CBA 2017 Symposium

"Building California's Sustainable Bioresource Economy"

November 1 -2, 2017

Ziggurat Building, 707 3rd St., West Sacramento

1:00 – 2:30 PM: Nov. 2, Session

THE BIOPRODUCTS PORTFOLIO APPROACH -

framework and tools for organics capacity and market expansion planning and investment

Dan Noble, ACP, NRG – Moderator

- **Dan Noble,** ACP, NRG: *The bioproducts portfolio - a new market assessment tool for bioproduct market analysis and development*
- **Ruihong Zhang,** University of California Davis: *Digestate alone and with compost - designing for specific end uses*
- **Greg Kester,** California Association of Sanitation Agencies: *Biosolids markets and restrictions*

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THE BIOPRODUCTS PORTFOLIO:

a new market assessment tool for bioproduct market analysis and development

Dan Noble

President

Noble Resources Group, LLC

Bioproduct Industry Development

Executive Director

ASSOCIATION OF COMPOST PRODUCERS

"We Build Healthy Soil"

www.healthysoil.org

Topic Outline

- **Association of Compost Producers**
- **Bioproducts**
  - Closing the Loop –> Circular Economy
  - A Market Framework
  - Bioproducts Market Database
- **Organics to Bioproduct "Markets"**
  - Feedstock Control
  - Process Technology Train
  - Local Bioproduct Markets
- **Integrated Market Assessments & Plan**
  - Product quality, *and*
  - Selling the whole, integrated "value cycles"

Association of Compost Producers

A Public/Private Association - 501(C)6 – Calif. State Chapter of US Composting Council

- Public and Private Organics Residual Generators
  - Green Waste, Manure *(into and out of animals)*
  - Food Waste, Biosolids *(into and out of people)*
- Public and Private Compost Producers
- Public and Private Compost Marketer/Distributors

Our Vision:

- *Support beneficial reuse of organics in California, compost playing a central role to*
- *Build and maintain sustainable healthy soils,*
- *Keeping our state's lands productive, green and biologically diverse for generations to come.*

Our Mission:

Increase the quality, value and amount of compost being used in California.

- **Burrtec**
- **CalPoly SLO**
- **CR&R**
- **Engel and Gray**
- **Filtrexx**
- **Inland Empire Utilities Agency**
- **Kellogg Garden Products**
- **Liberty Compost**
- **Los Angeles County Sanitation Districts**
- **P.F. Ryan and Associates**
- **Serrano Creek Soil Amendments**
- **Scott Brothers Dairy**
- **Synagro**
- **University of California, Cooperative Extension**
- **Vision Recycling**

Noble Resources Group, LLC

Mission

Noble Resources Group (NRG) leads and supports other leaders to transition their companies, agencies and communities to succeed in the developing a sustainable renewable carbon economy.

Clients

Past

- *Founding Financial Editor – Environmental Business Journal®*
- *Water View Reports – Environmental Business International, >100 clients*
- *WateReuse Foundation – "Indirect Potable Reuse Best Practices"*

Currently Representing

- *Association of Compost Producers*

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Bioproducts: Development of a Circular Economy

Linear Economy*

Natural Resources & Resource Industries
- •Air
- •Water
- •Land & Minerals
- •Energy
- •Biological

→ **Industrial Processes, Distribution & Product Use** → **Waste & Pollution**

From Eugene Odum, Ecology, 1963 and www.Ecocycle.org, 2008

Journey to Sustainability: Development of a Circular Economy

Circular, Zero Waste, Economy*

Natural Resources & Resource Industries
- •Air
- •Water
- •Land & Minerals
- •Energy
- •Biological

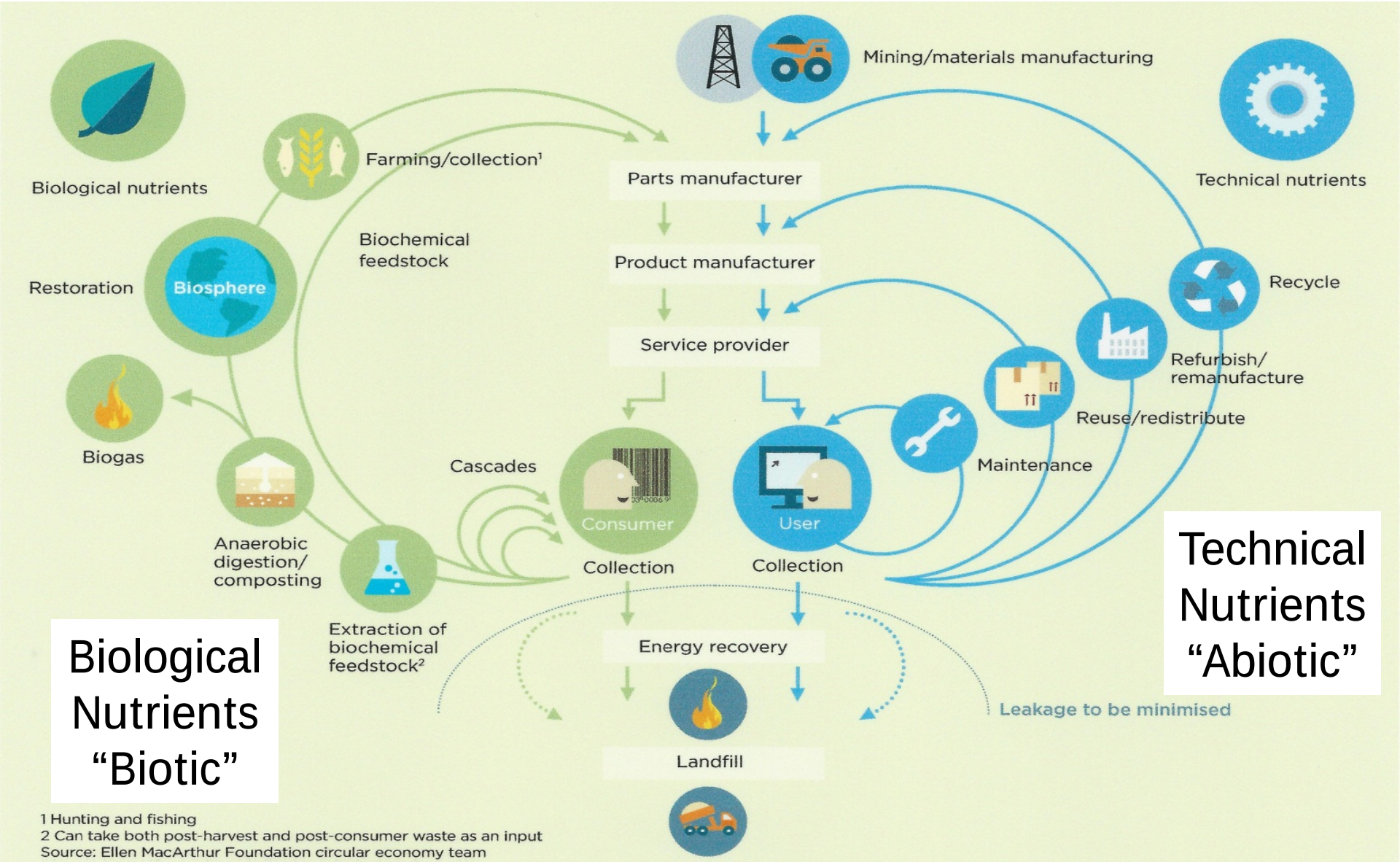
Industrial Processes, Distribution & Product Use

Waste & Pollution

Environmental Industry

From Eugene Odum, Ecology, 1963 and www.Ecocycle.org, 2008

Emerging Circular Economy:
an industrial system that is restorative by design



1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input
Source: Ellen MacArthur Foundation circular economy team

Biological Nutrients (Bioresources)

Carbon's "6 F's"

Food

Fuel

Fiber

Flowers

Feed

Fertilizer

Organic Residuals are…

From Agricultural Product to Organics Residual

Food → *Disposer & Sewage* → ***Biosolids***

Fiber → *Solid Waste* → ***Food scraps***

Flowers → *Landscape Maintenance* → ***Green material*** / ***Woody material***

Feed → *Livestock Waste* → ***Manure***

Fuel

Fertilizer

→ ***No Residual (except pollution!)***

Bioresource Feedstocks → Bioproducts

A "Whole Systems" Approach,
All inclusive by design

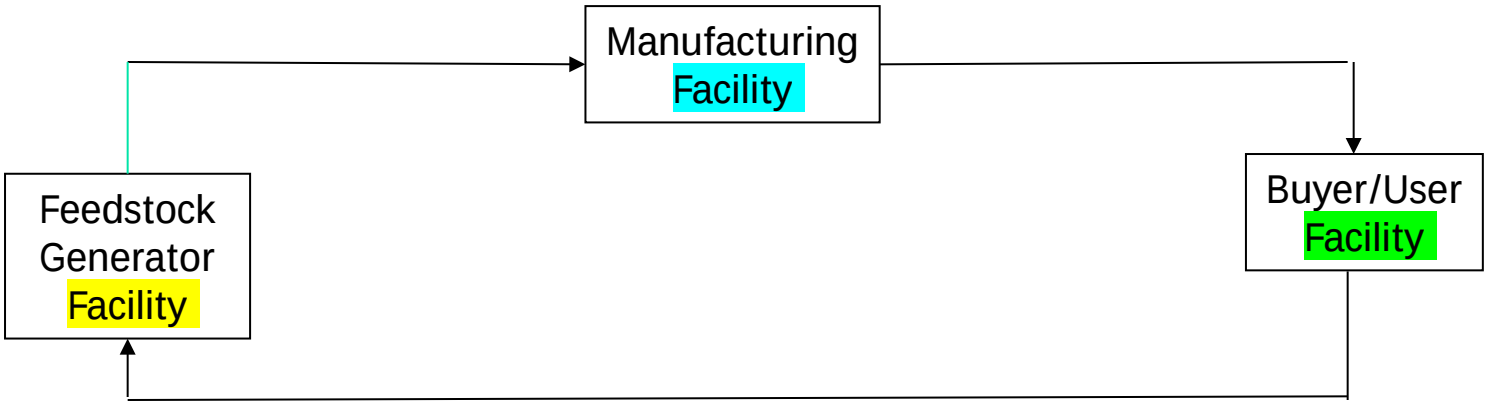
Feedstock(s) (organic residuals) →

Process train →

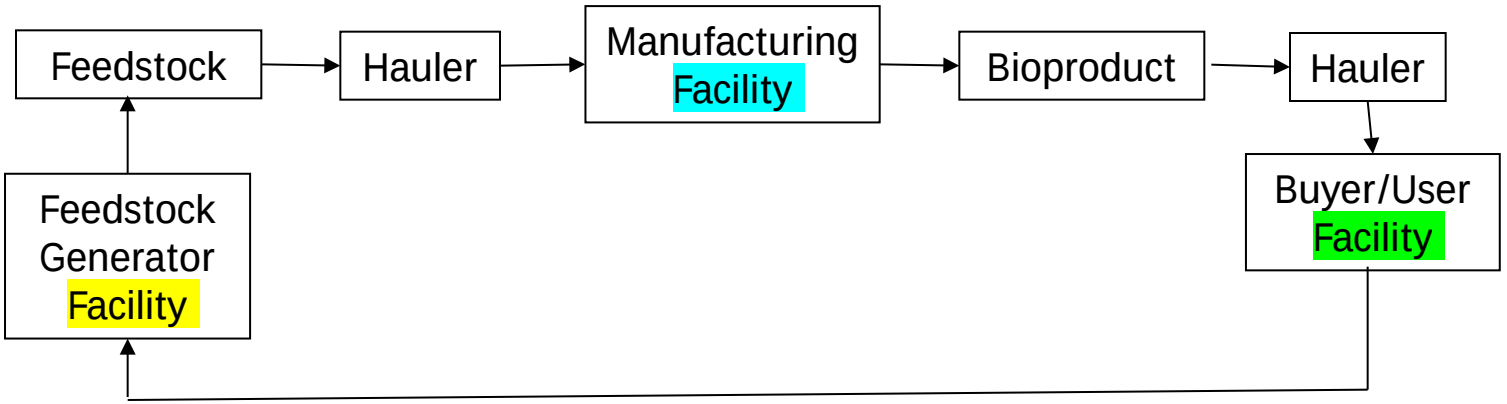
Bioproduct(s)

Bioproducts Market Database
Framework and Context

Bioproducts Industry Process Diagram



Bioproducts Market Database
Framework and Context



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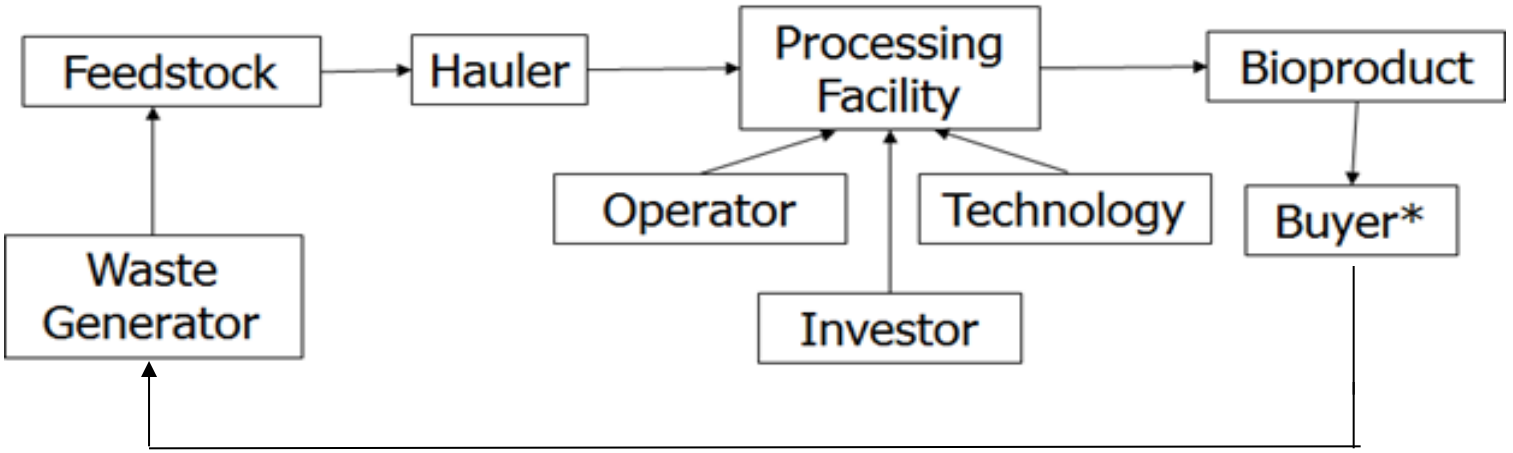

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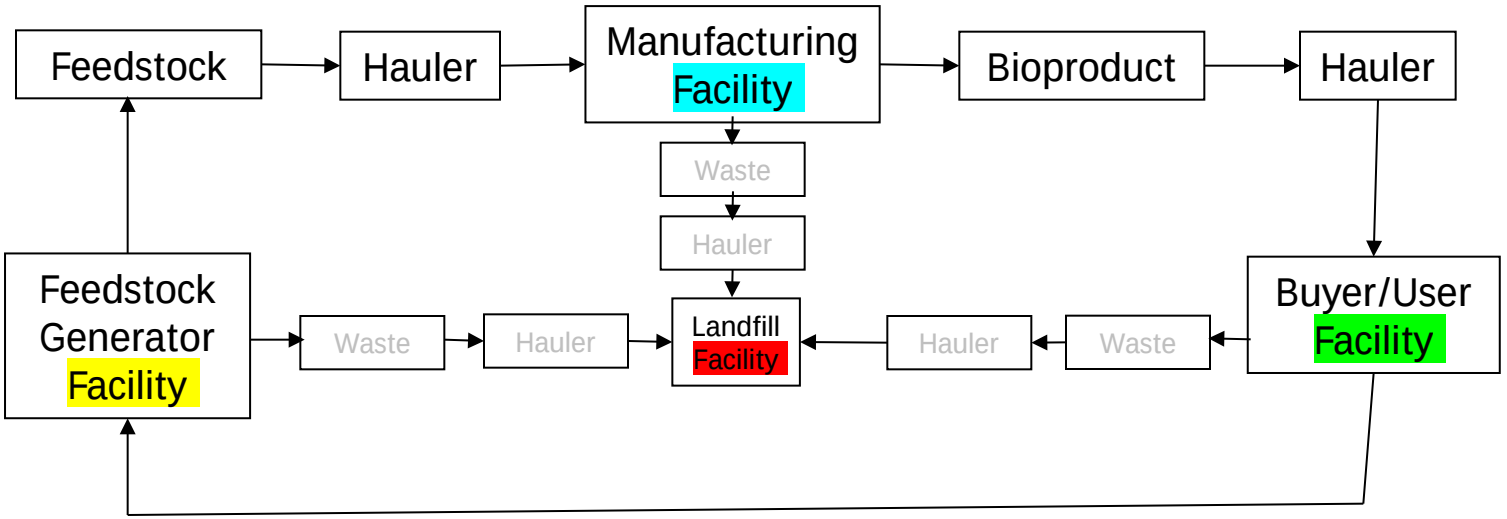
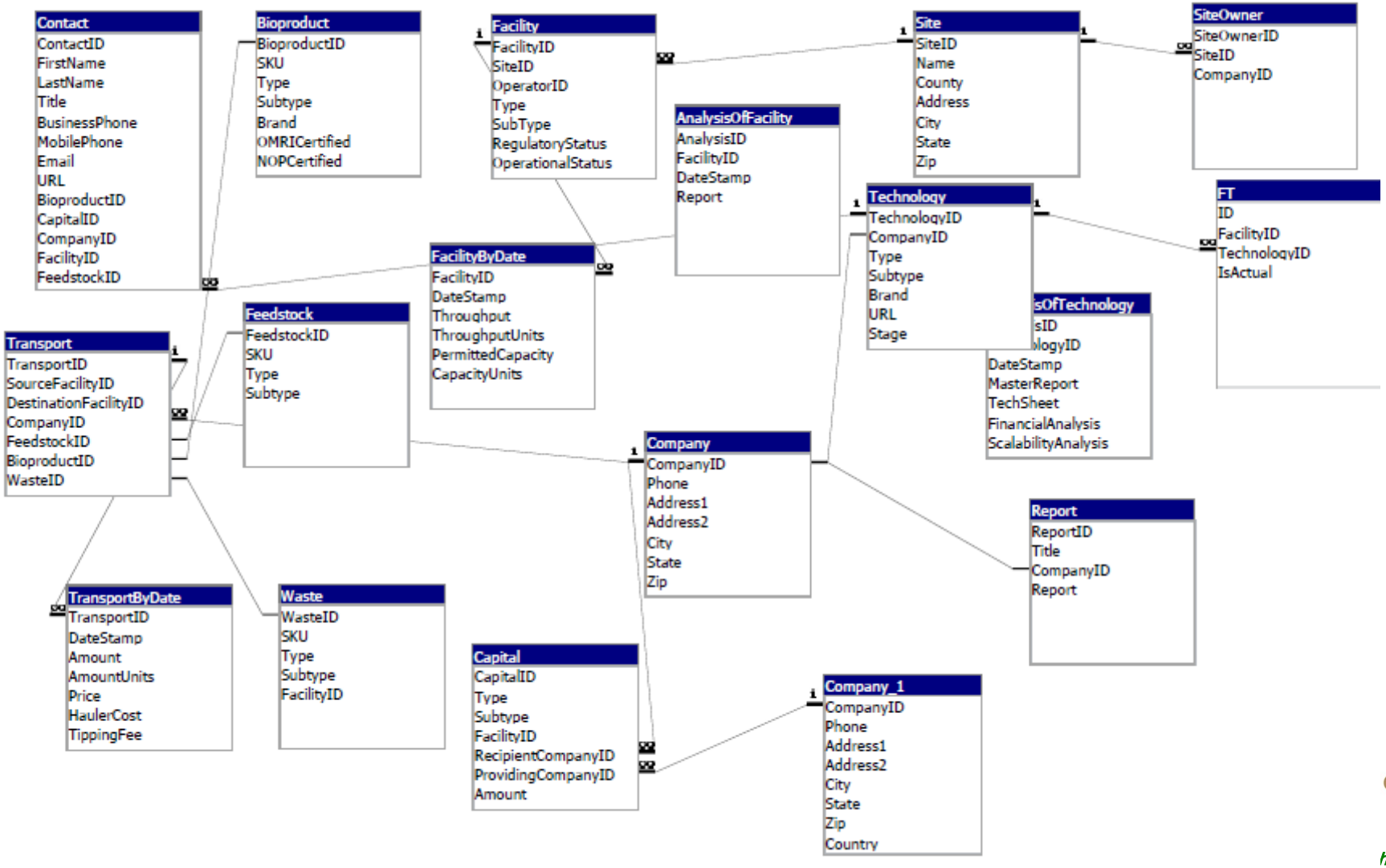


Bioproduct Markets
Seven (7) Integrated Markets

PRODUCT Enterprise/Markets	SERVICE Enterprise/Markets
Feedstocks	*Logistics*
Equipment	*Operations*
Facility / Site	*Investment*
Bioproduct	

Bioproducts Market Database

NRG's BioDB



OF

Feedstocks to Process Train

Organic Feedstocks

Green material

Woody Material

Food scraps

Biosolids

Manure

Processing

Chip & Grind

Composting

Feed Production

Anaerobic Digestion

Thermo-chemical

Microbial Fermentation

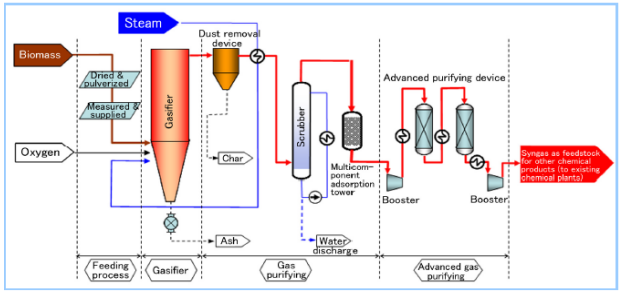


Figure 4 Diagram of the biomass gasification and syngas purifying system.

Anaerobic Digestion (AD) Bioproduct Portfolio

Feedstocks → Process Train → Bioproducts

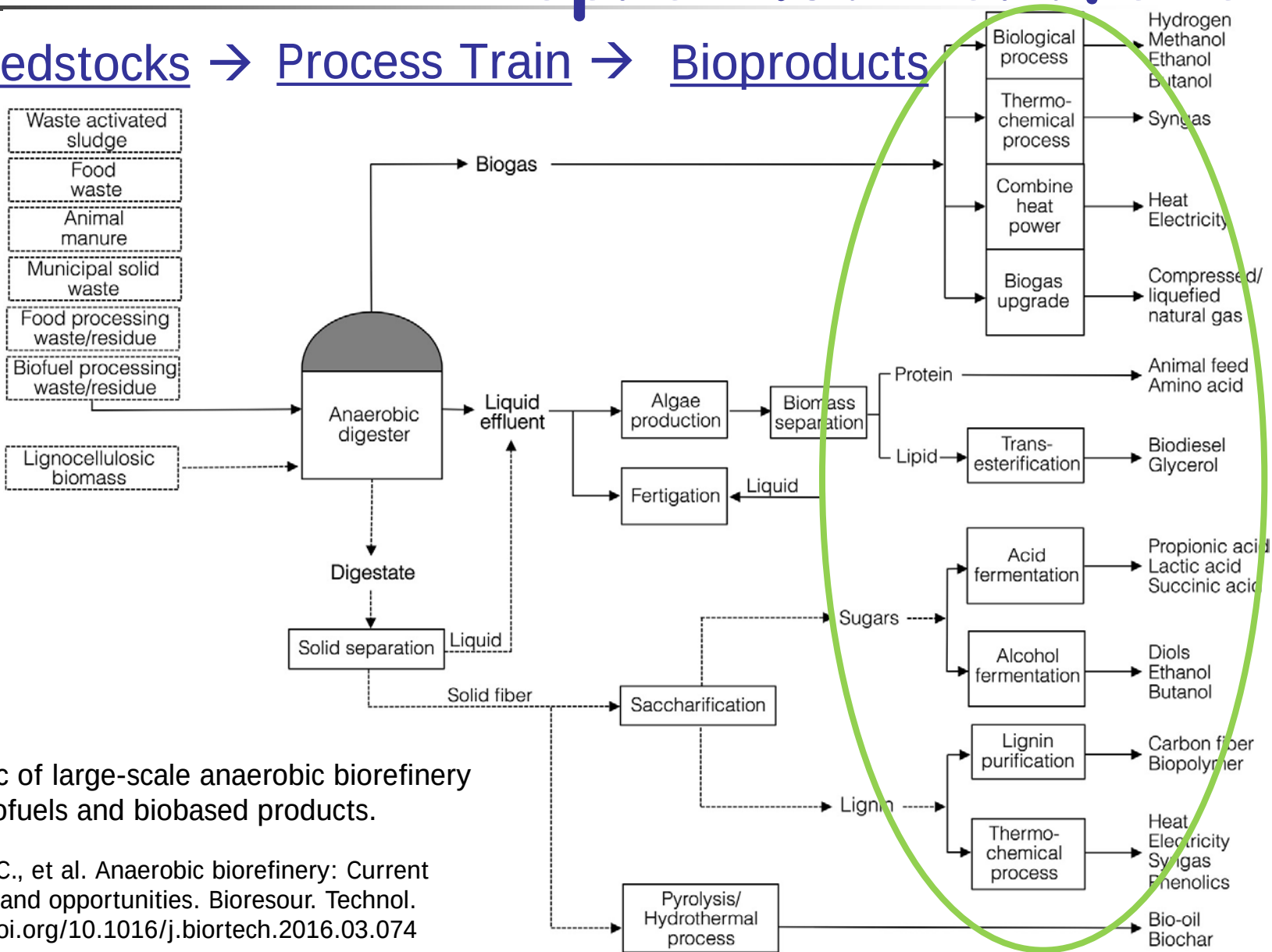


Fig. 1. Schematic of large-scale anaerobic biorefinery for producing biofuels and biobased products.

Sawatdeenarunat, C., et al. Anaerobic biorefinery: Current status, challenges, and opportunities. Bioresour. Technol. (2016), http://dx.doi.org/10.1016/j.biortech.2016.03.074

Bioproduct Portfolio, or Categories

aka *Categories of Value*

- Mulch

- Compost

- Biofertilizer

- Biochar

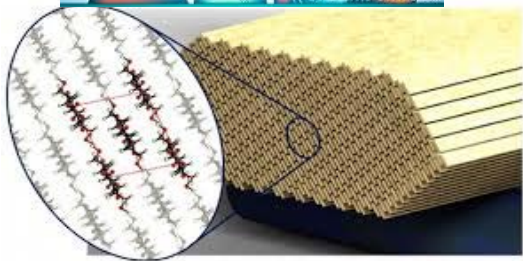
- Animal Feed

- Electricity

- Biofuels

- Chemicals

- Product Materials



Spectrum of Values in the Bioproduct Portfolio

Organic Product Category	Technology Options	Technology/ Facility Capital Cost Range	Current Market Value Range of Finished Products
Mulch	Chop & Drop, Chip/Grind & Reuse, Chip & Ship	**$2-10/tpy**	**$0-$15/ton (FOB)**
Compost	Backyard, Container, Windrow, eASP, Gore, ECS, enclosed, AgBag, Vermicompost, etc.	**$25-$450/tpy**	**$10-$30/ton - bulk (whsl), $80-120/ton - bagged (retail)**
Animal Feed	straight foodscraps, food dehydrator/cooker, aquaponics	**$10-$750/tpy**	**$50-$150/ton**
Biofertilizer	High nitrogen composting, biosolids pellets, manure pellets	**$100-$800/tpy**	**$80-200/ton**
Electricity	Anerobic Digestion --> Methane --> gas turbine	**$200-$850/tpy**	**$150-$300/ton**
Biofuel	Anerobic Digestion --> Methane Pyrolytic Conversion --> methanol, ethanol, biodiesel, etc.	**$250-$900/tpy**	**$250-$750/ton**
Chemicals	Distributed Biorefinery (emerging)	**$300-$1,000/tpy**	**$500-$10,000/ton**
Product Materials	ecorUSA.com	**$500-$1,500/tpy**	**$500-$10,000/ton**

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- Integrated Market Assessments & Plan
  - Product quality, *and*
  - Selling the whole, integrated "value cycles"

Feedstocks to Bioproducts

***4** of the **7** interrelated and integrated*

***MARKETS** contained within and supporting the Organics Value Cycle*

Feedstock(s) (organic residuals) →

Process train →

Bioproduct(s)

Capital ($$, NatCap, Social, Informational)

BTW, these Bioproducts markets are, in turn, integrated with the WATER & ENERGY utility and product markets… but that's another story! … an important one!

What's a "market"?

John Chamberlain –

"When two subjective senses of value meet in an objective price,

*a **market** is born."*

***Marketing** is giving people*

what they want.

***Sales** is giving people*

what you have.

Bioproduct Market Players

Compost Producer Type	Ownership Type	Advantages	Disadvantages
1. Wastewater Agency	Owned by a quasi-government organization: agency, district, or	• Not for profit • Rate payer revenue base • Local monopoly on feedstock (biosolids) • Large capital base • Extensive permitting expertise	• In the open market for bulking agent • Stigma attached to biosolids feedstocks • Must build market expertise
2. Municipality	City or county	• Not for profit • Can develop compost without having to adhere to market forces	• Not in business to develop product markets • No price means product has no/low value • Subject to political process more than market forces
3. Franchise Hauler	Private business	• Have rolling stock (trucks) • Have bankable collections revenue to invest and build a business	• Product production is a different business than hauling • Inevitable tradeoffs between the two models • Unclear brand
4. Independent	Private business	• Flexible • Responsive to customer needs • Choices of feedstock	• Generally undercapitalized • Not connected to franchise bankable revenue
5. Generator – food systems	Private business	• No hauling of material • Could be part of green business and/or green building objectives • Can save money on hauling	• Not in the compost/soil business • Inevitable tradeoffs between the two models • Unclear brand
6. Agriculture	Private business	• Saves money • Avoids burning • Lower crop inputs • Can be part of organic, sustainable, regenerative, biodynamic farm practices	• May not be consistent with other business units • Could be too much material • Could cost more than its worth
7. Un-permitted C&G	Private business	• Can make good profit with low overhead	• Creates downward pressure for the permitted markets • Can literally trash the environment

Legal Structure for Control

State Legislation and Regulations – California Example

- ***AB 939*** *– (1989) Recycling laws*

- ***AB 341*** *– (2011) 75% Recycling by 2020 Goal for California, & Mandatory Commercial Recycling*

- ***AB 1826*** *– (2014) Mandatory Commercial* ***Organics*** *Recycling (MORe)*

  Every SW Jurisdiction (>350) must "set up a program"

  www.calrecycle.ca.gov/recycle/commercial/organics/FAQ.htm

Evolving Legal Structure for Industry

State Legislation and Regulations – California Example

- ***AB 876*** *– (1915) Organics Management Infrastructure Plan*
- ***AB 901*** *– (2015) Recycling and Disposal Facility Reporting*
- ***SB 1383*** *– (2014) Short-Lived Climate Pollutants (SLCP): Organic Waste Methane Emissions Reductions*

Feedstock "Control" – Monopoly

CREATE LOCAL "MONOPOLIES"

Rationale:

- *Reduce redundant Investments*
- *Own/control the material*
- *Ratepayers and material ownership is BANKABLE!*

Examples:

- ***Wastewater Treatment Plants**, by law, control our poop, and therefore the biosolids, water and energy products that are produced*
- ***Hauler Franchise Agreements/Contracts:** Waste collectors serve the ratepayers, and take ownership of the discards*
- ***Agricultural and Forest Residuals**: Own both the cultivated products* and *the residuals*

Feedstock "Control"-Markets

CREATE LOCAL "MARKETS"

Rationale:

- *Generator is the primary "owner"*
- *Reduce transportation if managed onsite*
- *Ratepayers and material ownership is BANKABLE!*

Examples: - onsite/neighborhood

- ***Wastewater:*** *Greywater and composting toilets*
- ***Solid Waste:*** *Reduce, compost or biogas and/or self haul*
- ***Agricultural and Forest Residuals:*** *Reduce, compost or biogas and/or self haul*

Programs: Developing the Organics Value Cycle

Food Scraps Example

- *Become a biorefinery developer!!*

- ***Source Separation***
  - *Disposers to POTW's*
  - *Food scraps in the Green Bin*
  - *Onsite Processors*
- ***MRF Separation (Materials Recovery Facility)***
  - *Food Scraps to Anaerobic Digestion*
  - *Food Scraps & Green Material to Composting*
- ***Processing***
  - *Composting*
  - *Anaerobic Digestion*
  - *Bio Products*
- ***Marketing, Use (& Generation, again)***
  - *We are all "user/generators" (not "consumers")*
  - *Marketing Product Use within the Organics Value Cycle*

Process Technology Train

Technology Categories

- *Chip & Grind*
- *Composting*
- *Animal Feed*
- *Anaerobic Digestion*
- *Thermochemical*
- *Microbial Fermentation*

Competitive Dimensions

SCALE: *small, medium or large;*
<12.5K ⟺ 50K ⟺ >200K/year

CAPITAL COST: *per ton of annual throughput*

OPERATING COST: *per ton of annual throughput*

REGULATORY DYNAMICS: *develop and change of state, region and local regulations*

LOCAL ACCEPTANCE: *of both the bioproducts & env. impacts*

Local Bioproduct Markets

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  - Technology Cost/Availability
- **Integrated Market Assessments & Plans**
  - Product quality, *and*
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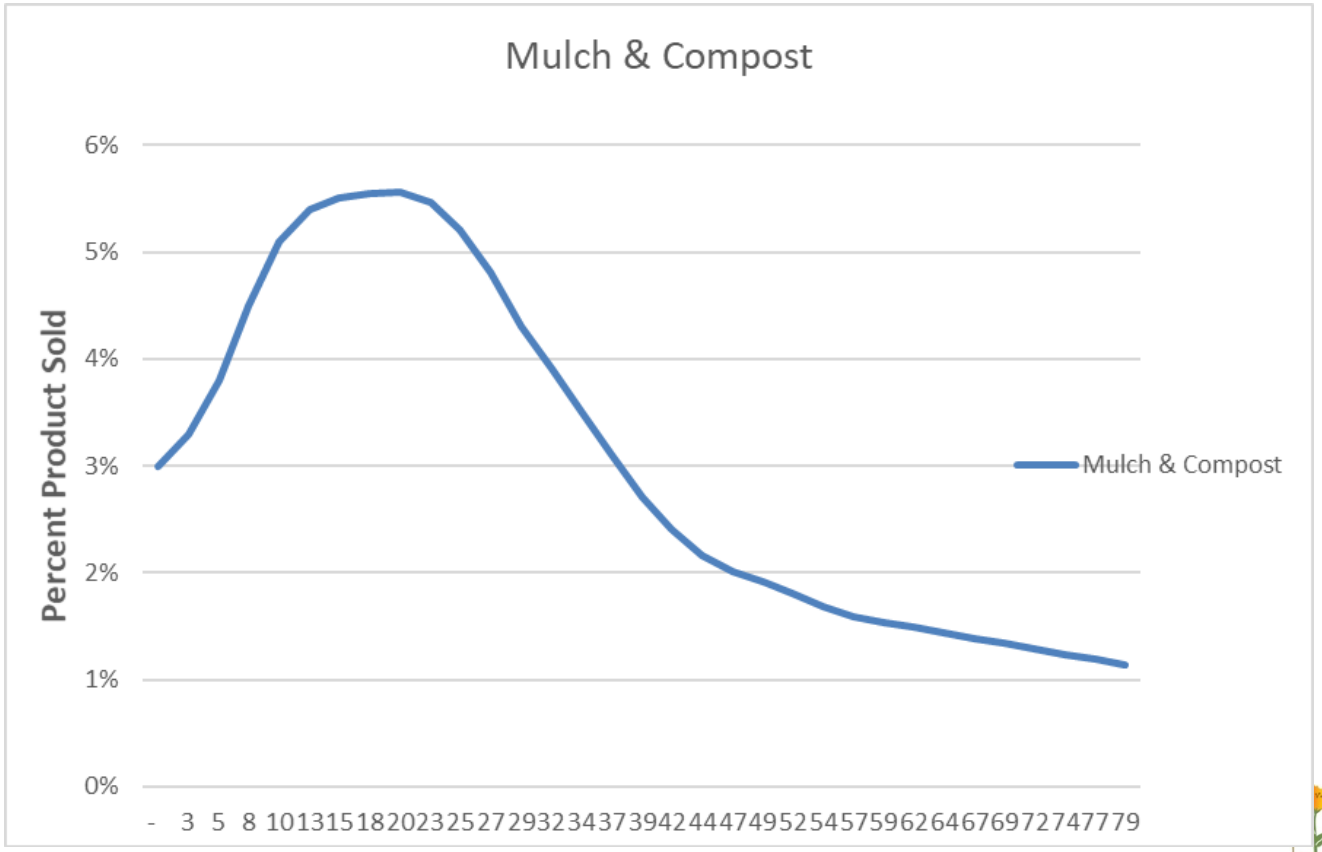
SoCal Market Model & Conclusions

Mulch and Compost Production in the *10 Southern California Counties 2017*

County	Distance (miles FRB to Co. Seat)	Permitted Facilities	Permitted Capacity (tpy)	Available Capacity (tpy, *est.*)	Mulch Produced (yd^3)	Compost Produced (yd^3)
Orange	14	10	349,550	64,016	294,210	546,390
Riverside	38	23	1,590,591	1,587,119	1,008,448	1,872,832
Los Angeles	45	28	1,250,306	1,548,681	494,865	919,035
San Bernardino	50	37	4,846,200	3,818,688	831,201	1,543,659
San Diego	87	16	800,375	954,750	275,310	511,290
Ventura	111	12	398,470	421,206	105,840	196,560
Santa Barbara	148	7	572,786	615,246	156,597	290,823
Kern	156	11	3,662,562	3,753,170	922,148	1,712,561
Imperial	193	9	362,311	408,739	109,020	202,466
San Luis Obispo	233	6	175,300	212,540	63,399	117,741
		159	14,008,451	15,884,420	4,261,038	7,913,357

SoCal Market Model & Conclusions

Price Distribution Curve Estimate for Mulch and Compost Sold and distributed in Landscape Markets in Southern California, 2017



$/yd^3

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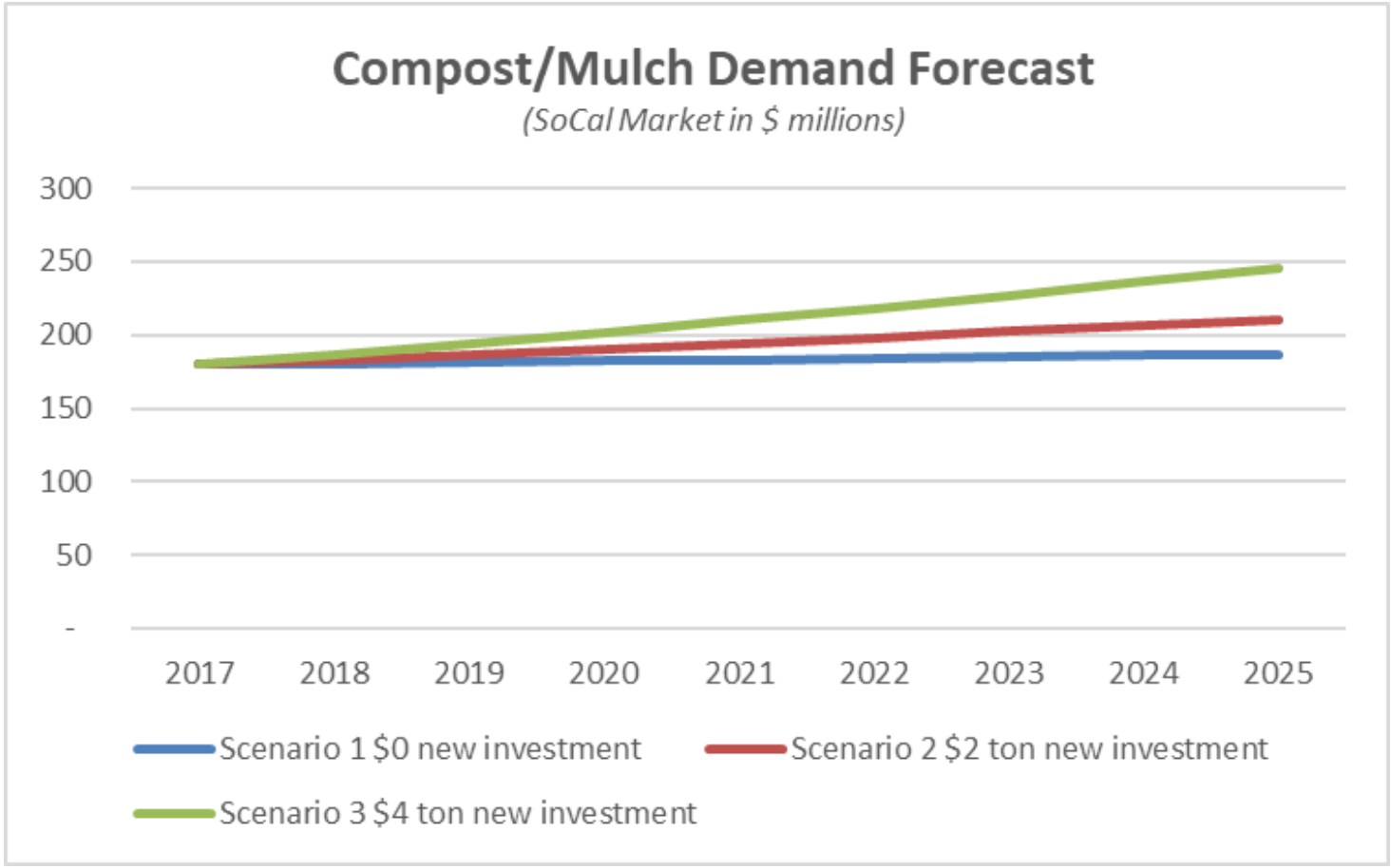
Compost/Mulch Demand Forecast 2018 – 2025



Integrated Market Assessments & Models

Product quality

the best product, for the lowest price

Trashy

vs.

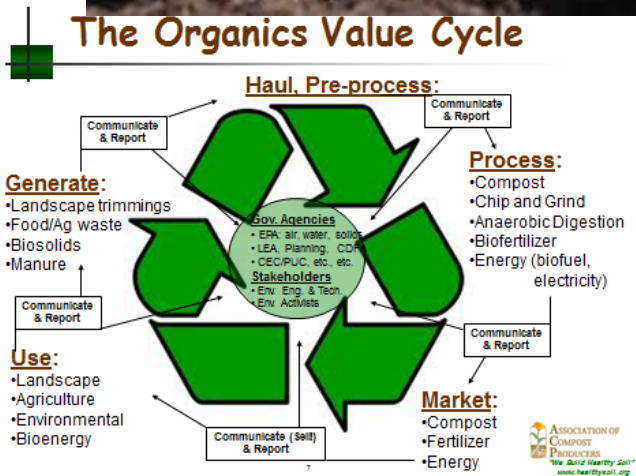
Premium

Proven Organic.

Selling the whole, integrated "value cycles"

e.g. LOOP

LOOPforYourSoil.org



Markets – Capacity and Markets go hand in hand

We are creating a new narrative, a new story, for our food AND discards:

- Addressing key new questions -

- *Where did our food and other products come from?*
- *How healthy is it, are they?*
- *Was it made with love … and compost?!*

- *Where do our discards go?*
- *Do we keep it clean, for the compost pile?*
- *Do we make/buy & use compost?*

Education *and* Marketing

Education:

- *Teaching or training people to "do it them selves" (DIY)*

Pros:

- Empowers people, & low cost solution
- Government & industry doesn't have to deal with it
- Organics value cycle is already personal

Cons:

- Requires attention, higher burden
- Can be inconvenient and messy

Marketing:

- *Providing a specific solution "for a price"*

"We'll take care of it" – Burrtec

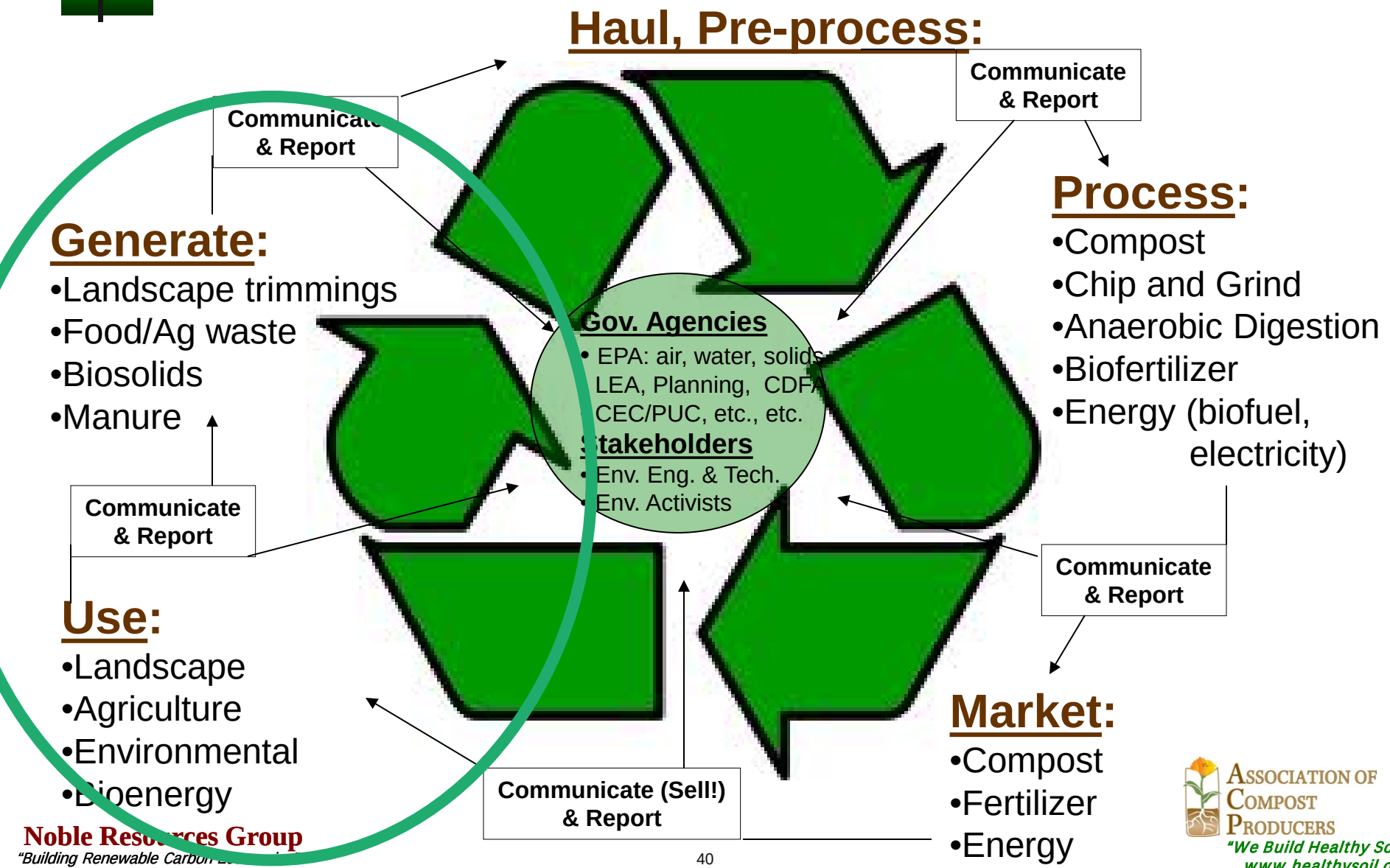
Pros:

- Convenience - others do the dirty work
- Can leverage economies of scale

Cons:

- Disconnects users from resource cycle, still feels like consumer, not user
- Must now market use of material

The Organics Value Cycle



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Build a Sustainable "Enterprise" Model: *Strategy/Policy into Products (AB 876)*

Assess Markets → Plan → Invest → Launch → Operate

- ***Feedstock Assessment***
  - Residual Generation Sources
  - Catalogue of Options
- ***Technology Assessment***
  - Product Appropriate
  - Scope to Scale Specific
  - Value and Investment Desired
- ***Bioproduct Market Assessment***
  - Product Specific
  - Brand Value Options
  - Channel Availability
- ***Capital Assessment***
  - Capital Elements Available (4 types- monetary, natural, social, info
  - Sources Available & Alignment

Bioproduct Industry Database

- ***Enterprise Plan***
  - Manufacturing & Operations
  - Marketing & Sales
  - Finance & Accounting
- ***Invest & Build***
  - Venture, Debt, Bond, User Fees
  - Operational Training
  - Merchandising & PR
- ***Commission Facility(s)***
  - Trial Runs
  - Hiring
  - Press Releases, Sales
- ***Launch & Operate***

Enterprise Planning → PLAN

Develop Models and Scenarios

Enterprise Type	FEEDSTOCK (Type & Rev.)	SCALE (tpy)	PROCESS TRAIN	MARKET MODEL	BIOPRODUCT PORTFOLIO
Public (wastewater)					
Public (municipal solid waste)	✓	✓	✓	✓	✓
Private (waste hauler/recycler)					
Private (agriculture)					
Public/Private (forest)					

Develop your unique enterprise business model… which becomes your local BRAND!

Questions?
Comments?
Discussion…

Dan Noble
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danwyldernoble@gmail.com

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1:00 – 2:30 PM: Nov. 2, Session

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