AccelWater

Accelerating Water Circularity in Food and Beverage Industrial Areas around Europe

A case study of the Italian tomato processing industry: a comprehensive evaluation from production, water, and energy consumption to waste valorization and LCA point of view

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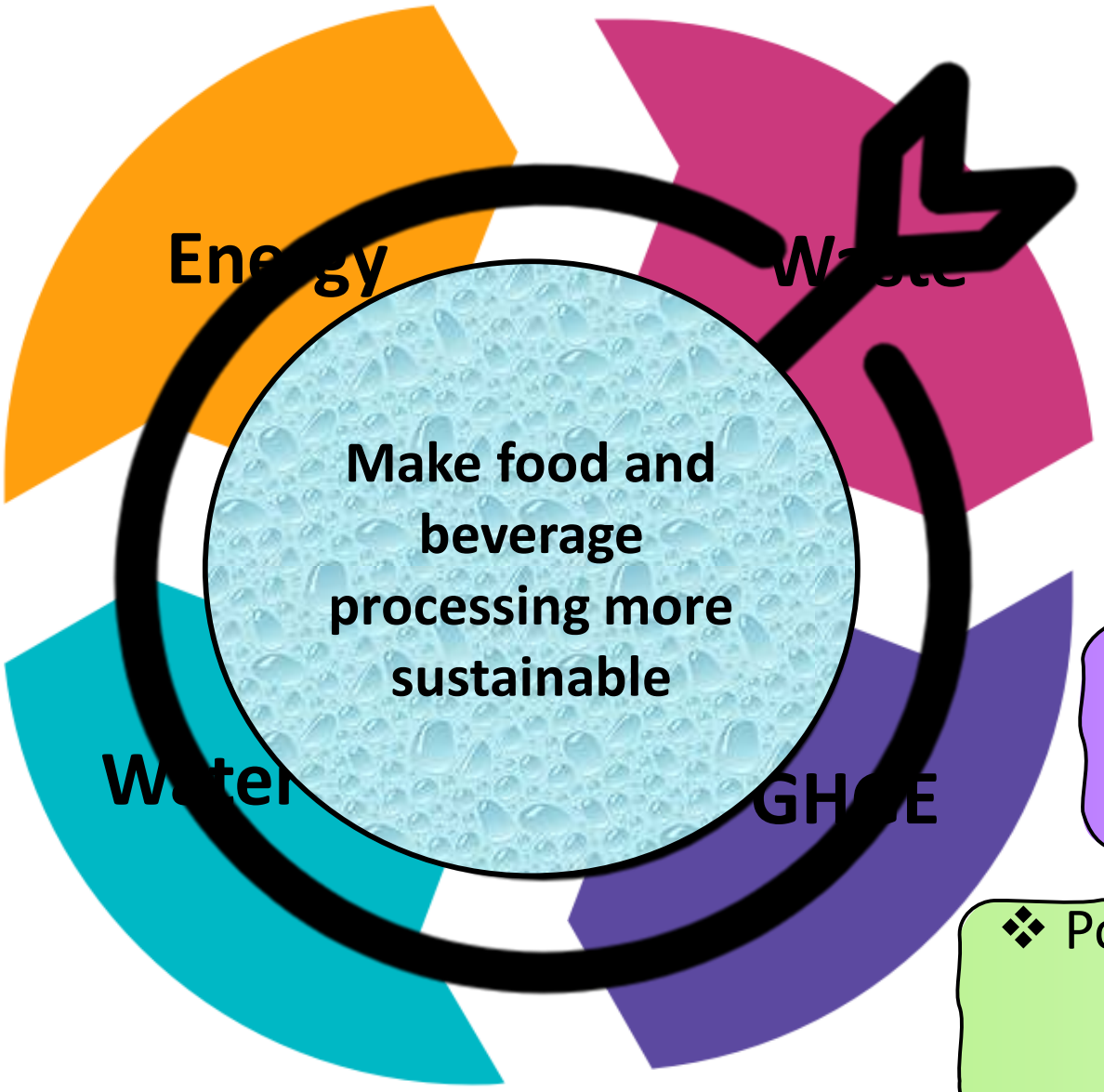
Problem Statement



- ❖ Energy consumption in food industry is 200EJ, 30% of total energy
- ❖ 10% of total water is used in the food industry
- ❖ Global water demand is predicted to increase about 50% until 2050
- ❖ Food waste generation is 1.6 billion tons (10% is during food processing)
- ❖ Food industry generates one-quarter of the world's greenhouse gas emissions
- ❖ Population growth will be over 9 billion until 2050
- ❖ Global demand will be 20 fold

Problem
Aim
Method
Result
Conclusion

AccelWater Project

European Commission | Horizon 2020 European Union funding for Research & Innovation

- It is a European project funded by EU Horizon 2020.
- Represented by 4 countries (Italy, Greece, Iceland & Spain).
- focuseing on sectors of the food and beverage industry consuming a high amount of water and energy.

The main objective is optimization of water consumption in the food industry by developing of water-waste-energy nexus.

Tomato Processing Demonstrator

Problem

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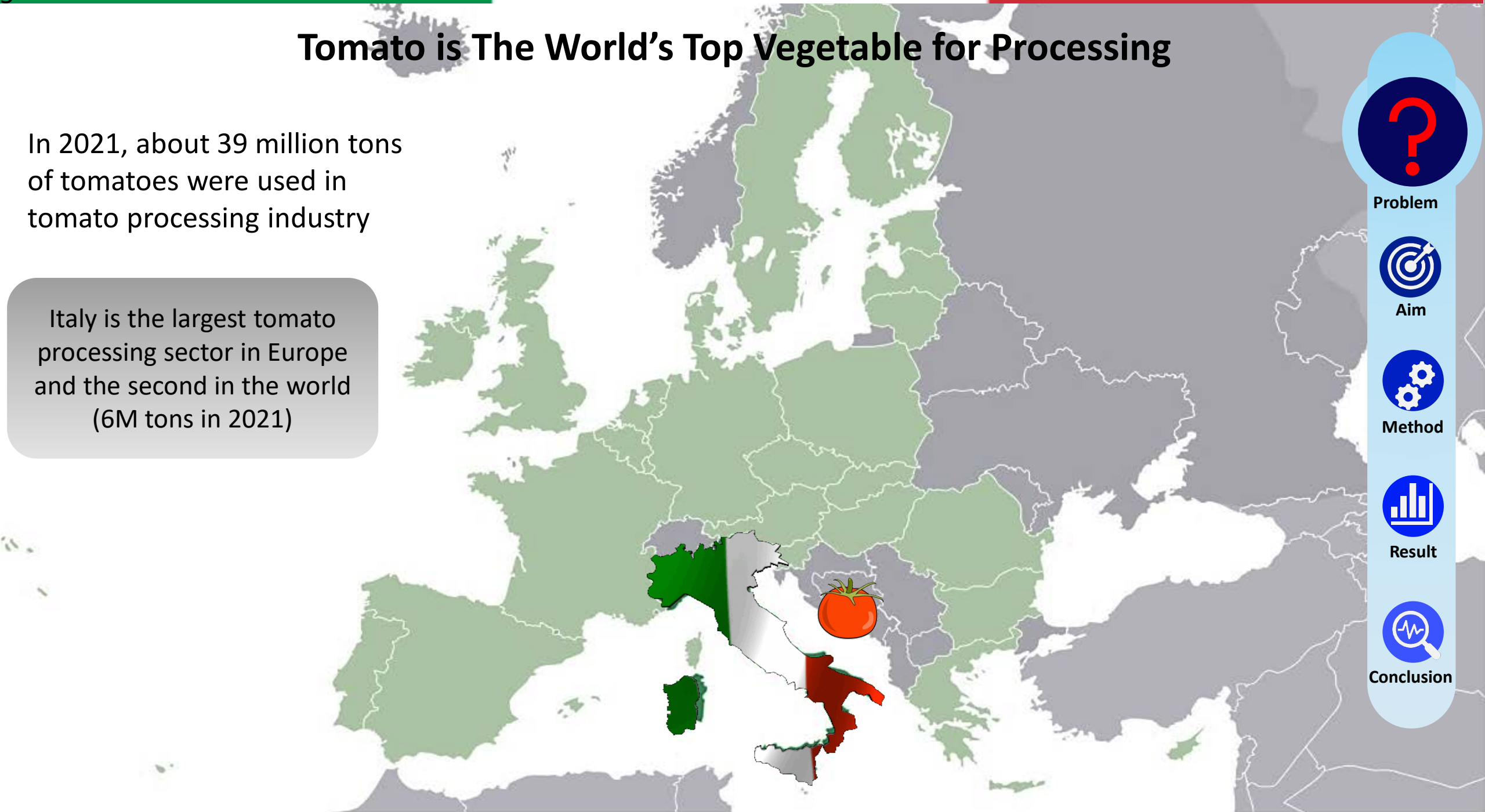
Tomato is The World's Top Vegetable for Processing

In 2021, about 39 million tons of tomatoes were used in tomato processing industry

Italy is the largest tomato processing sector in Europe and the second in the world (6M tons in 2021)



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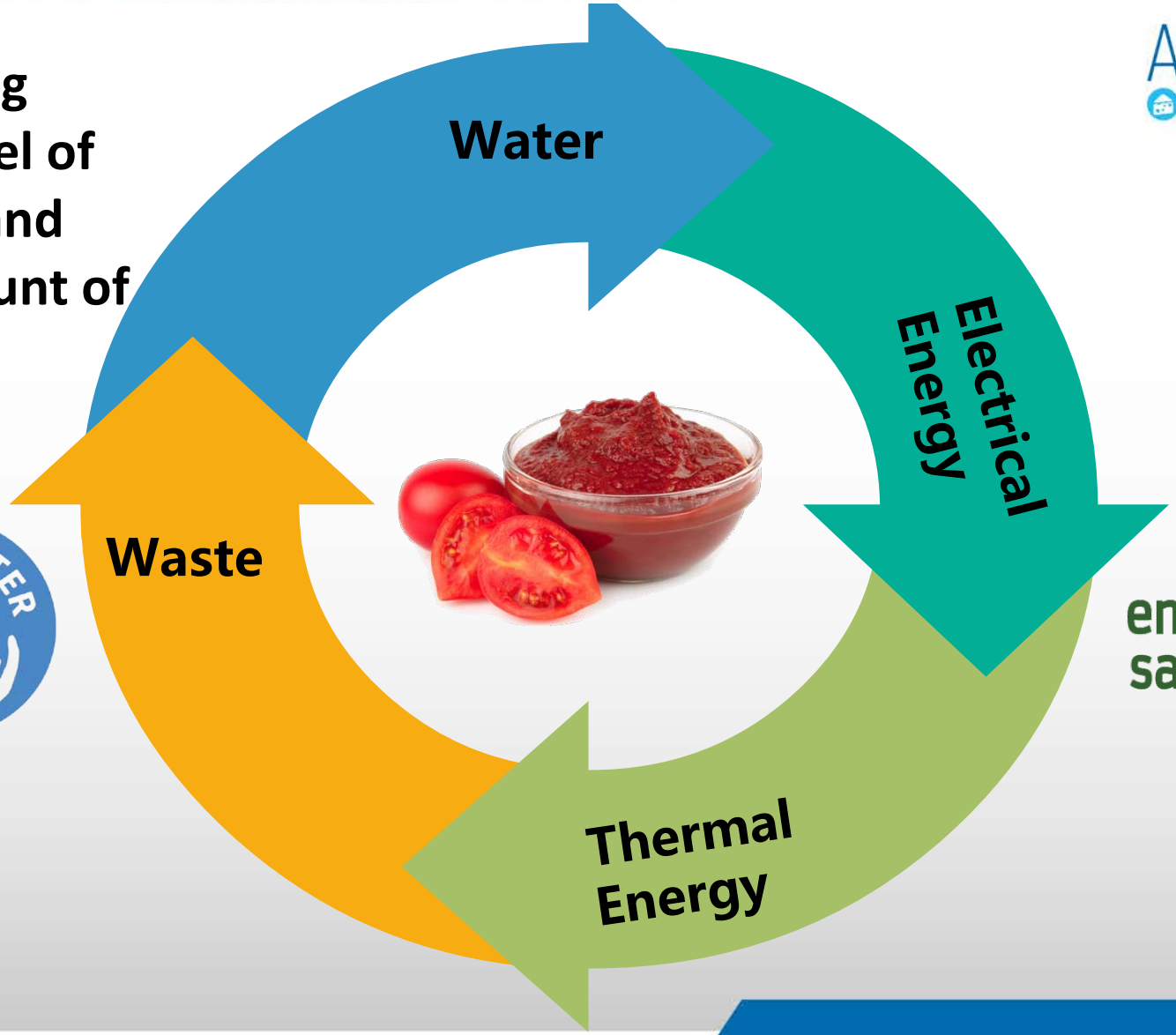
Problem Statement in Tomato Processing Industry

Tomato processing consumes a high level of water and energy and generates a high amount of waste



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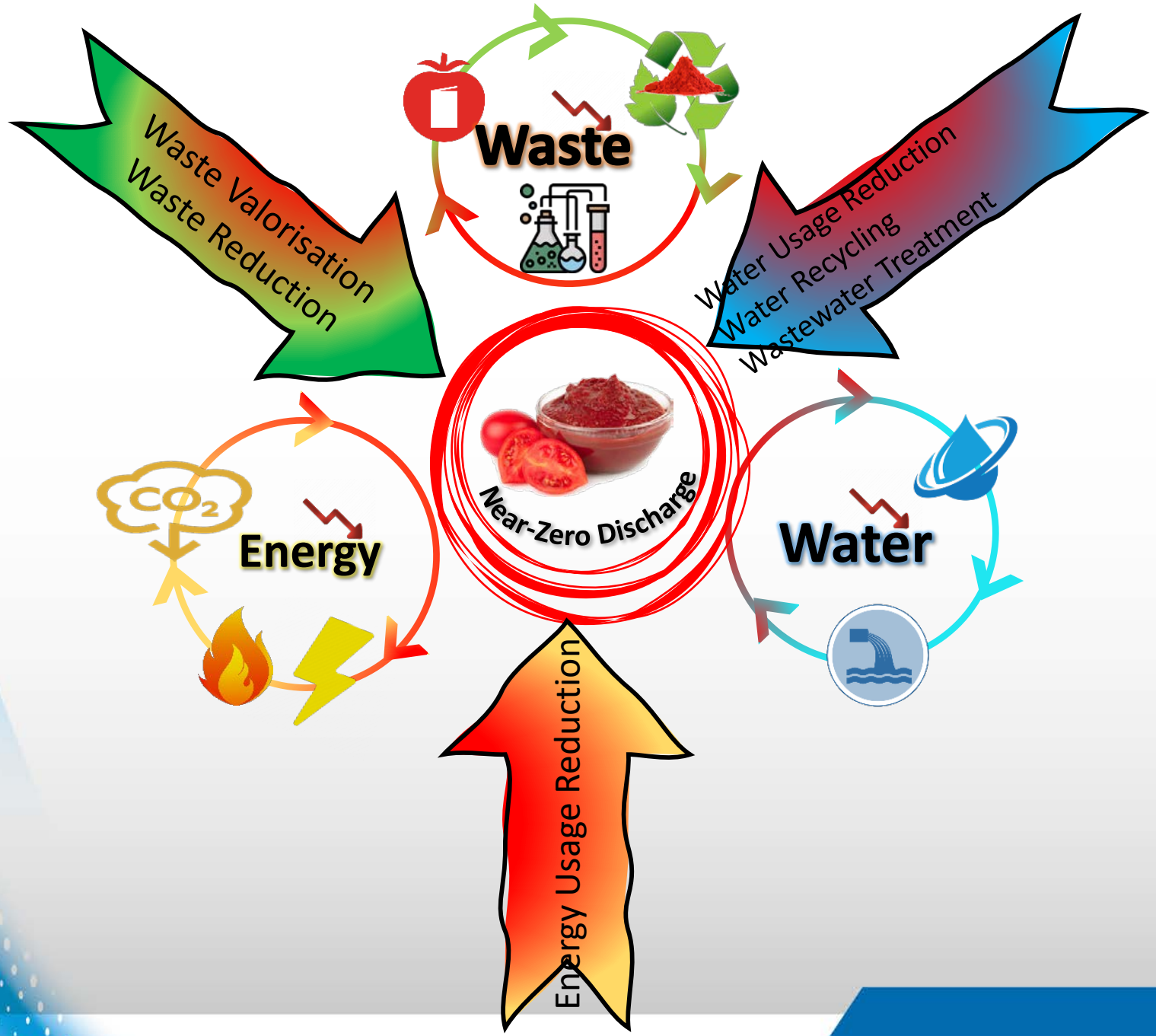

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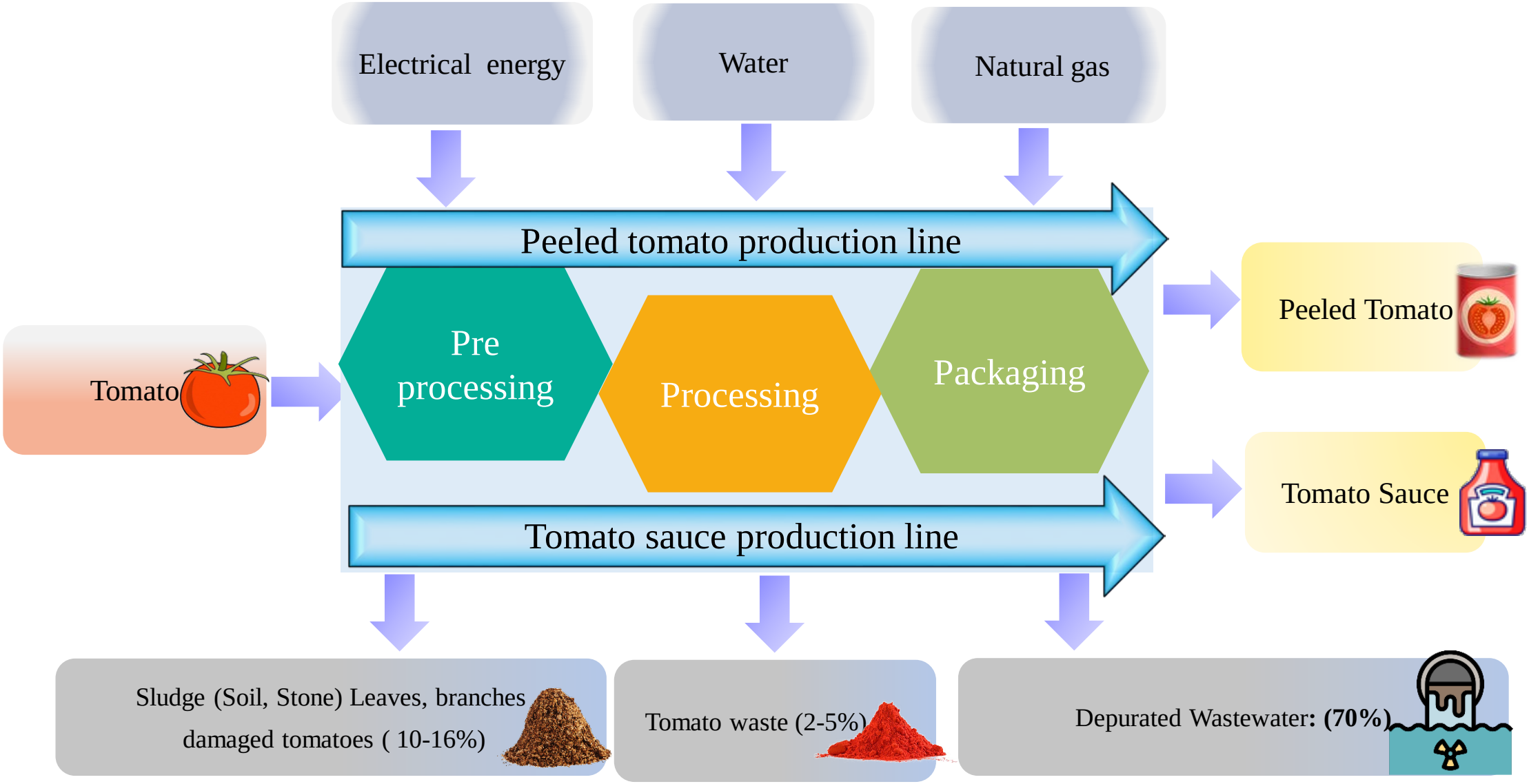
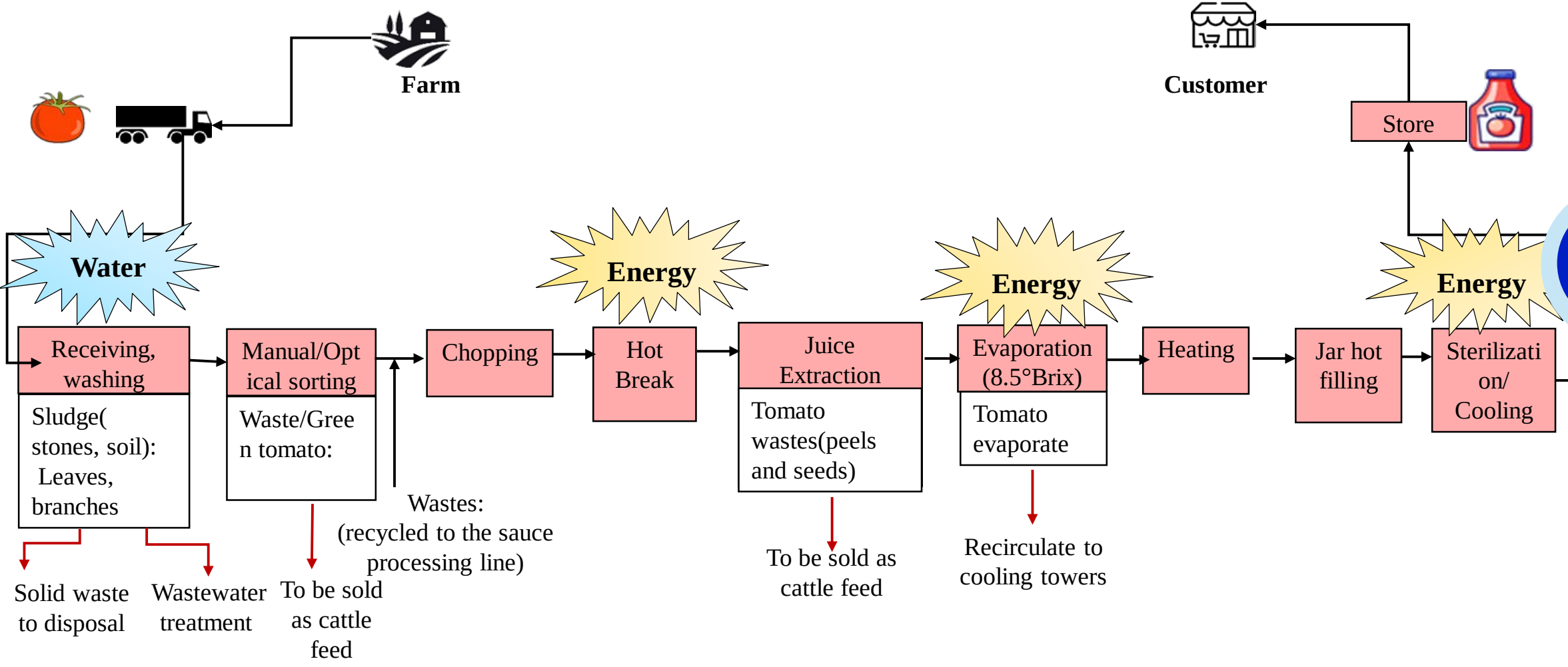
Company Workflow



Current Value Stream Map of Tomato Sauce Production



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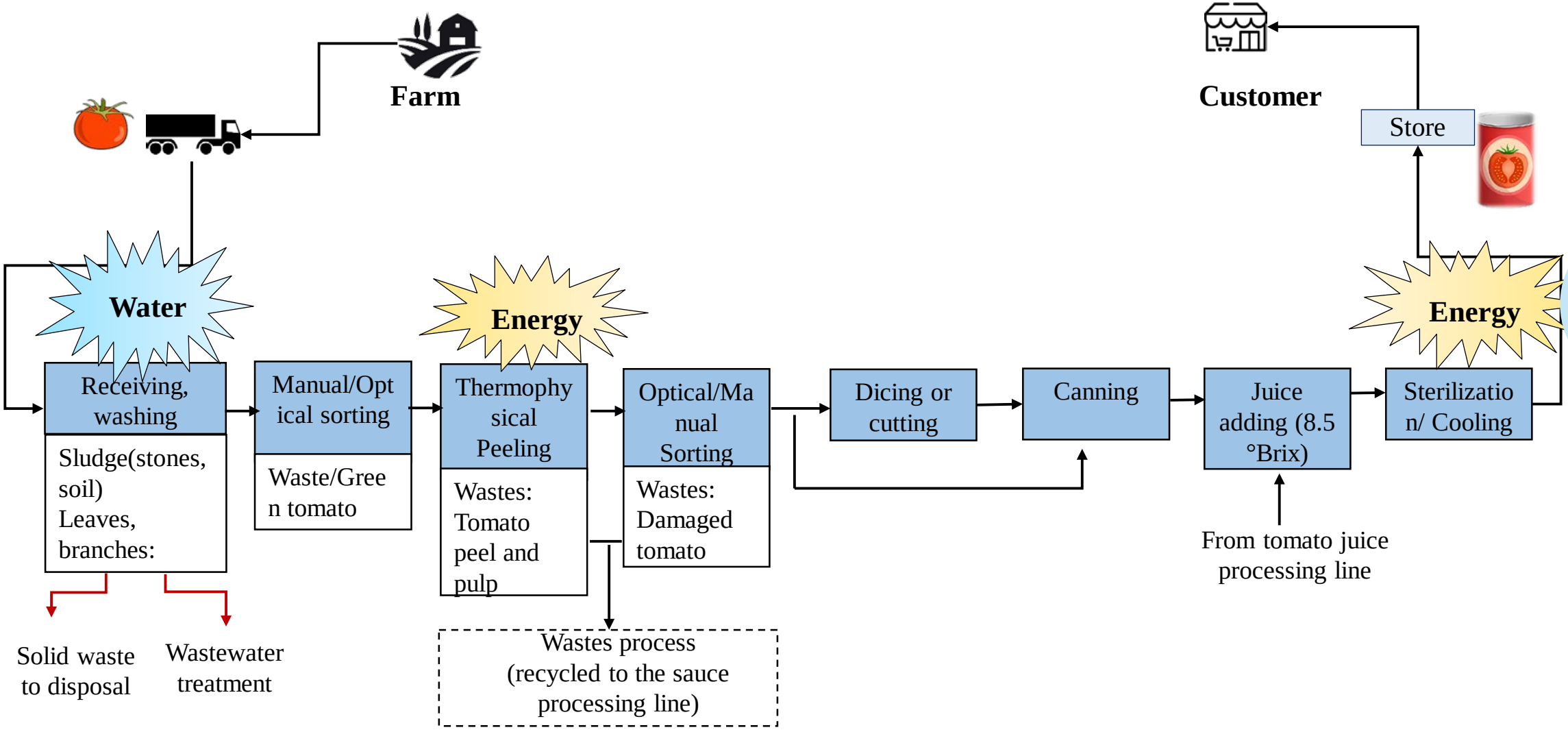
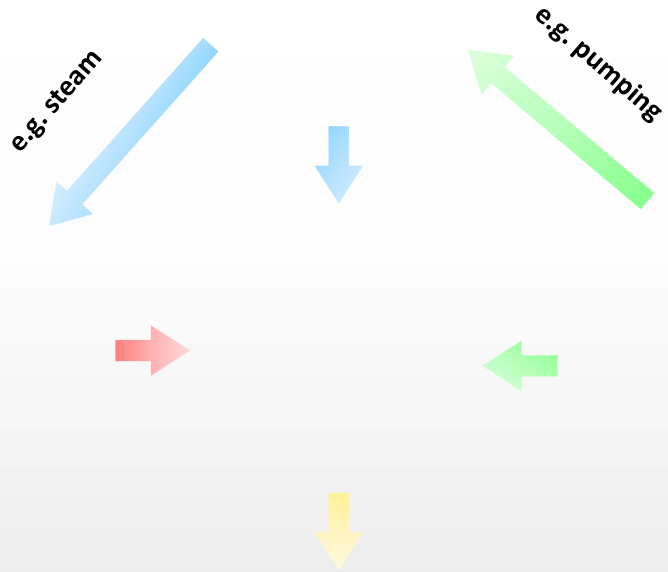
Current Value Stream Map of Peeled-Tomato Production

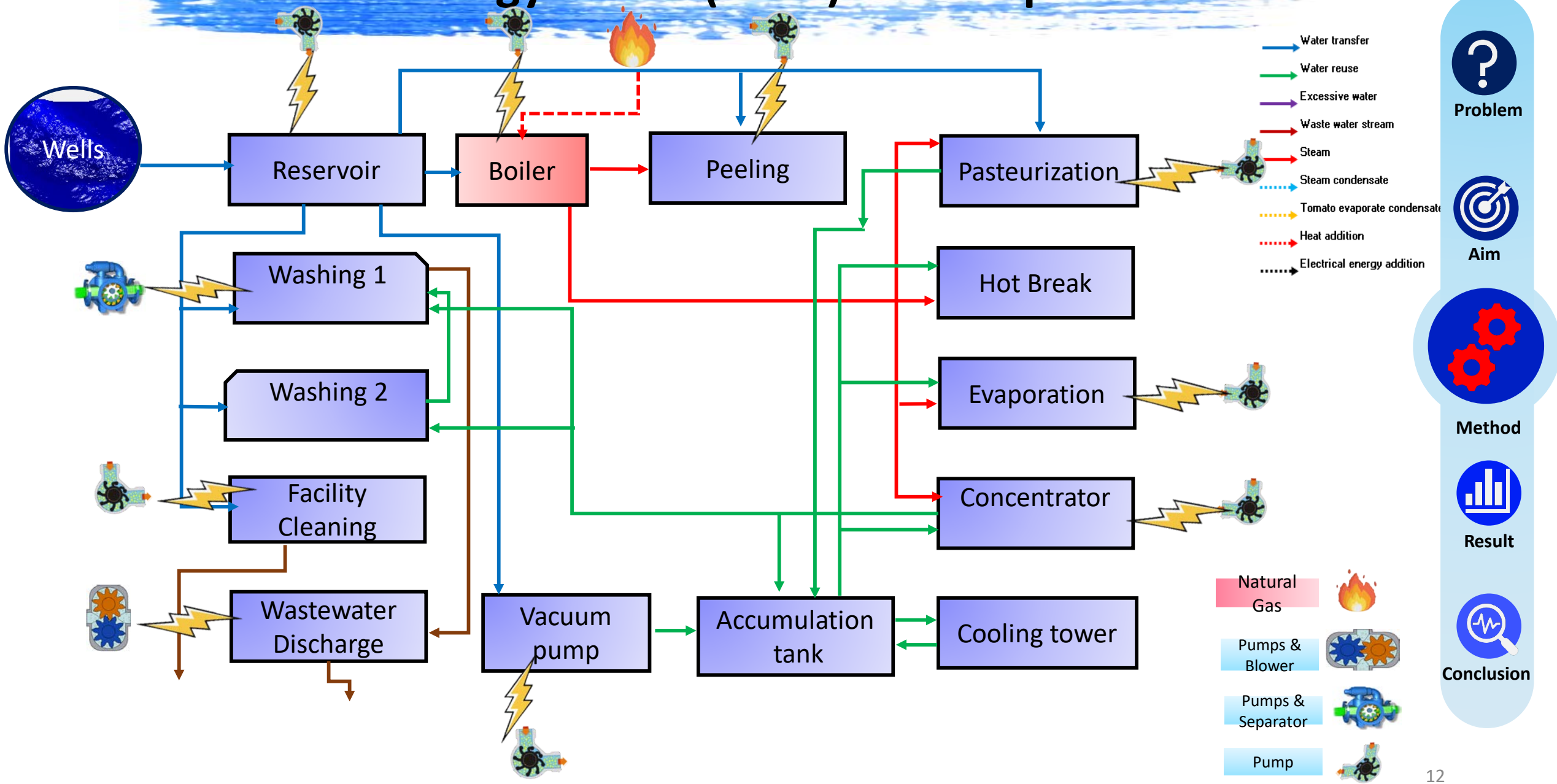


Water-Energy Nexus (WEN) concept

Water and energy consumption are often linked, energy is required to transport, heat, and cool water, and water in the form of steam is used to generate energy. These relationships are termed the water-energy nexus (WEN).



Water-Energy Nexus (WEN) & WEN points



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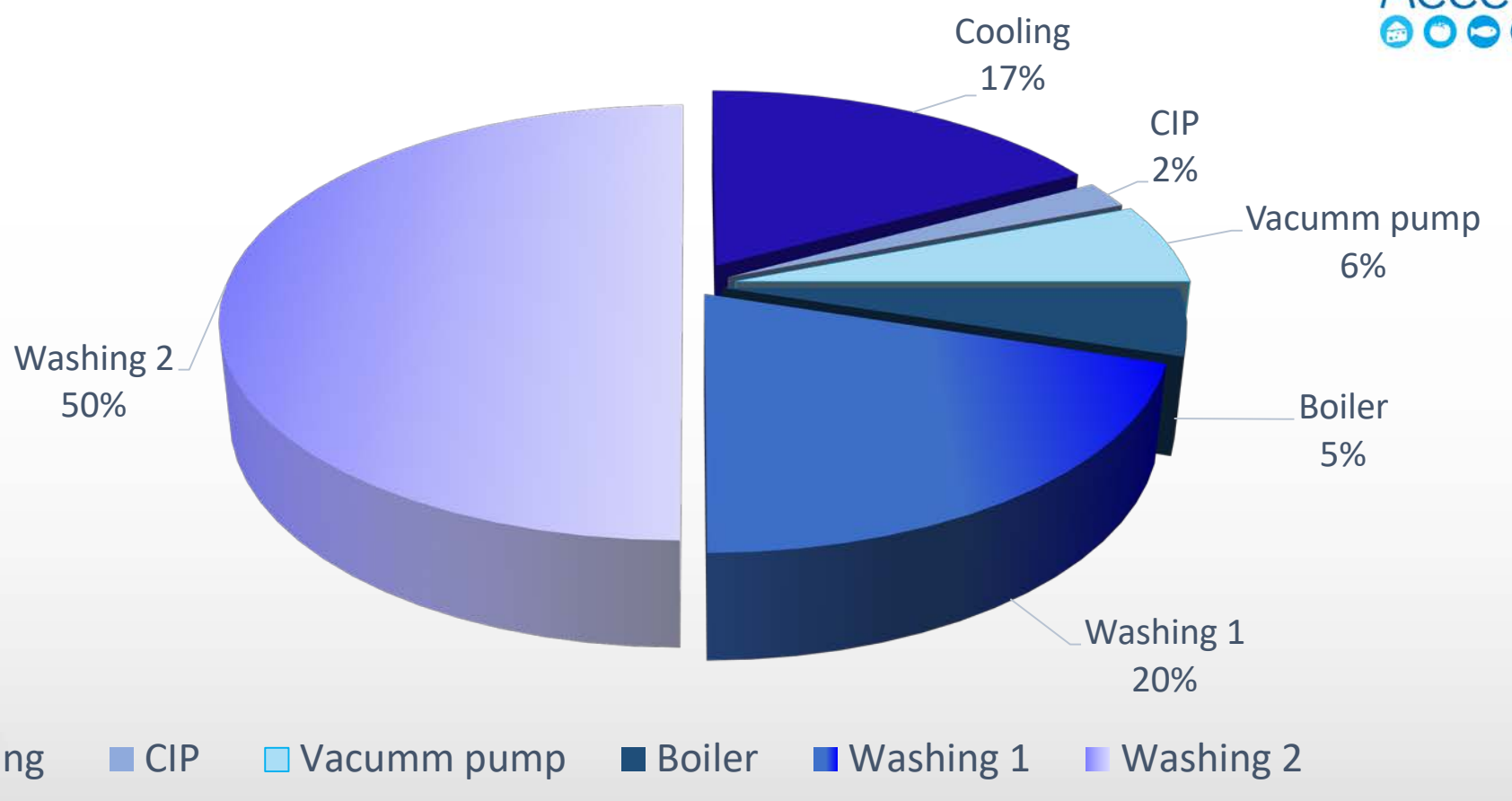
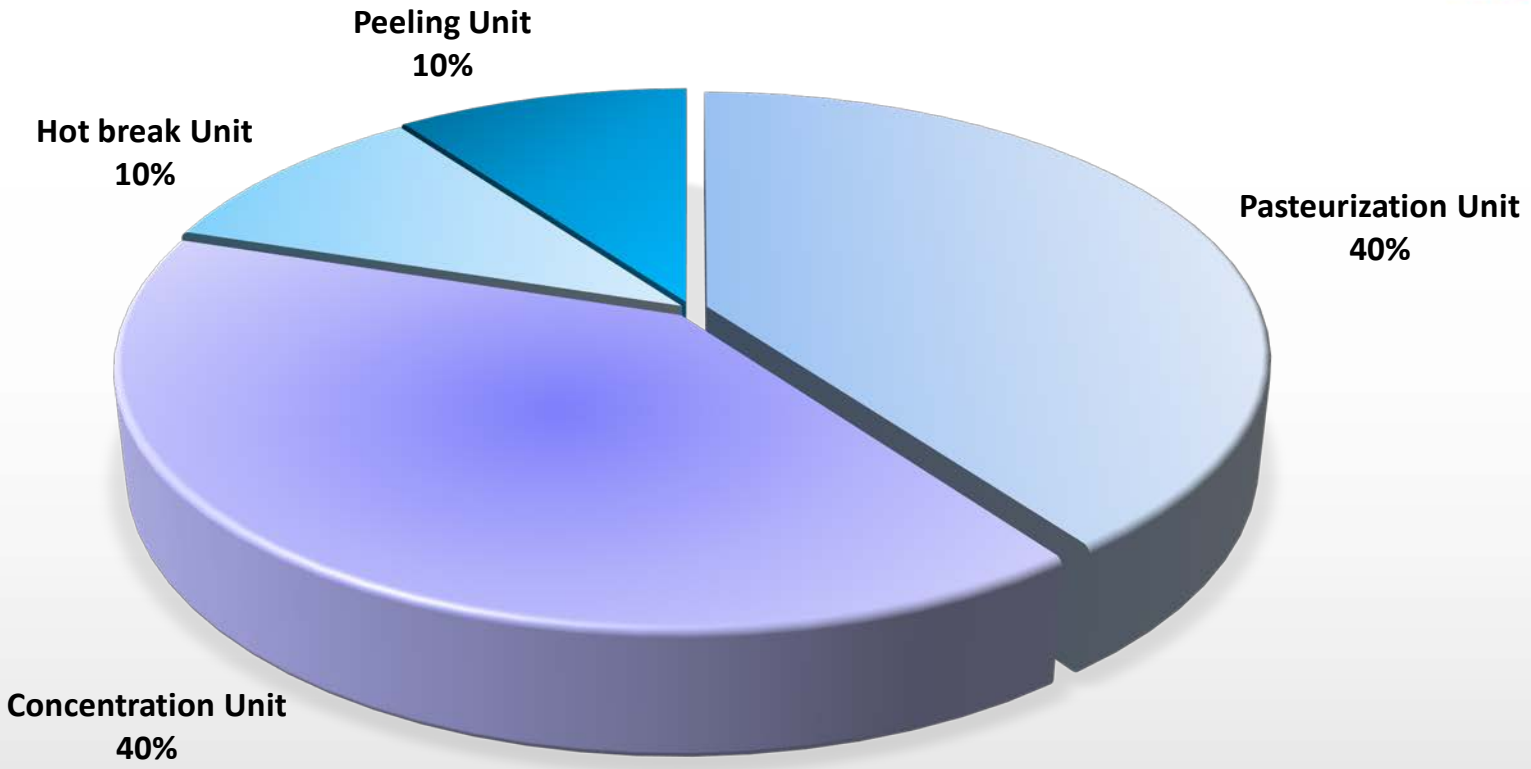
Water Usage


Cooling
17%
CIP
2%
Vacumm pump
6%
Boiler
5%
Washing 1
20%
Washing 2
50%
Cooling
CIP
Vacumm pump
Boiler
Washing 1
Washing 2

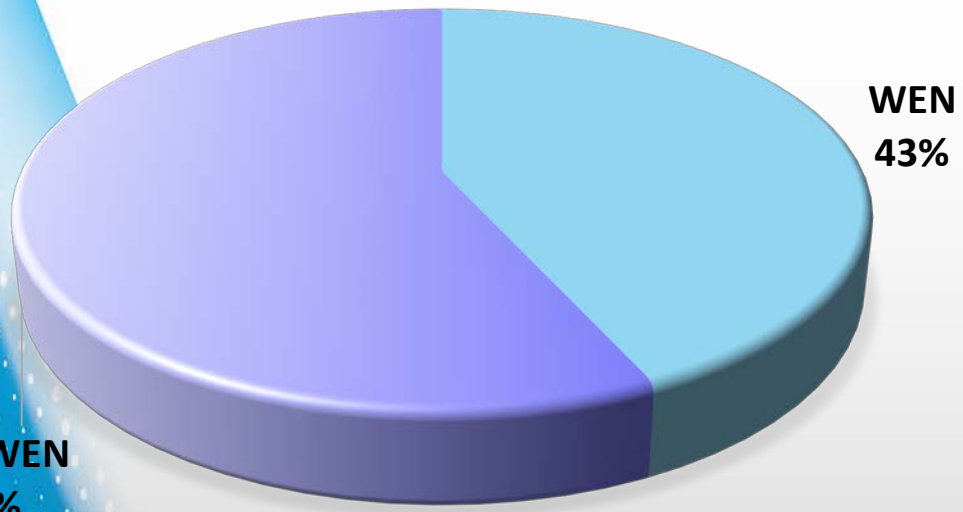
Thermal Energy Usage



Electrical Energy Usage

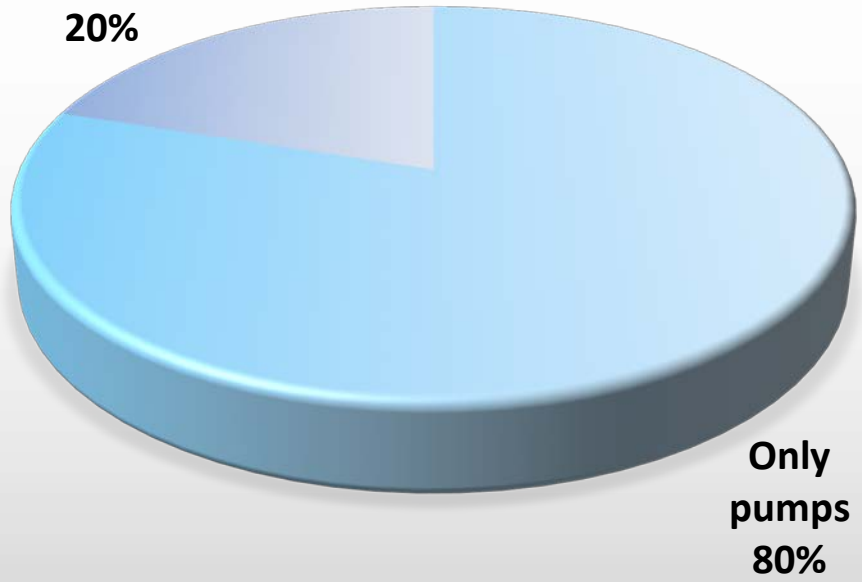
General Electricity Distribution

Electrical energy consumption in WEN and non WEN points

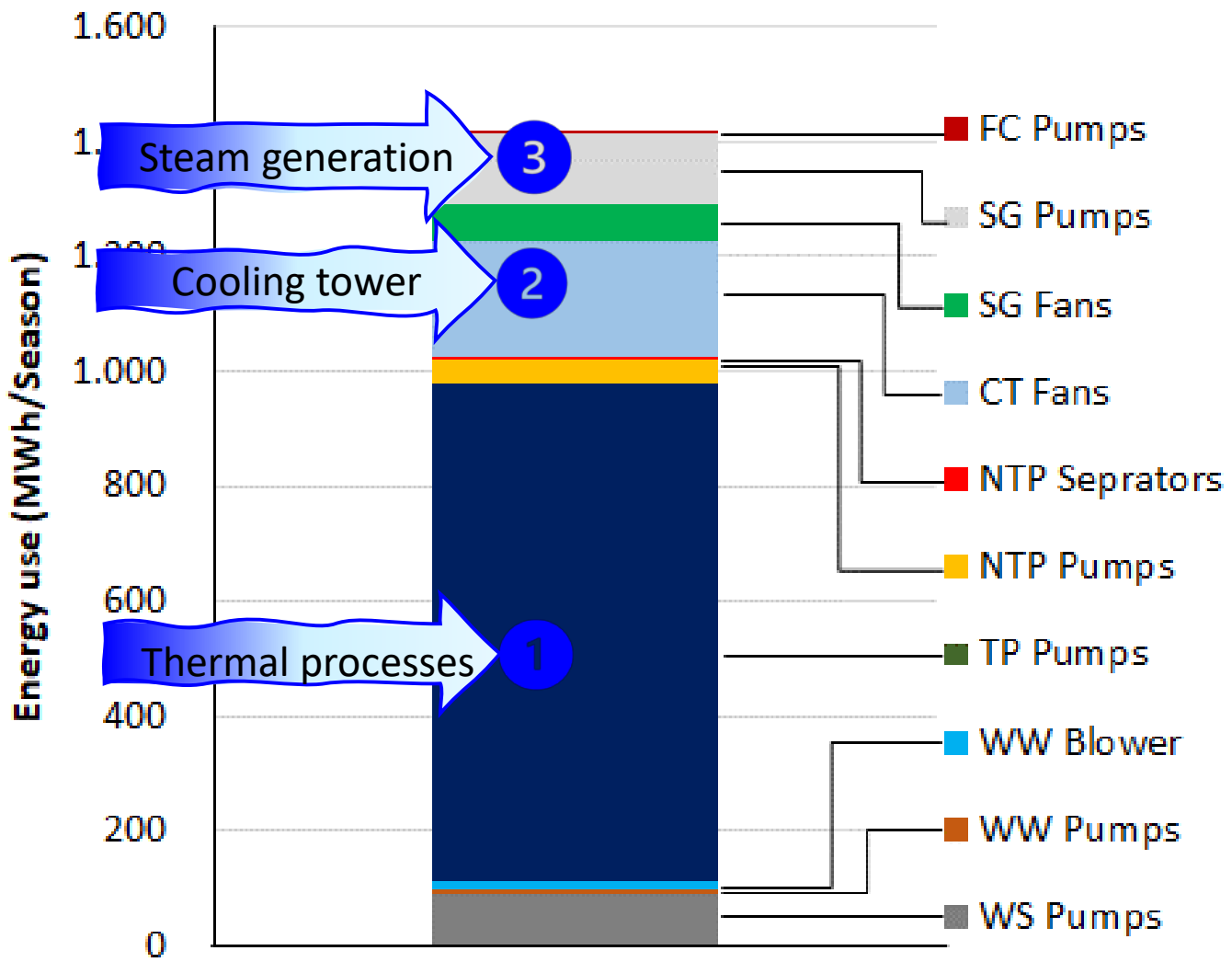


Electricity Distribution for WEN

Most Consuming Energy in WEN points



Electricity Distribution In WEN



- WS= Water supply
- WW = Wastewater
- FC = Facility cleaning
- NTP = Non-thermal processes
- TP = Thermal processes
- CT = Cooling tower
- SG = Steam generation

Life Cycle Assessment (LCA) Of The Tomato Processing Industry

Scope From gate to gate of tomato processing

Unit Function A can of peeled tomato (500 gr)
A bottle of tomato sauce (540 gr)

Goal Environmental impact of tomato processing

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Environmental Impact

A can of peeled tomato (1 kg)

Global warming: eq0.513 kg CO_2

A bottle of tomato sauce (1 kg)

Global warming: eq 0.47 kg CO_2

- Climate Change
- Material use
- Carcinogen
- Ozon layer
- Radiation
- Land use
- Ecotoxicity
- Acidification
- Eutrophication
- Fossil fuel
- Minerals

Human health

Ecosystem

Resources

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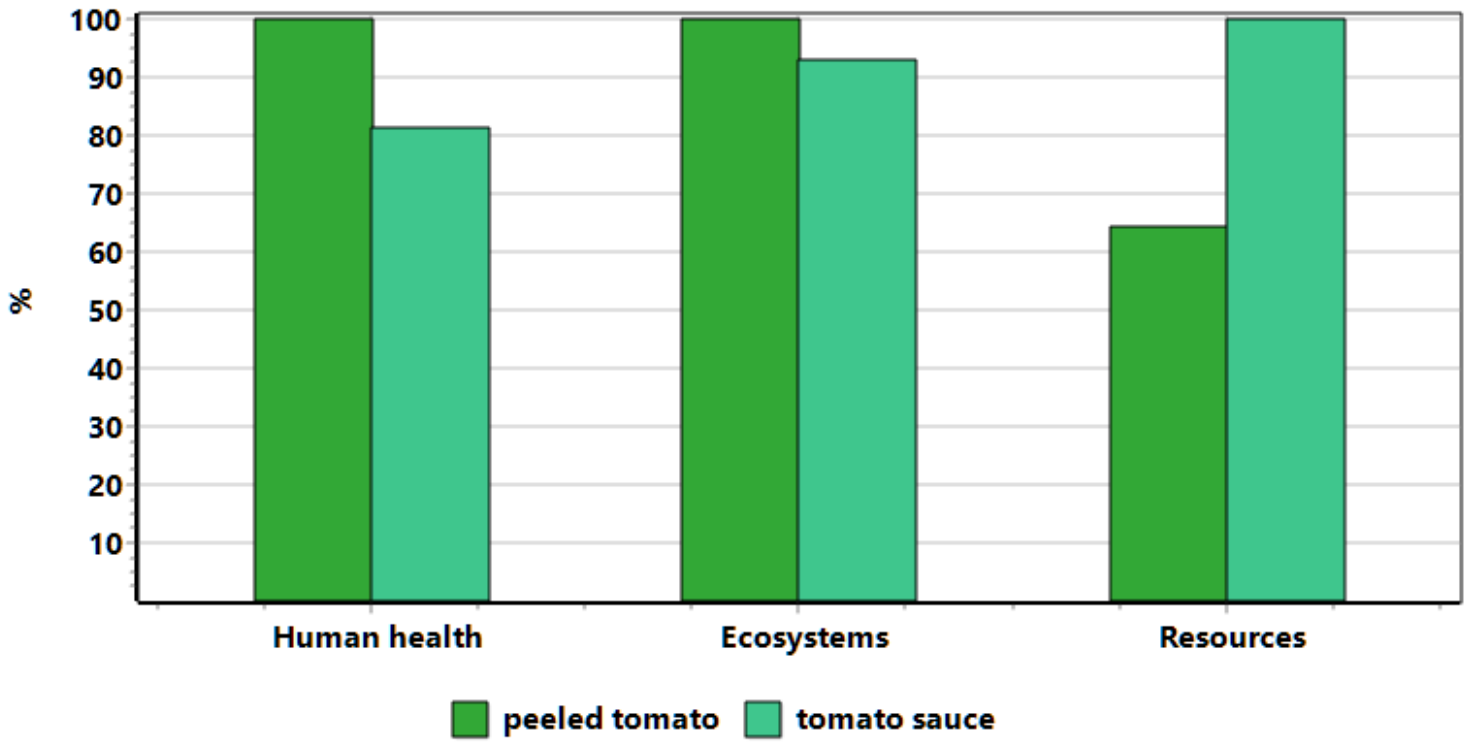
Comparison Between Peeled Tomato And Tomato Sauce LCA



Method: ReCiPe 2016 Endpoint (E) V1.03 / World (2010) E/A / Damage assessment
Comparing 1 kg 'peeled tomato' with 1 kg 'tomato sauce';

Critical Points In Tomato Processing Industry

1. **Most Water Demanding**
   Washing phase consume 70% of total water
2. **Most Thermal Energy Demanding**
   Pasteurization and evaporation 80%
3. **Most Electrical Energy Demanding**
   Pumps consume 80% of the electricity in WEN points
4. **LCA**
   Packaging has the highest environmental impact (more than 90%)

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Thank you for your attention

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