INL/EXP-22-65709-Revision-0



# Applying existing methods from other industries to decarbonize food processing

February 2022

Ruby Thuy Nguyen, Md Mamunur Rahman, Damon S Hartley, Michael H Severson, Yingqian Lin

Changing the World's Energy Future

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# Applying existing methods from other industries to decarbonize food processing

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**February 2022**

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**U.S. Department of Energy**
**Under DOE Idaho Operations Office**
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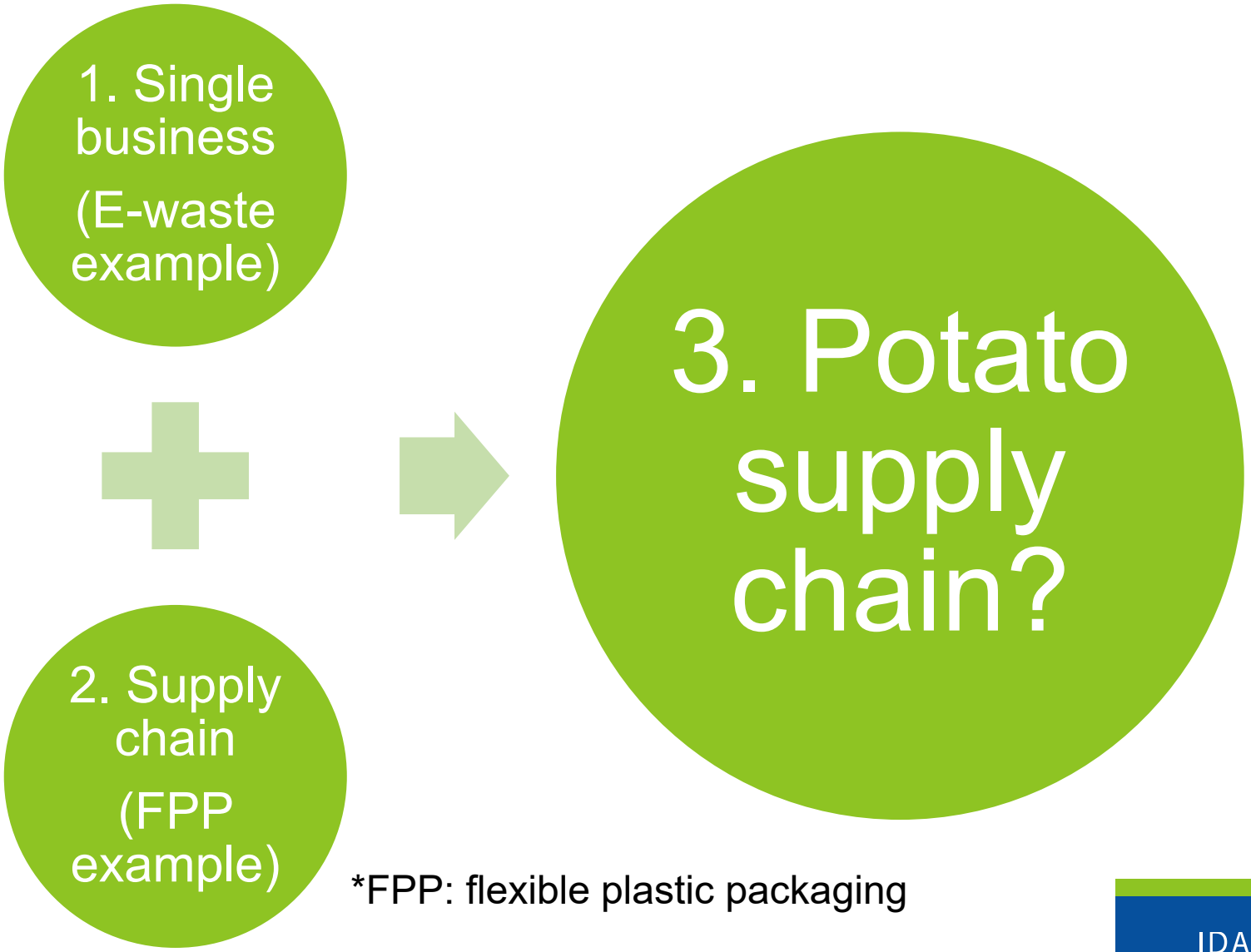
# Applying existing methods from other industries to decarbonize food processing

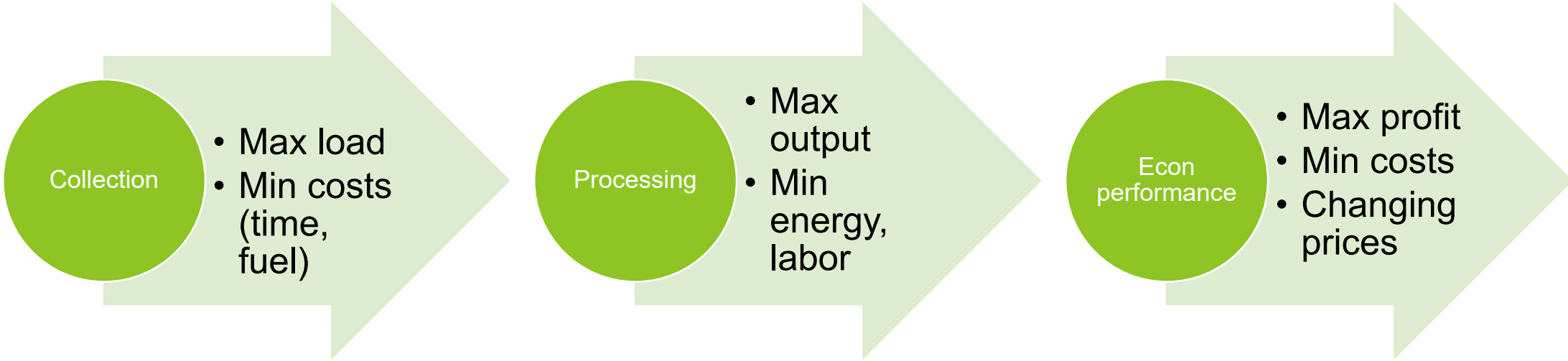
# Two levels of decarbonization




*FPP: flexible plastic packaging

# 1. Decarbonizing a single business

## Manufacturing industry: e-waste example

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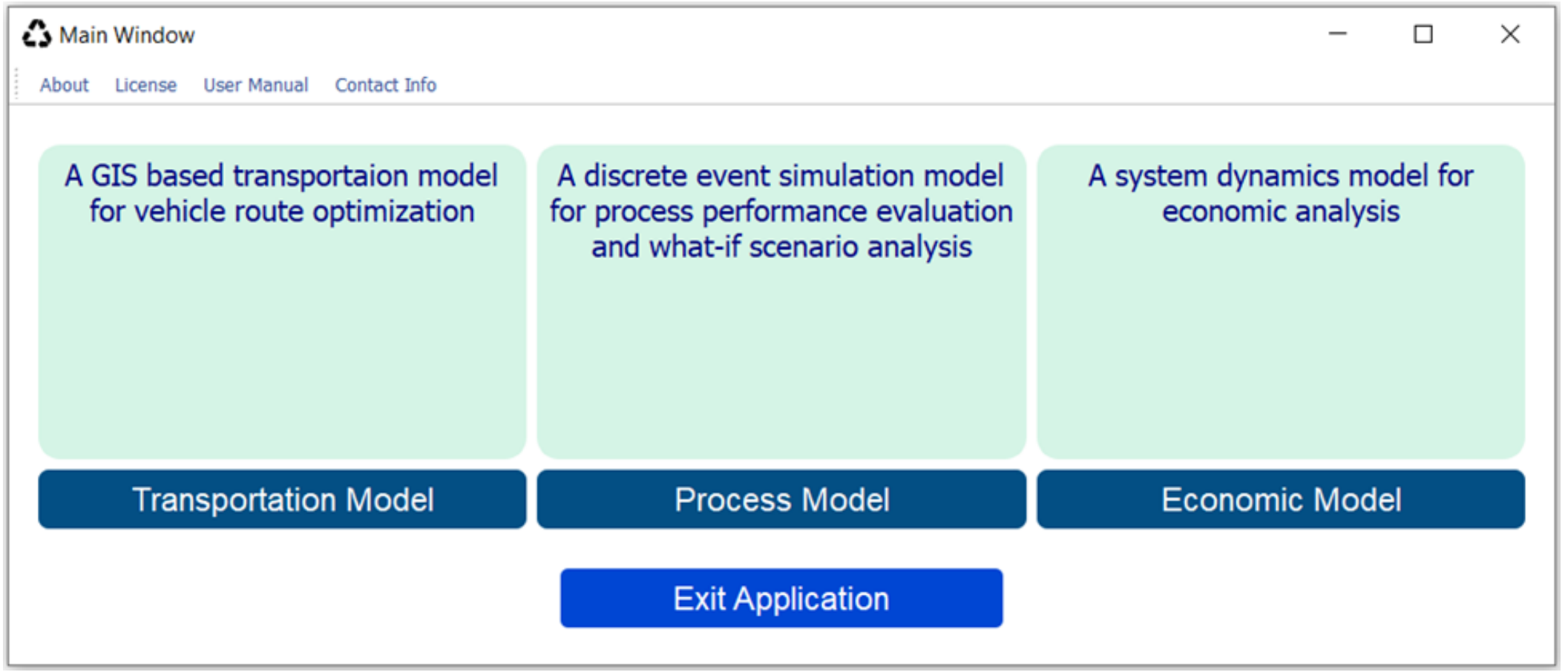
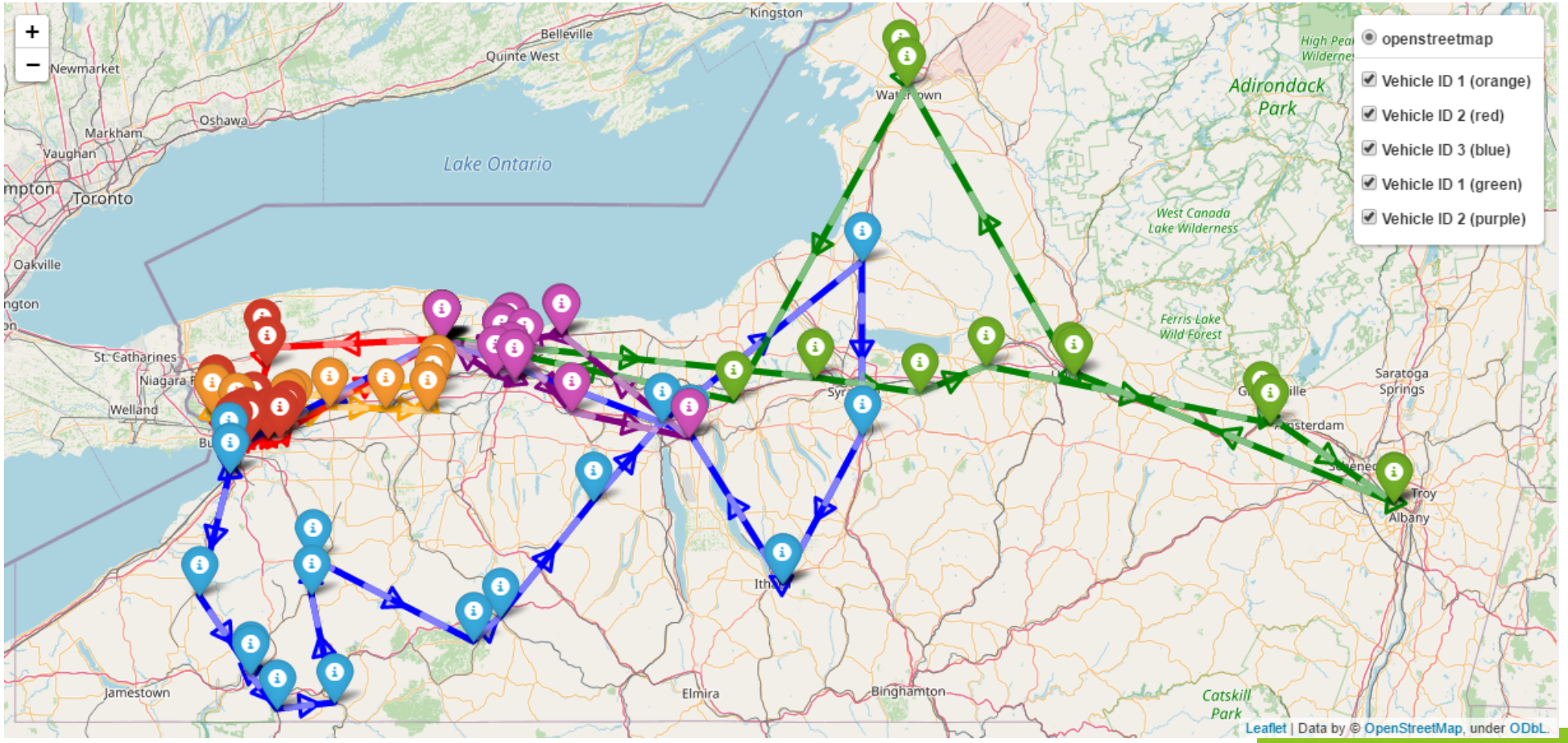
# 1. Decarbonizing a single business

Application interface, Python based



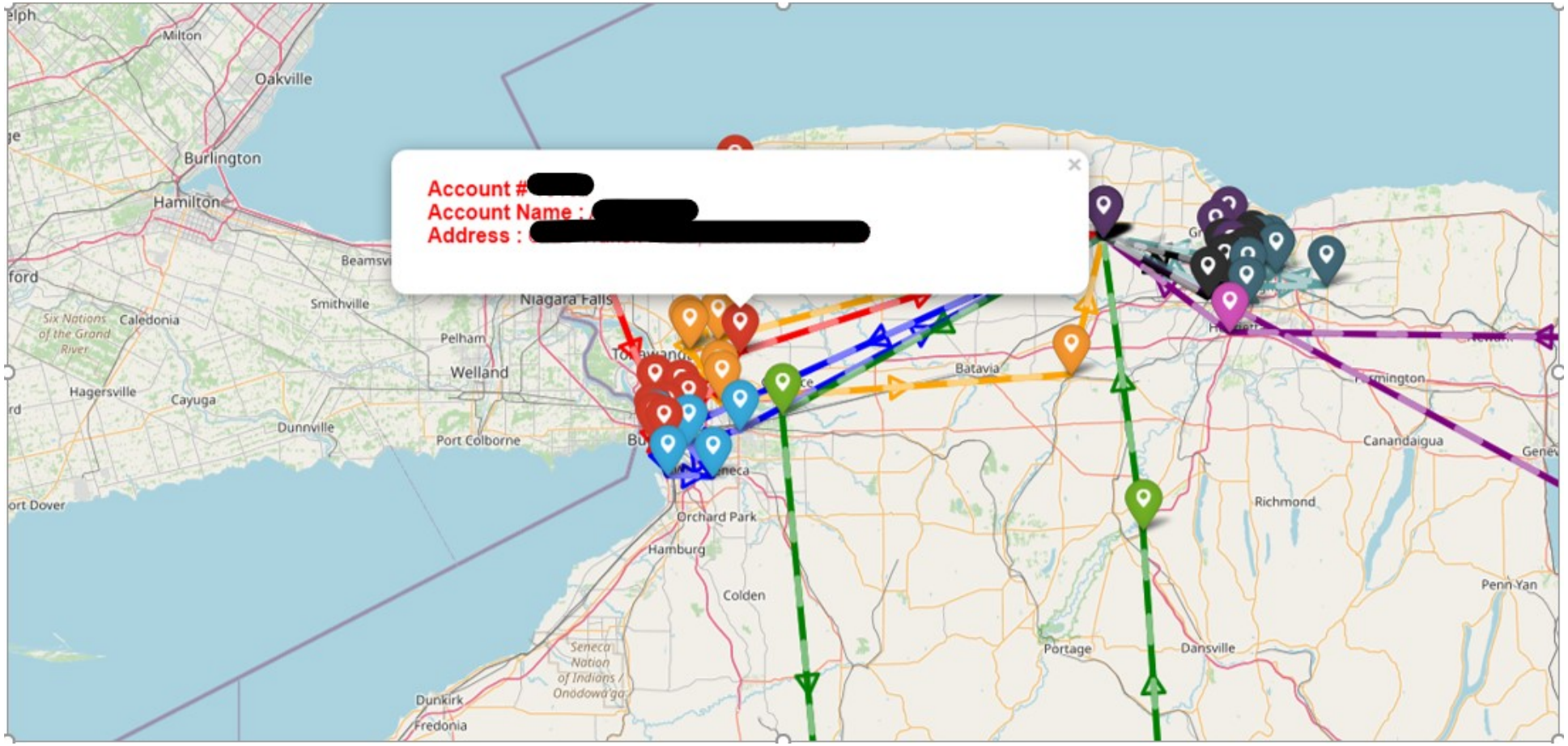
# 1. Decarbonizing a single business

## 1.1 Transportation module: minimize time or distance



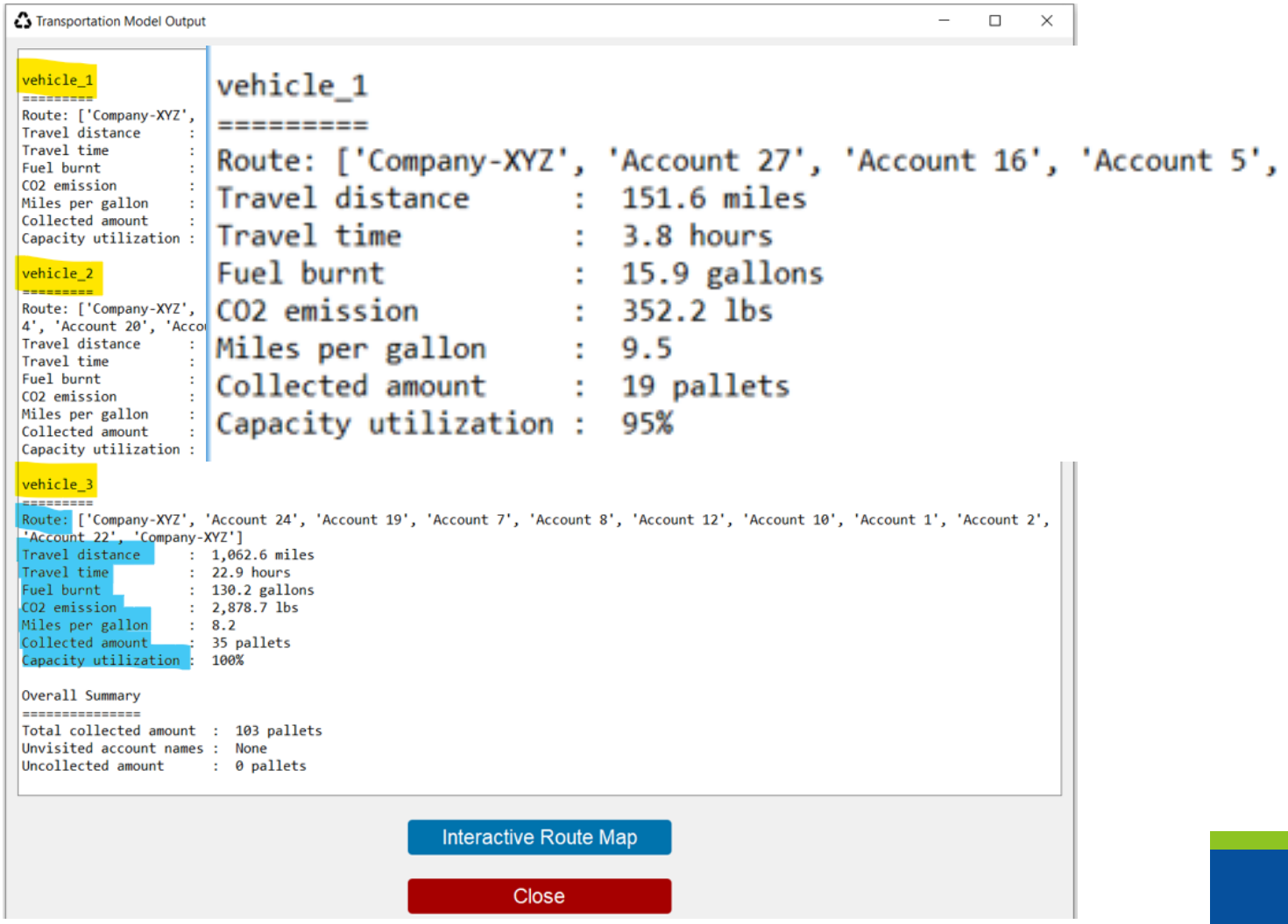
# 1. Decarbonizing a single business

## 1.1 Transportation module



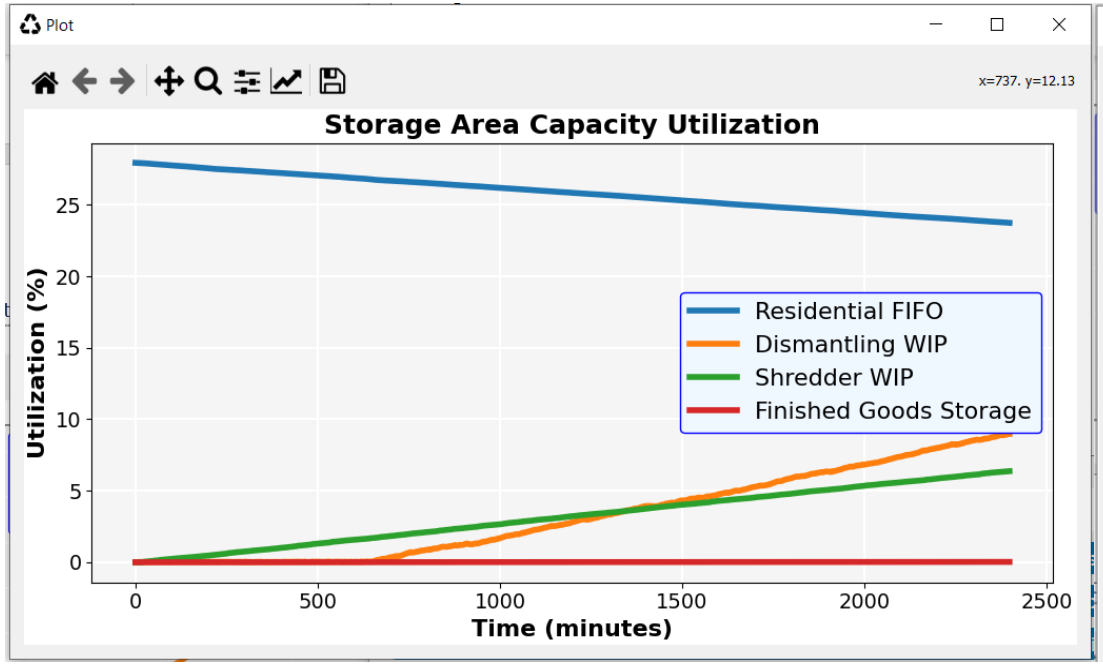
# 1. Decarbonizing a single business

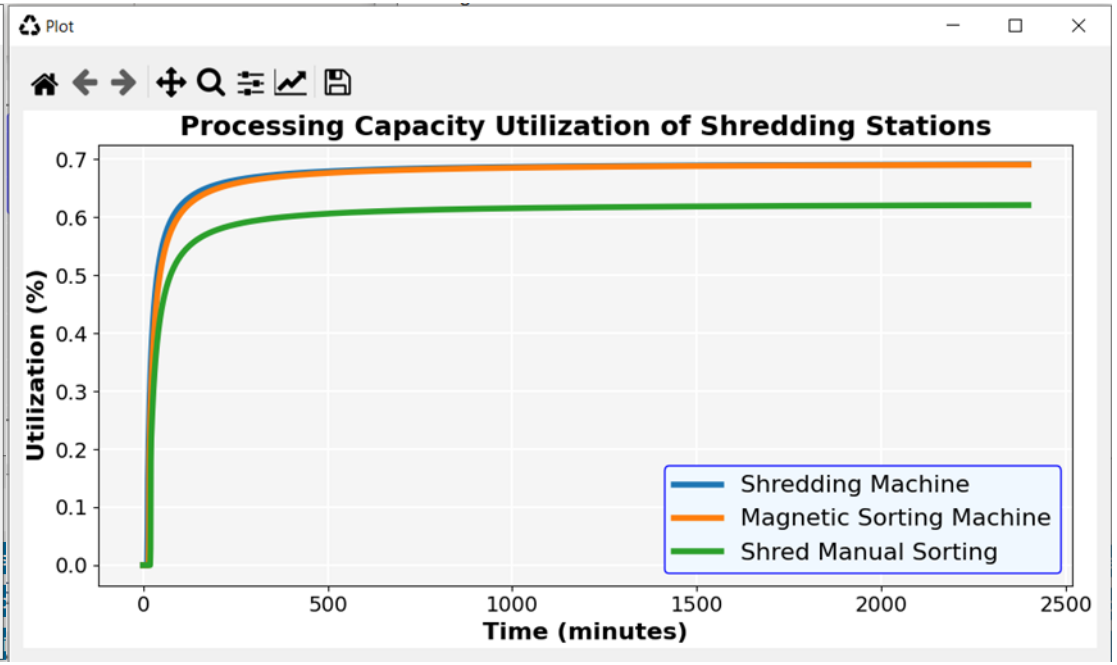
## 1.1 Transportation module



# 1. Decarbonizing a single business

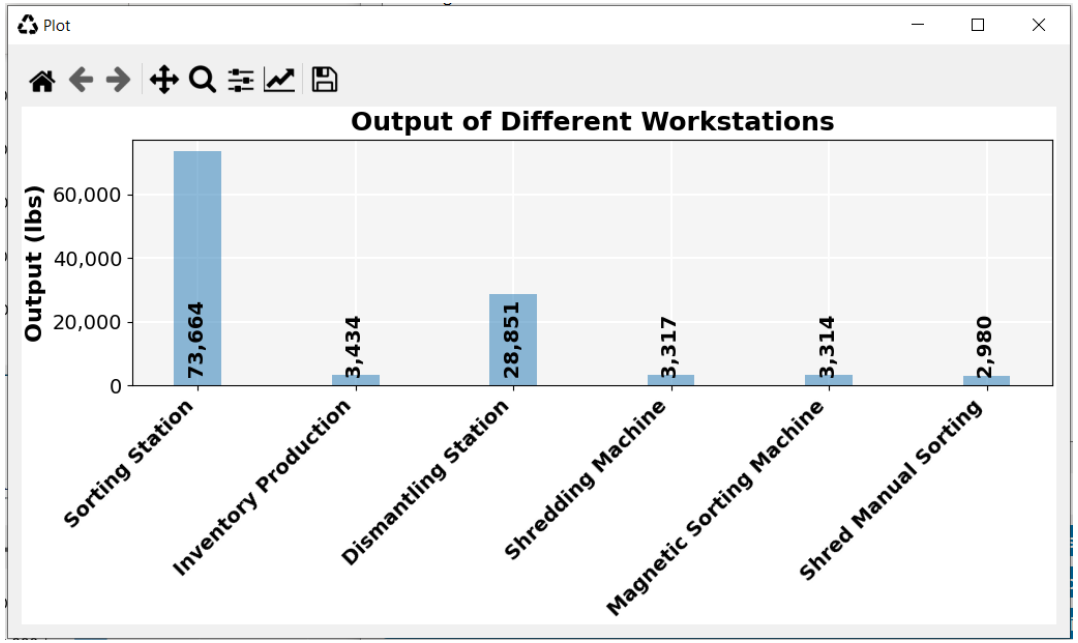
## 1.2 Process module: modularized, adaptable

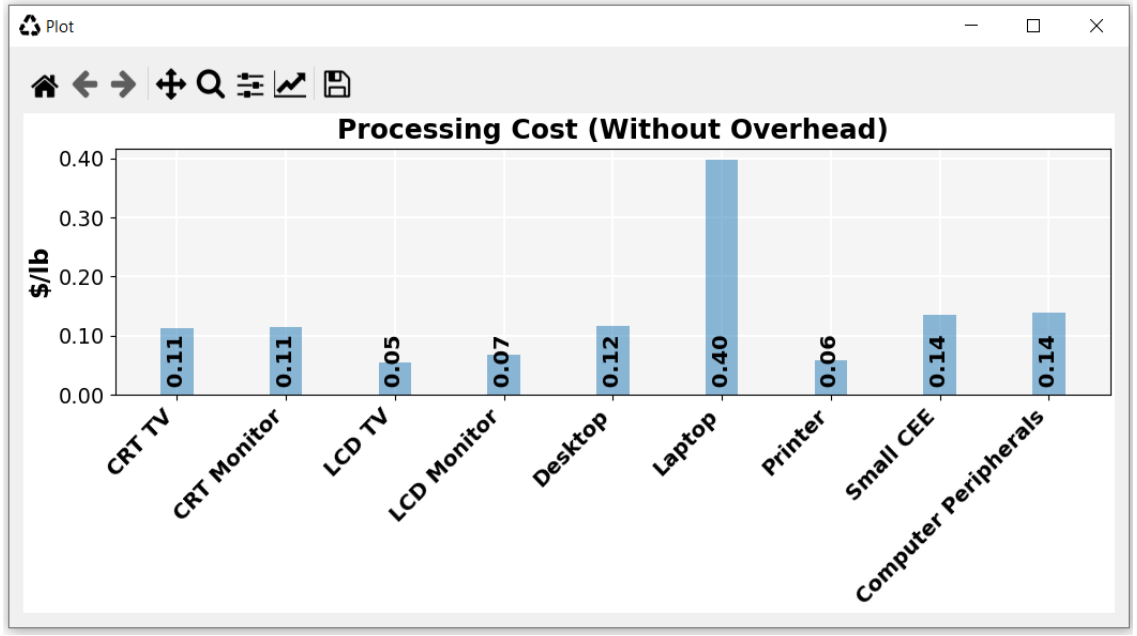


# 1. Decarbonizing a single business

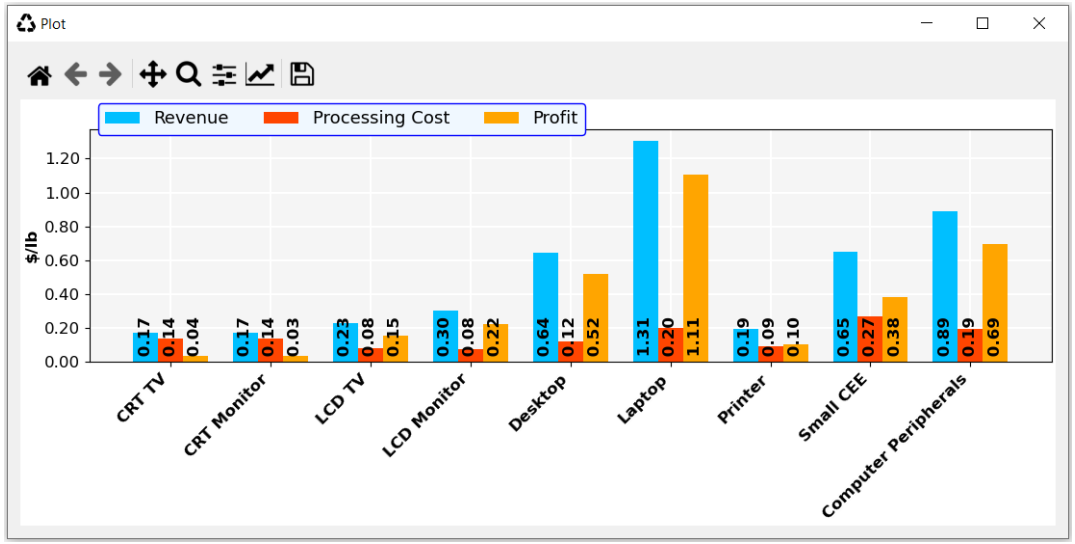
## 1.2 Process module

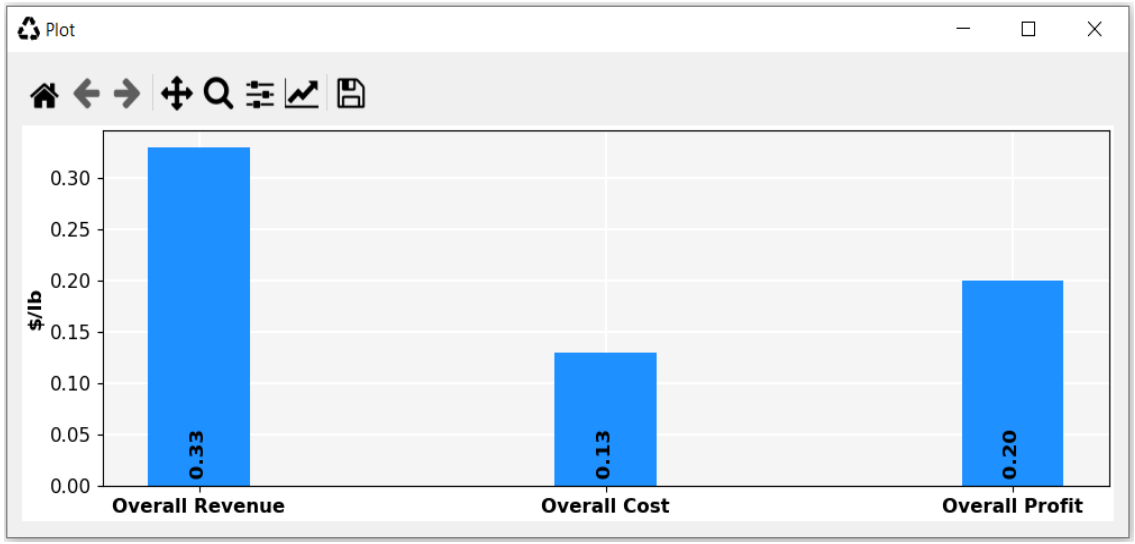


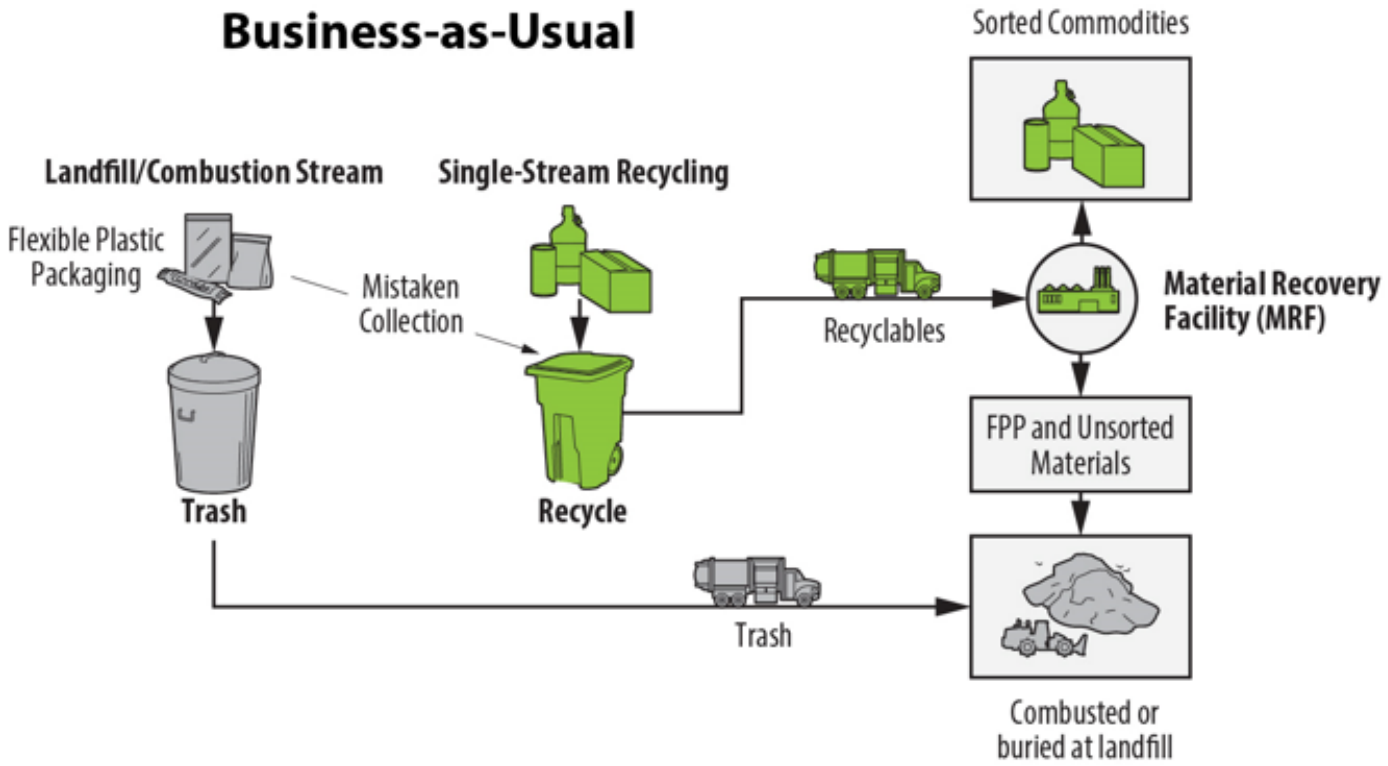
# 1. Decarbonizing a single business

## 1.3 Economic module

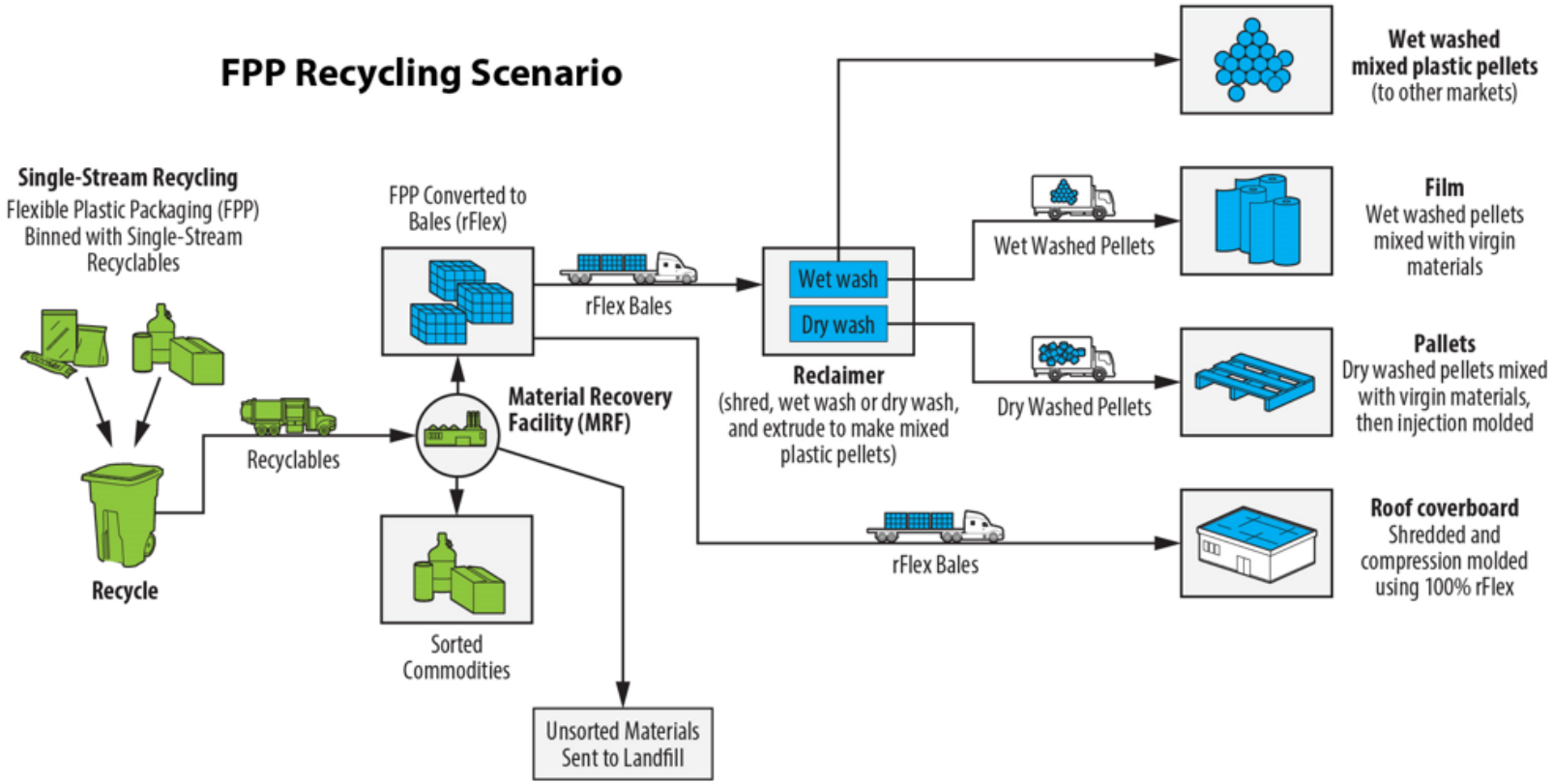


# 2. Decarbonizing a supply chain



# 2. Decarbonizing a supply chain

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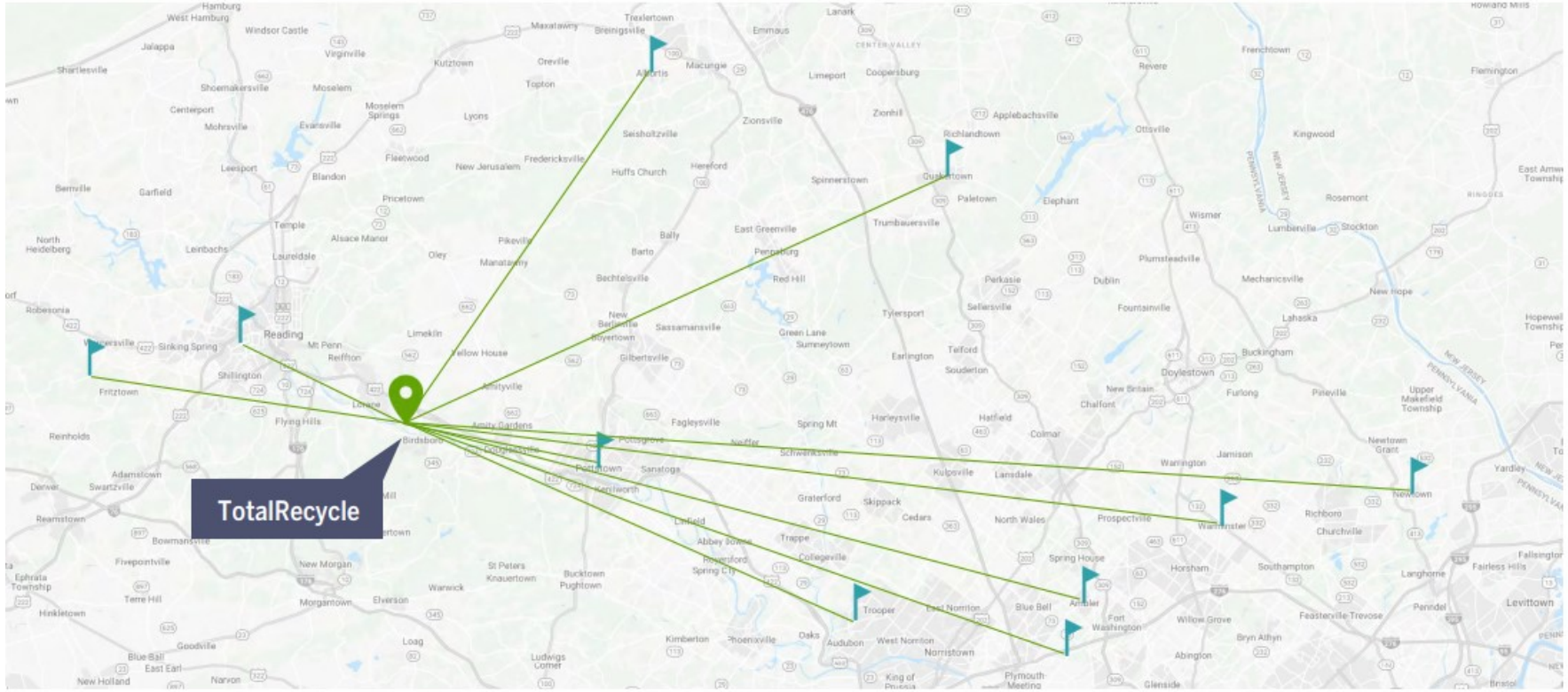
Research team American Chemistry Council RRS recycle.com TotalRecycle

# 2. Decarbonizing a supply chain

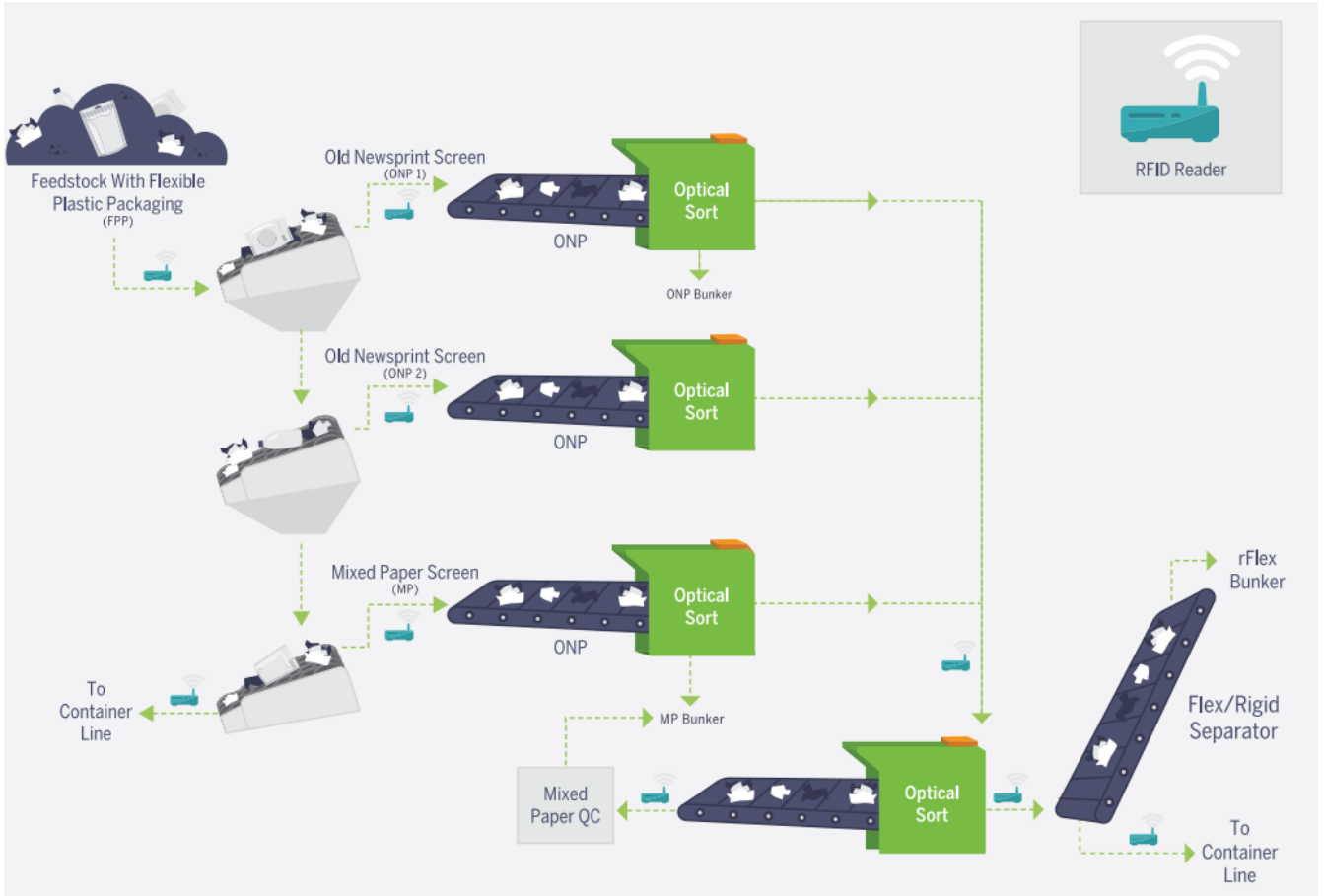
Pilot program: 10 municipalities, 5 counties, 56,915 households




Source: MRFF, 2020

# 2. Decarbonizing a supply chain

## Pilot program




Source: MRFF, 2020

# 2. Decarbonizing a supply chain

## Initial test results

EVERBOARD® roof board containing 25% rFlex (Source: MRFF, 2020)

# 2. Decarbonizing a supply chain

## Initial test results

Paver made from rFlex (Source: MRFF, 2020)

Shredded & pelletized rFlex (Source: MRFF, 2020)

# 2. Decarbonizing a supply chain

Research tools:

- Pilot testing
- Life cycle assessment
- Economic assessment

Other tools:

- Stakeholder engagement
- Awareness raising, enhanced communication
- Market development

# 2. Decarbonizing a supply chain

## Initial LCA analysis results

- All market pathways show positive results
- Decontamination process plays an important role in total environmental performance

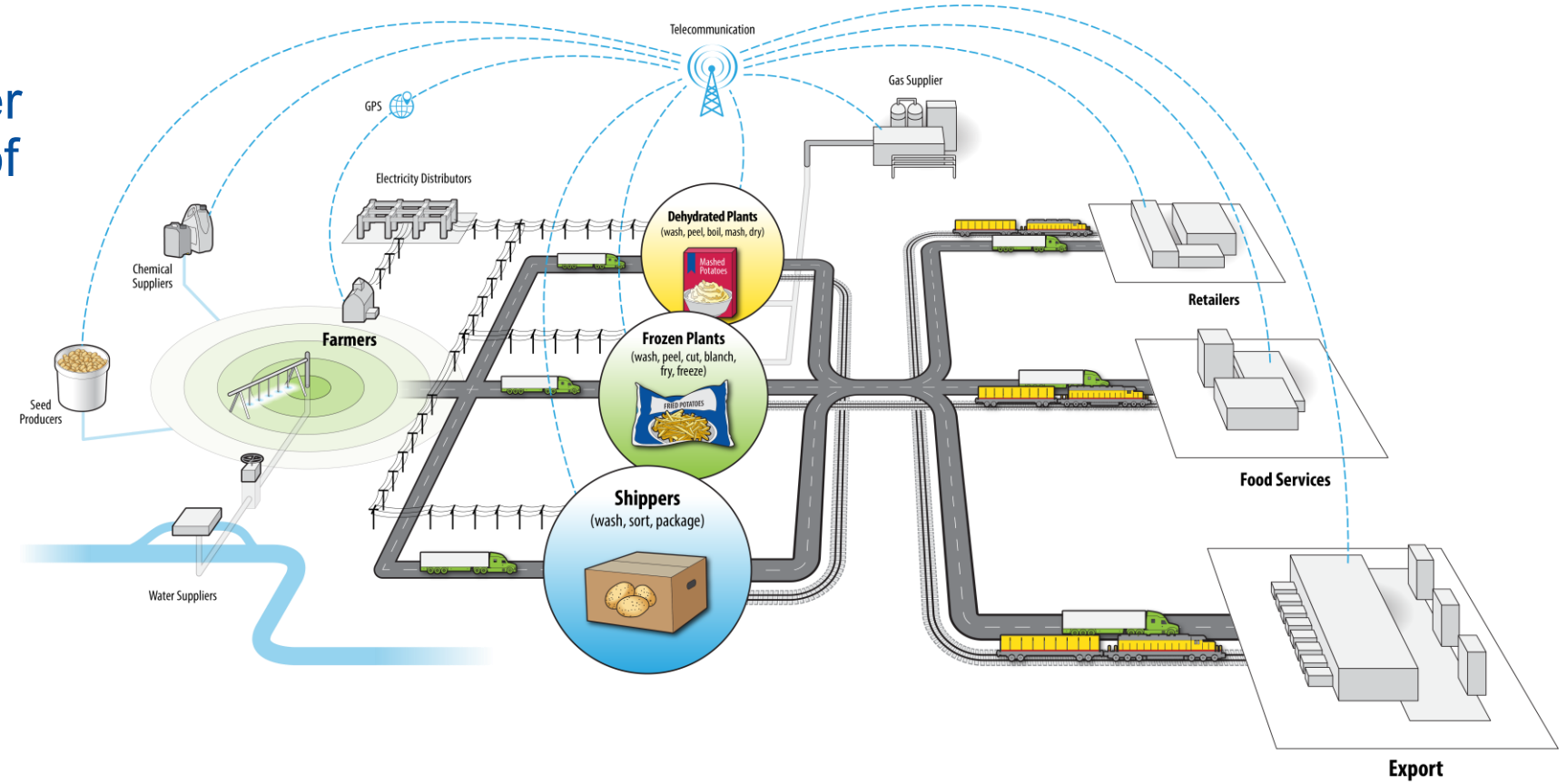
# 2. Decarbonizing a supply chain

## Initial economic analysis results

- Roof coverboard is the most promising pathway
- Most pathways are more economical than comparable products
- Downstream market development is critical to drive rFlex demand and capacity expansion

# 3. Decarbonizing the potato supply chain?

- Internal INL research, partner with University of Idaho
- Initial goal to understand supply chain resilience



# 3. Decarbonizing the potato supply chain?

**Year 1**
- Map the supply chain
- Examine demand disruption impacts

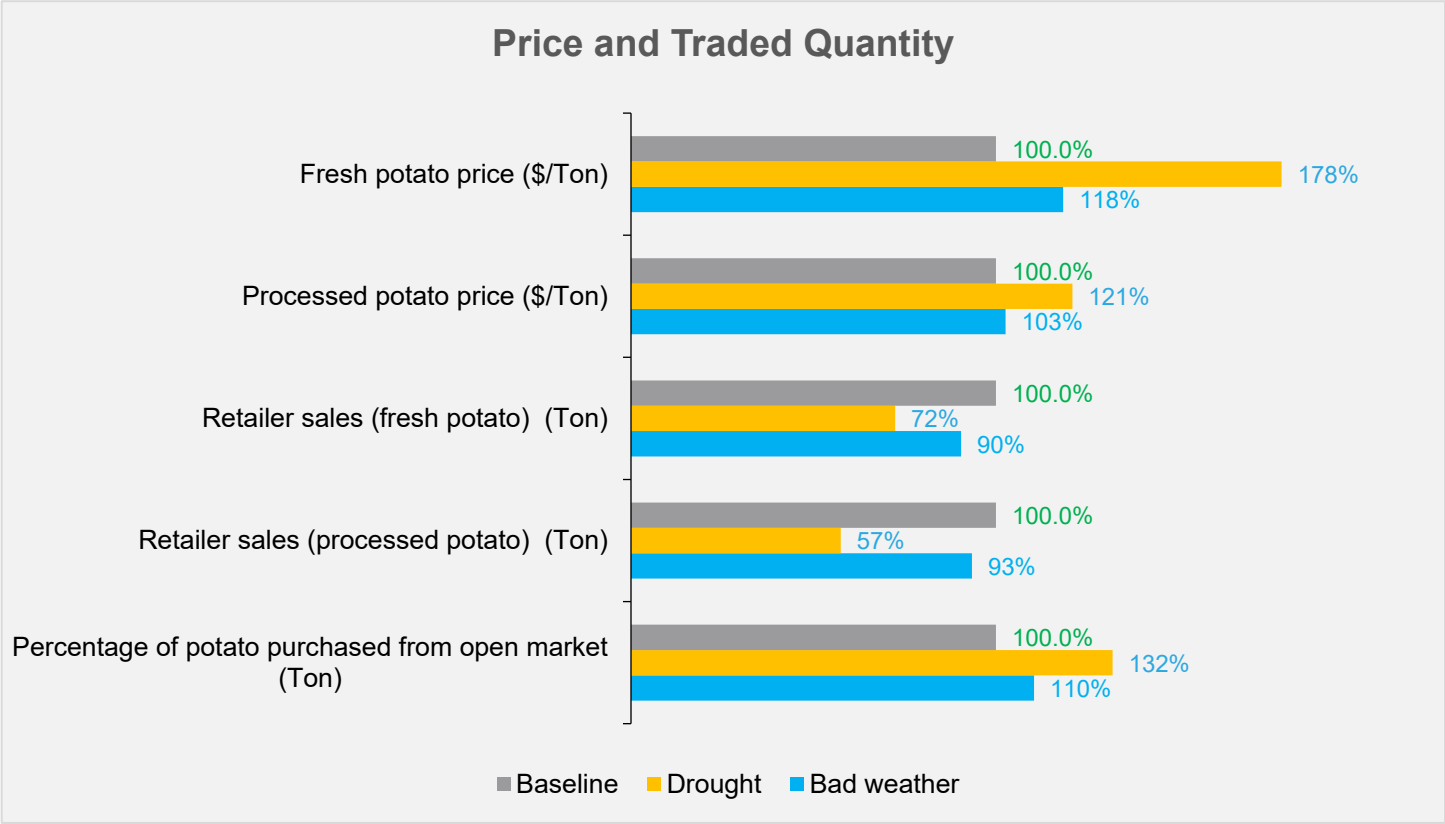
**Year 2**
- Examine supply disruption impacts
- Conduct risk analysis

**Year 3**
- Focus on manufacturing
- Connect infrastructure analysis & supply chain

# 3. Decarbonizing the potato supply chain?

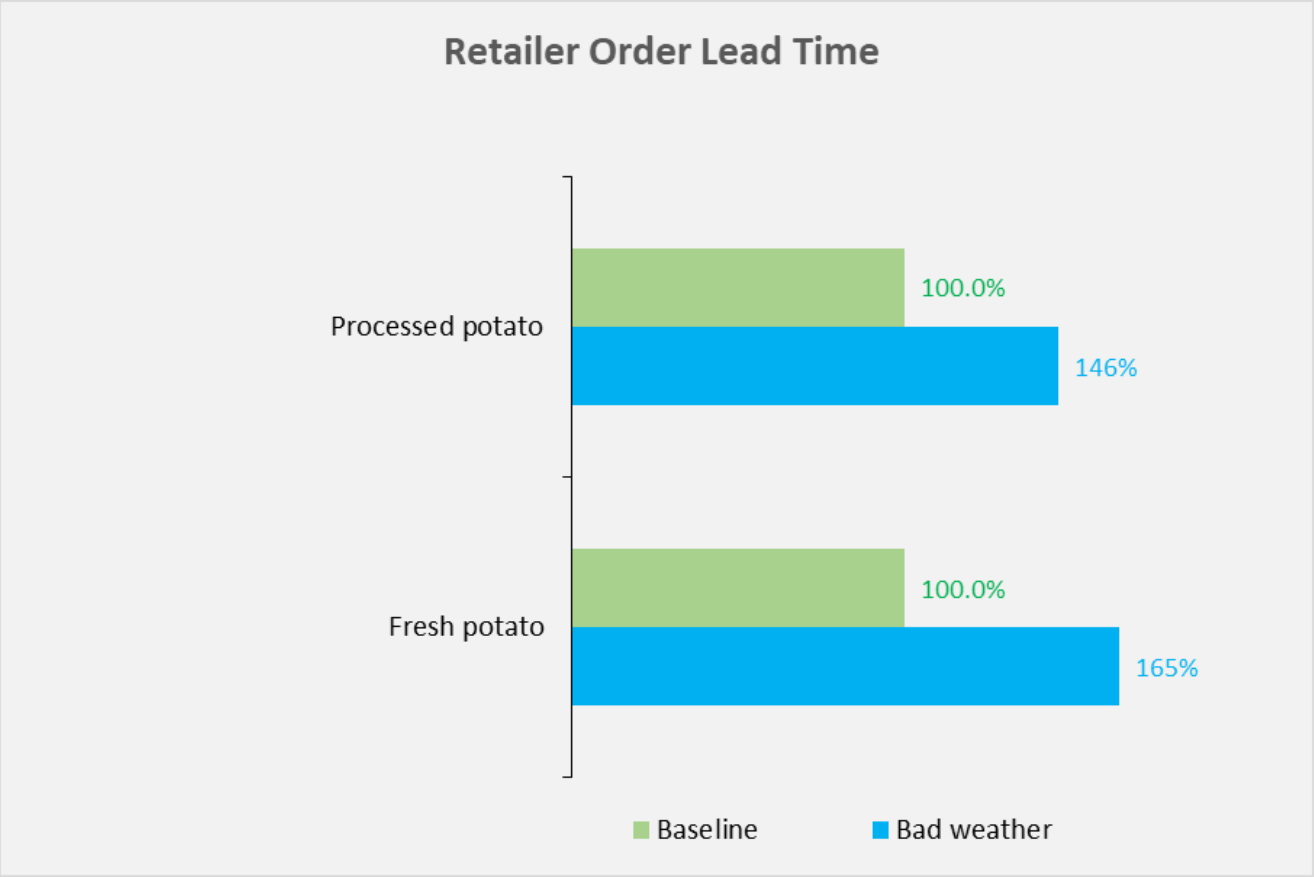
Initial results for supply disruptions:

1) Early frost in Oct  2) Severe drought, 50% less water



# 3. Decarbonizing the potato supply chain?

## Initial results for supply disruption: Early frost in Oct



# 3. Decarbonizing the potato supply chain?

- Potential approaches:
  - Optimize decarbonization at each stakeholder level
  - Optimize decarbonization at supply chain level

# THANK YOU!

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