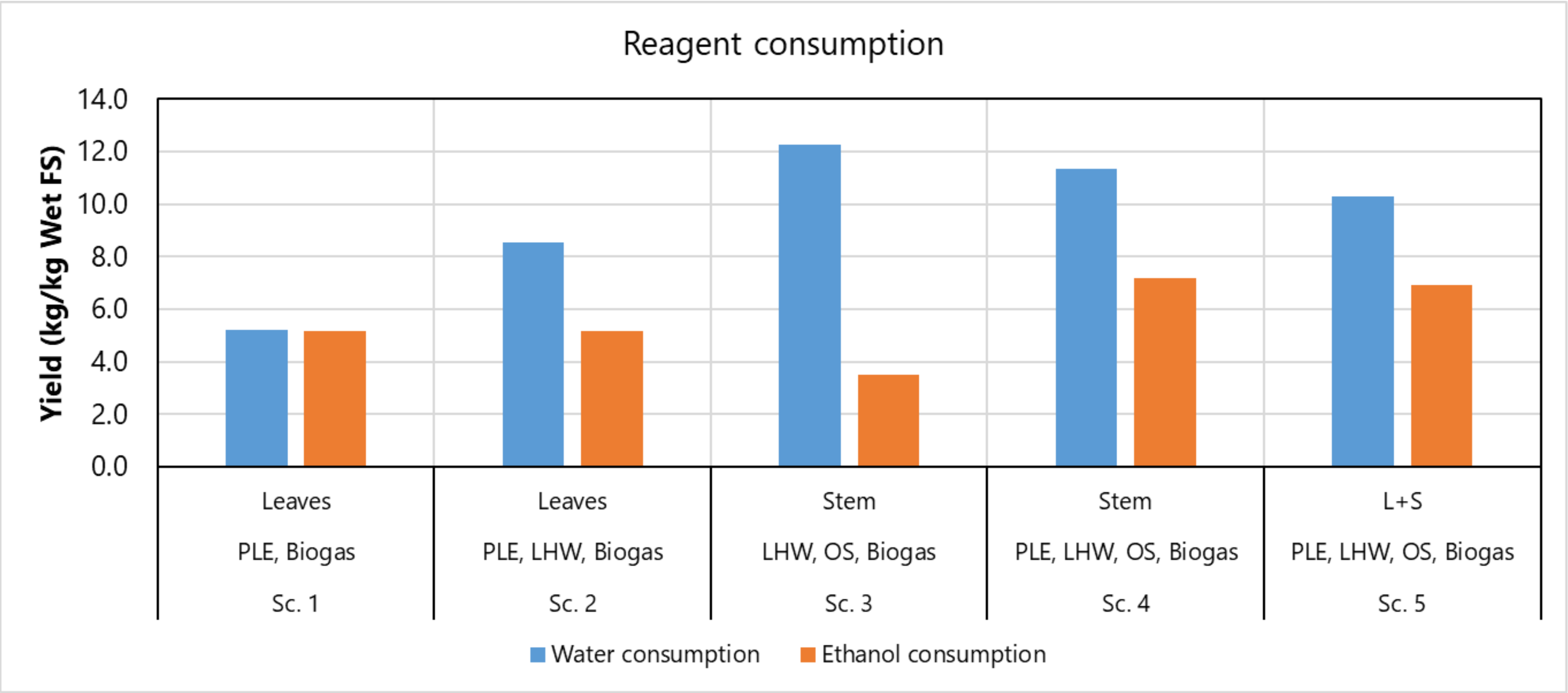
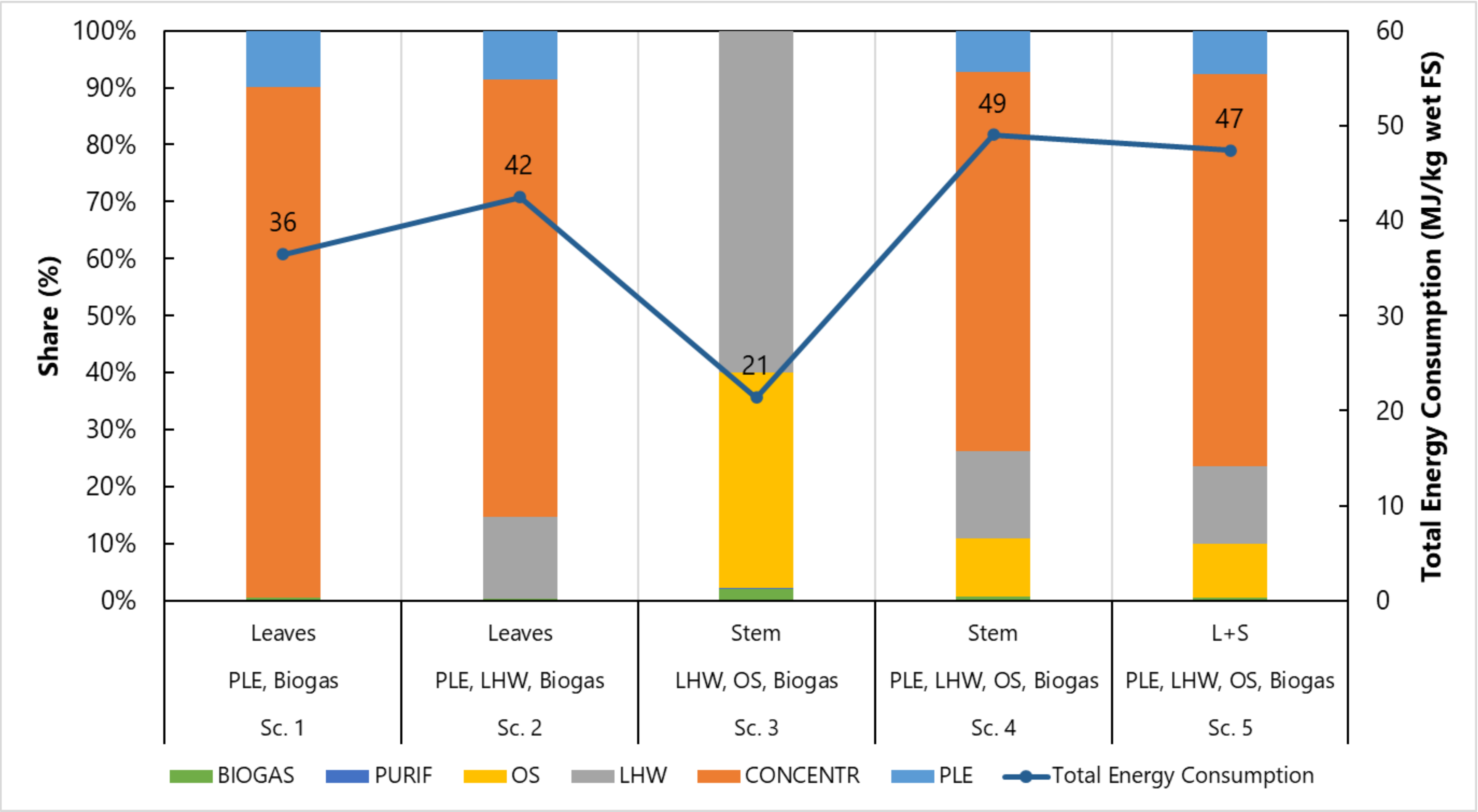
Results

Technical Assessment: Reagent consumption



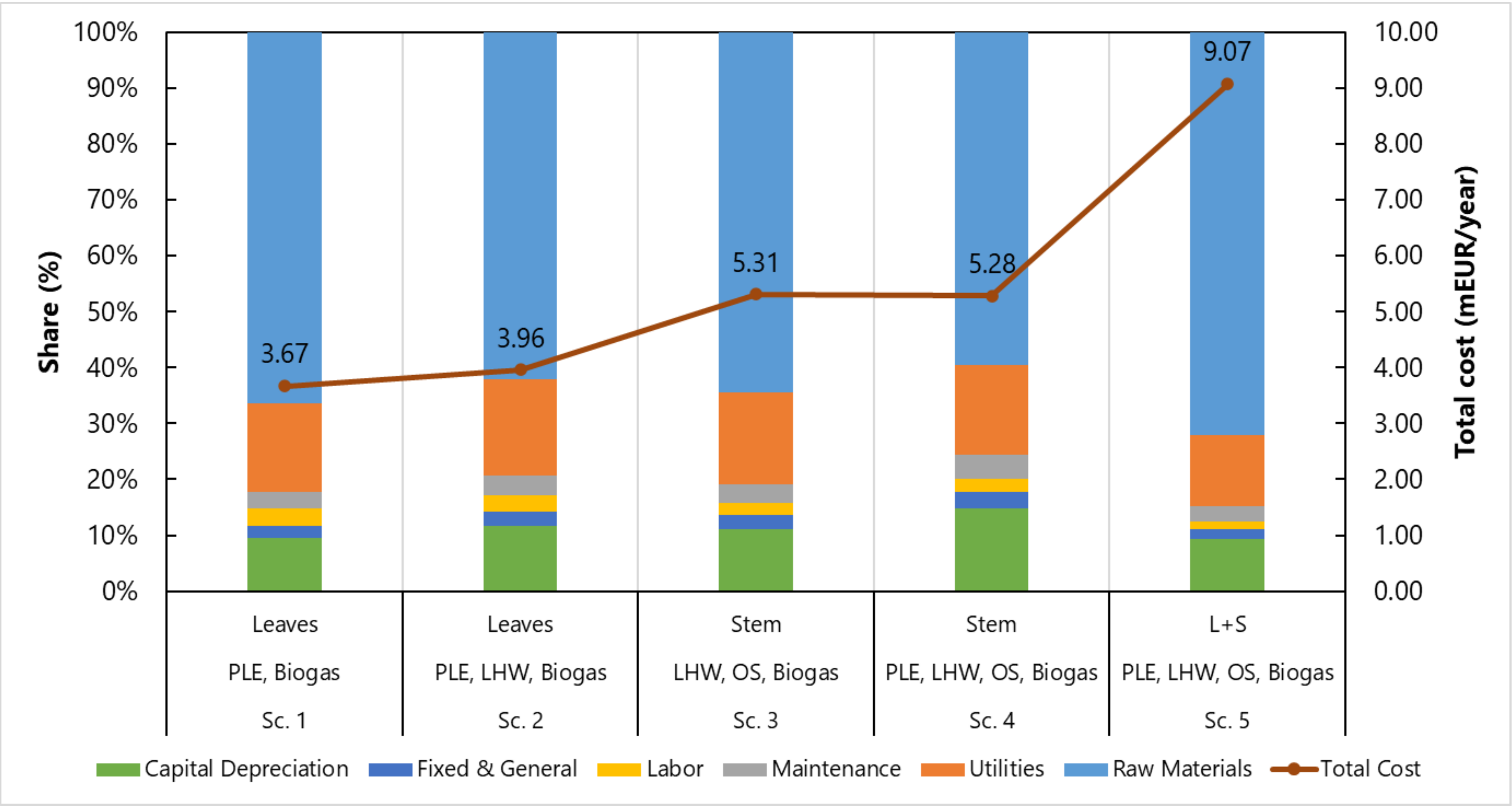
Results

Technical Assessment: Energy consumption



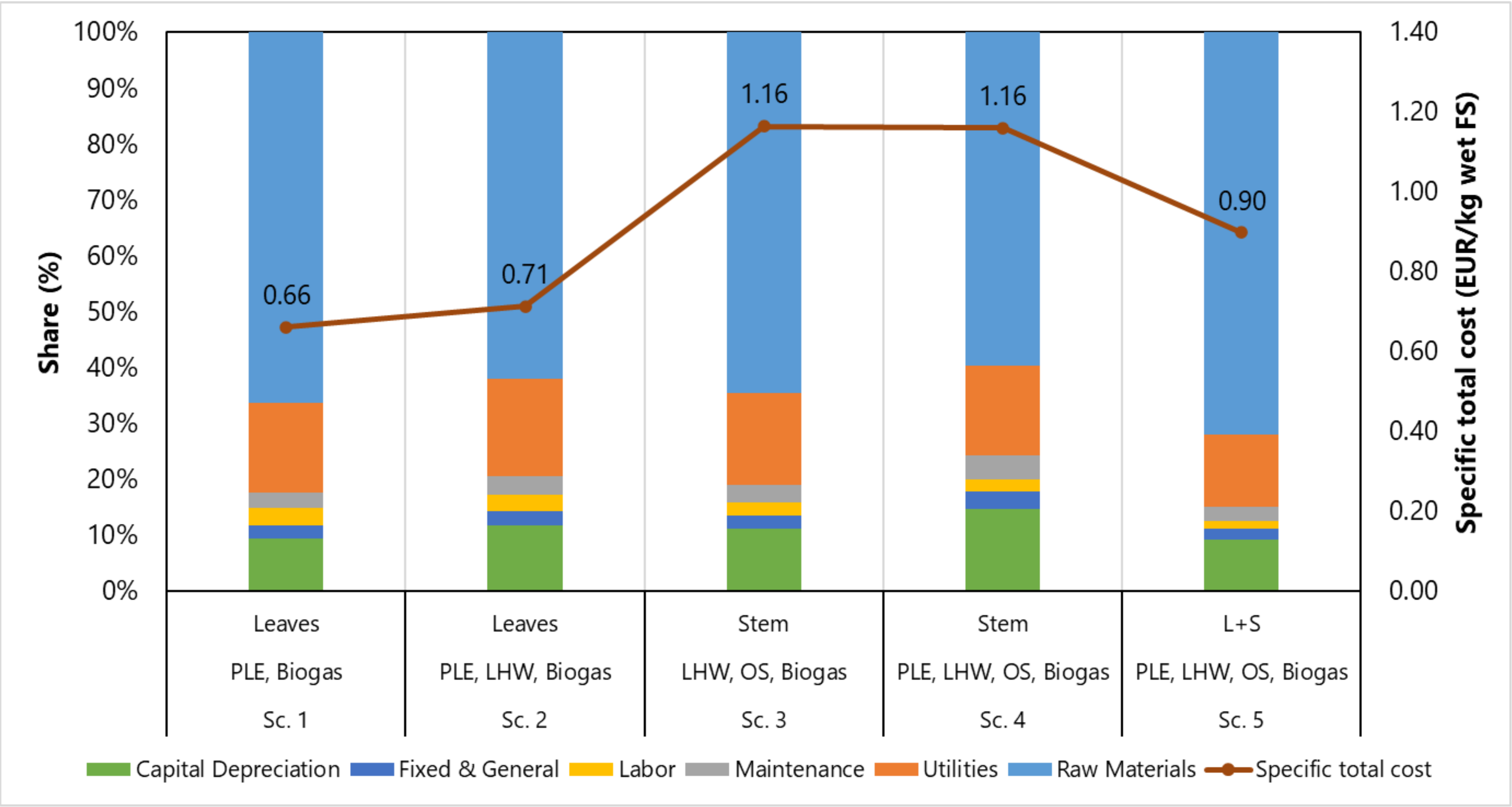
Results

Economic assessment: Total cost and costs distribution



Results

Economic assessment: Total cost and costs distribution



Upcoming work

- ✓ Sequential processing (biorefinery) improved the extraction of compounds of interest (bioactive compounds, hemicellulosic sugars, and lignin)
- ✓ Mass integration did not increase the specific consumption of reagents and energy.
- ✓ Total specific costs decreased, while increasing the output of products.

- Scenario evaluation:
  - Market costs for intermediate products (?)
  - Prospective LCA

Agenda

- Contact Links:

Sebastian Serna-Loaiza

sebastian.serna@tuwien.ac.at

https://www.linkedin.com/in/sebastian-serna-loaiza-b9735596/

Bioactive Project

https://bioactive.tuwien.ac.at/home/

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Thank you for your attention!

Questions