ALBERTA INNOVATES

Under Construction:

Refocussing Our Renewable Fuels Research and Innovation Priorities

Susan Carlisle
Clean Energy Manager – Bioenergy
Susan.Carlisle@albertainnovates.ca

July 8, 2020
Biomass Energy Network

ALBERTA INNOVATES

Alberta Innovates Overview

SUBSIDIARIES

- **Alberta Innovates**
- Innotech Alberta
- C-FER

LINES OF BUSINESS

- **Clean Resources**
- Health Innovation
- Investments + Emerging Tech

PROGRAM AREAS

Advanced Hydrocarbons
Environmental Innovation
Smart Agriculture & Food
Bio-Industrial Materials
Alberta Prion Research Inst.

Clean Technology

- Renewable
- Bio-Fuels (and waste diversion)
- CCUS
- H2, Li, V, etc.

Clean Resources Goals

- Sustain/Grow our $140B resource industries (Oil & Gas, Agri-Food, Forestry); diversify with value-add products
- Develop cleantech & digital sectors; reduce GHGs; protect Alberta water & land resources

2

ALBERTA INNOVATES

Bioenergy Program Scope

Feedstocks
- Forestry and Agri-Foods
- Municipal/Other Bio-Based Residues/Waste
- Non-Recyclables (not limited to biomass)

End Products
- Liquid/Gas/Solid Biofuels
- Other Refinery Products (e.g., chemicals)

Other

Key Performance Indicators Include
- $ Leveraged
- TRL Advancement
- GHG Reductions & Other Environmental
- Publications & Knowledge Translation
- HQPs Trained and Job Creation

Current & Past Programs Supporting Bioenergy

- Clean Resources Programs (ACTIVE)
- Water Innovation Program (ACTIVE)
- Alberta BioFutures Program (closed)
- CCITF Program (closed)
- Other Former AI-BIO and AI-EES Programs

All Active Projects and funding are now managed within the Clean Resources line of business

Access to Clean Resources Funding

- **Continuous Intake (new Online Application Portal)**
  - Up to $200K: Expression of Interest (EOI)
  - Over $200K: EOI → Full Project Proposal (FPP)
  - Support up to 50% of project cost (cash + in kind)
  - Please Connect with our Team (Susan/Mehr) Before Applying
- **Time Limited Calls**
  - None planned for Biofuels at present
  - Other Calls Maybe Relevant: e.g Digital Innovation for Clean Energy, Carbon Utilization, Smart Ag & Food

https://albertainnovates.ca/
“Discover our Programs”

Other Alberta Innovates Services

- InnoTech Alberta, Entrepreneurial Investments, Alberta Data Institute, etc.
- Support ERA Project Management

5

Bioenergy Projects Supported by Alberta Innovates

ALBERTA INNOVATES

Recent & Current Bioenergy Projects

20 Projects

- 15 Active
- 2 Complete (2018 or later)
- 1 Under Negotiation
- 2 Terminated

Total Project Value: >$180M / ~$25M from AI

Sector Affiliation of 18 Recent and New Projects

- Alberta Post Secondary (8)
- Other Public Sector (4)
- Private Sector (6)

Most are collaborations with other sectors

Examples of Projects Supported by Alberta Innovates

Startups

Grizzly Paw Waste Dehydrators – (Thermal Vacuum Reactors TCR sub-pyrolysis unit developed by ECO-growth Environmental)

G4 Insights – Alberta RNG Demonstration Project (low temperature thermo-chemical technology)

ALBERTA INNOVATES

Value-Added Innovation at Existing Biorefineries

Enerkem

Advanced biorefinery technology demonstration for chemicals production from waste and biomass

ALBERTA PACIFIC FOREST INDUSTRIES INC

HOKUETSU GROUP

Identification of high-value chemical opportunities from Kraft pulp derived, wood-based bio-methanol

Basic and Applied Research

Project	Lead Organization
Process development for the cannabis waste management: on the way to sustainable waste disposal and bioenergy production	University of Alberta
Bio-processing of Amallin lignin for the production of lipids for drop-in diesel and bio-jet fuels	University of Alberta
Landfill BioCell (LBC) Technology	University of Calgary
Technology Pathway to Co-Process Biocrudes from Waste Biomass in Petroleum Refineries	CanmetENERGY-Devon
Wood Biomass Recovery, Pre-processing and Supply-chain Optimization of the Mature Ellerslie Short-Rotation Woody Crop (SRWC) Technical Development Site	Natural Resources Canada (NRCan)

12

The Innovation System

Alberta Clean Energy Technology Accelerator (ACETA) – City of Edmonton, in collaboration with InnoTech Alberta, University of Alberta, CanmetEnergy-Devon

The All West Bio-Industrial Park

Biomass Energy Network (BEN) – University of Alberta

13

Time for Alberta Innovates to Map Out a New Bioenergy Innovation Strategy

Source: climate.nasa.gov

Current Drivers

- International targets – etc. CORSIA, Paris Accord
- Federal Climate Change and Low Carbon Fuel Mandates
- Provincial GHG Reduction Mandates
- Waste Management and Landfill Vision
- Value Added Opportunity
- Economic Diversification and Rural Economy
- Competitiveness

15

2019-2020 AI Workshops: Some Innovation Opportunities

PRODUCTS

- **Gaseous Fuel Products:** especially RNG, BIOGAS and H2
- **Liquid Fuel Products:** including BIOJET
- **Fuel Precursor:** BIOCRUDE pathways and Quality
- **Other Biorefinery Products** – e.g., Chemicals, Biochars, Graphenes

TECHNOLOGY PROCESSES

- **Distributed and Small-Scale** processing/pre processing close to feedstock source
- **Feedstock Flexibility**
- **Existing Technologies**: Improve efficiency or output quality
- **Feedstock and Product Quality Assurance**

SYSTEMIC OPPORTUNITIES

- **Feedstock Sustainability Assurance**
- **Supply Chain Management** (e.g., logistics, traceability; digital solutions)
- **Small Communities:** Waste to value added
- **Integration** and **Implementation**

What is a Technology Road Map?

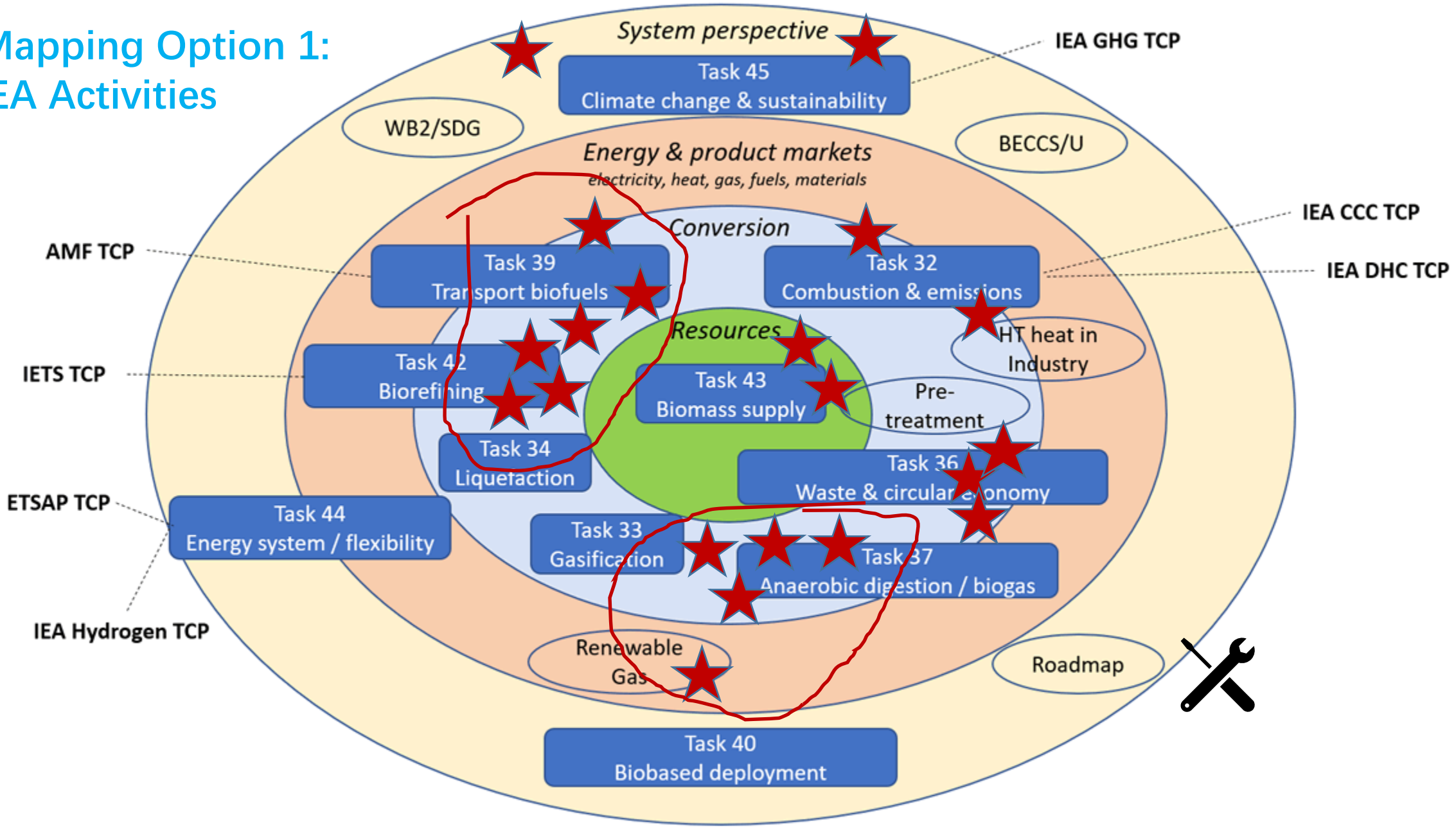
"The primary goal of a technology roadmap is to highlight and accelerate the deployment of a specific technology or group of technologies. A roadmap is, simply put, a strategy or a plan describing the steps to be taken in order to achieve stated and agreed goals on a defined schedule. It determines the technical, policy, legal, financial, market and organisational barriers that lie before these goals, and the range of known solutions to overcome them. Roadmaps can be developed for different levels of deployment, including global, national or regional, and can be sector- or technology-specific.

The evolving process by which a roadmap is created, implemented, monitored and updated is referred to as roadmapping..."

Source: IEA (2017), How2Guide for Bioenergy

International Energy Agency
Secure
Sustainable
Together

Mapping Option 1: IEA Activities



Mapping Option 2: IEA Pathways

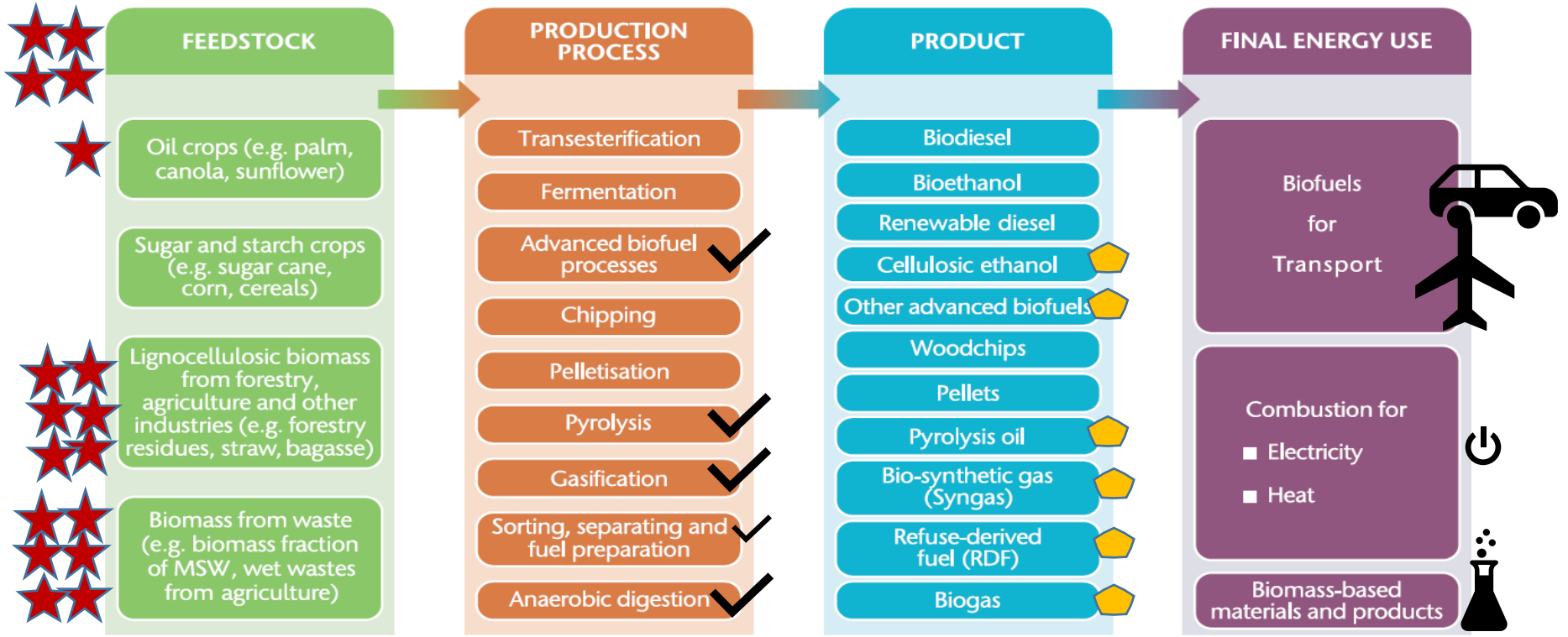
Project Count

Focus Area by Process

Focus Area by Product

Relative End Use Focus

Figure 2: Possible configurations of bioenergy pathways: from biomass to final energy use



Note: while a considerable number of combinations are available to convert each feedstock type, certain applications require specific bioenergy pathways. Certain products and production processes are feedstock specific and Figure 2 does not imply that all feedstocks are suitable for meeting all energy end-use requirements in an efficient and cost-effective manner.

Sources: adapted from IEA (2012), *Technology Roadmap: Bioenergy for Heat and Power*, and FAO (2014a), *Bioenergy and Food Security Rapid Appraisal (BEFS RA) User Manual Introduction*. Additional references are available within these source documents.

Mapping Option 3:
Supply Chain to Specific End Product

The Biorefiner Owner or Market Provides the Innovation "Pull"

UPSTREAM: Feedstock Logistics & Pre Processing

- Feedstock Resources
- Logistics Optimization
- Pre-Delivery: Sorting, Cleaning, Reformatting, Densifying

MIDSTREAM: The Biorefinery

- Feedstock Resource Management
- On Site Logistics
- Conversion
- Facility Maintenance
- Pre Market Product Management

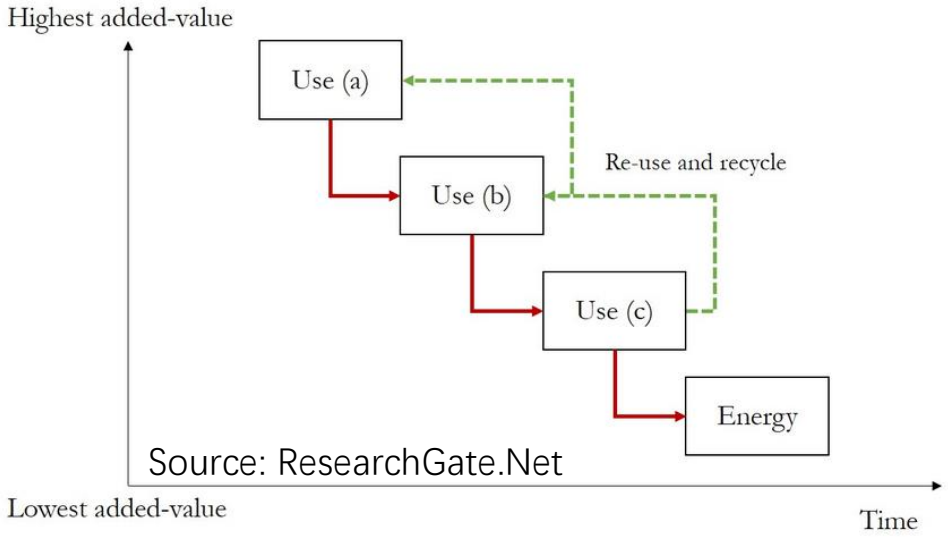
DOWNSTREAM: Bio-Product

- Product Marketing and Sales
- Logistics
- Consumption

20

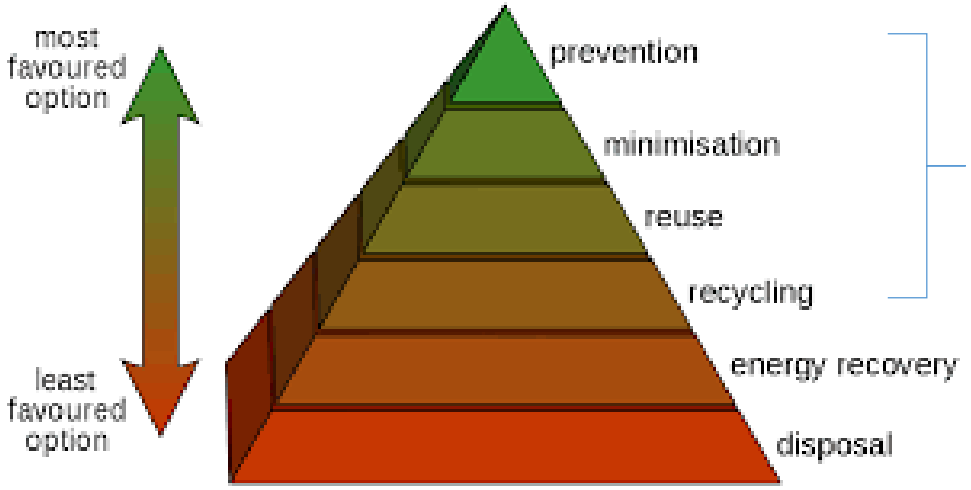
Closing Remarks: Bioenergy's Role in Biomass Use

Cascading Use



Source: ResearchGate.Net

Waste Hierarchy



Source: Wikipedia (I know!)

Circular Economy

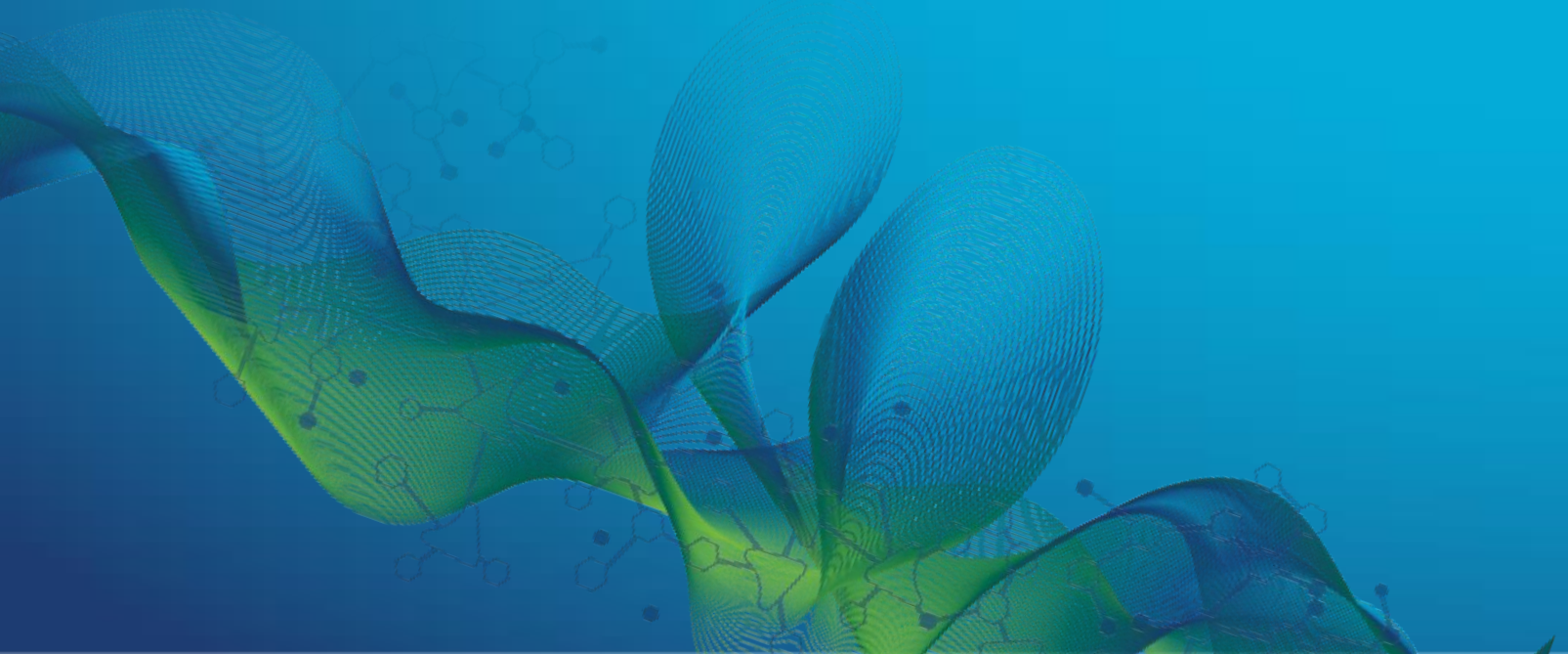
What Does Cascading Use Do to the Bioenergy Value Proposition?

How Can Bioenergy Support the Circular Economy?

21

ALBERTA INNOVATES

Thank you



ALBERTA INNOVATES

Example: Feedstock Resource – Simple Knowledge Map

We Don't Know That We Know

e.g., existing mineable data could answer questions about feedstocks, but has not previously been used for this purpose

We Know That We Know

e.g., we know how much waste is received by municipal facilities annually and general characteristics

We Don't Know That We Don't Know

e.g., some biomass waste resources may be "hidden" in waste audit categories

We Know That We Don't Know

e.g., private sector feedstocks/ residuals not included in public inventories

23