RUTGERS

THE STATE UNIVERSITY
OF NEW JERSEY

Achieving Pollution Prevention Through

Energy Efficiency In Wineries

EPA Pollution Prevention Grant to

Rutgers University, 2021

Serpil Guran

Director, Rutgers EcoComplex

"Clean Energy Innovation Center"

"Grape Expectations, 2022 Symposium" , March 5, 2022

The EcoComplex:

- The EcoComplex is a clean energy innovation center at Rutgers University that harnesses research and education resources towards the development and commercialization of innovative clean energy, agricultural, and environmental and technologies.

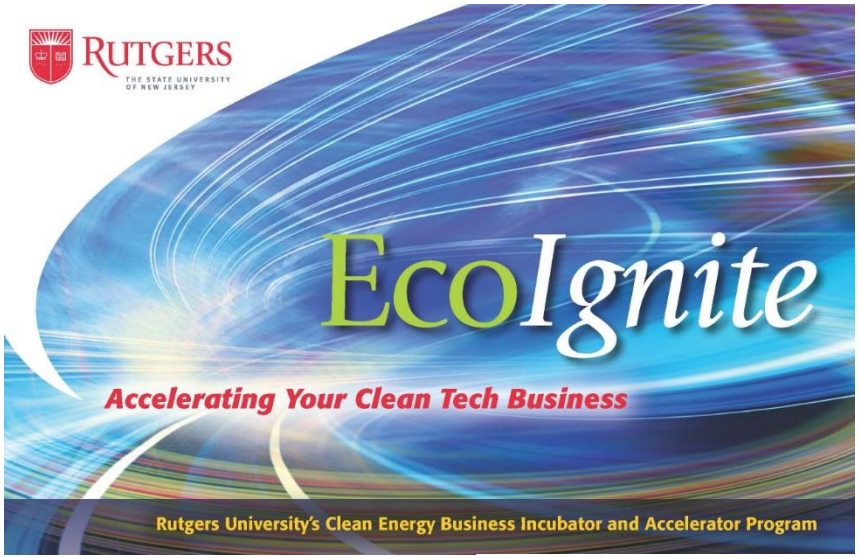
- The Center also serves as a business incubator and houses 7 start-up companies.

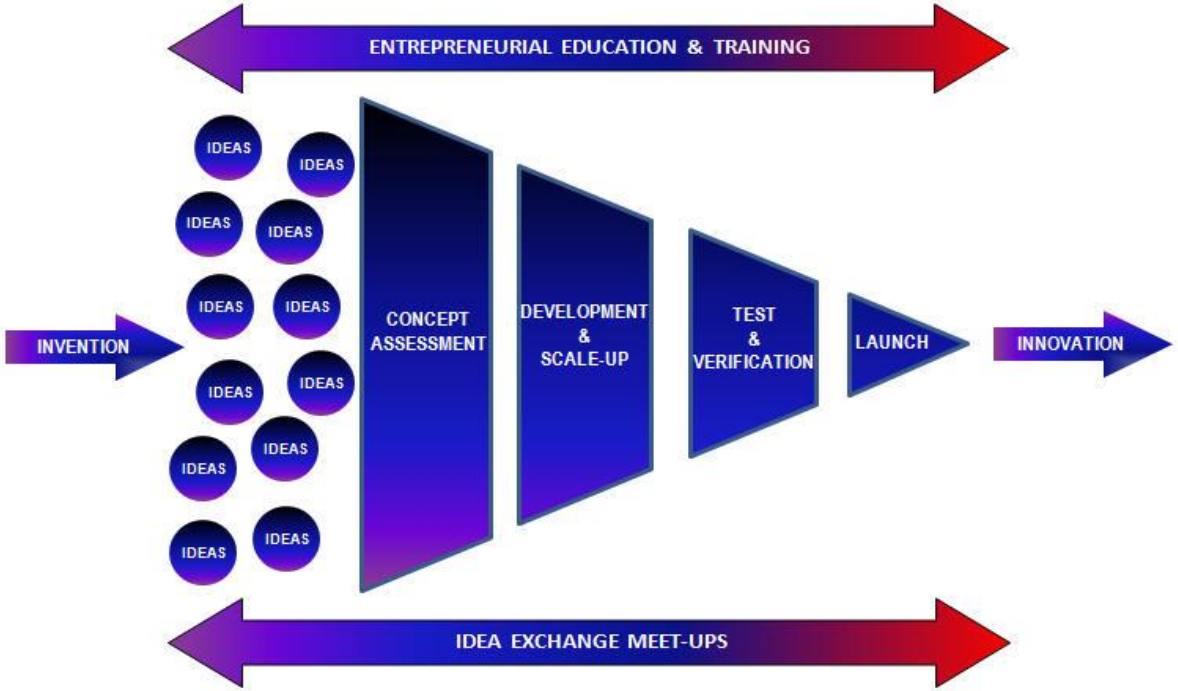
member incubatenergy network

nbia INTERNATIONAL BUSINESS INNOVATION ASSOCIATION SOFT LANDINGS

NEW JERSEY BIN BUSINESS INCUBATION NETWORK

Rutgers EcoIgnite:
Clean Tech Proof of Concept Center & Accelerator





New Program:
WindIgnite Accelerator

Support for:
Minority- and Women-Owned OSW Supply Chain Start-ups

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EPA Pollution Prevention Grant to

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PROVIDING TECHNICAL ASSISTANCE TO NEW JERSEY WINERIES: ACHIEVING POLLUTION PREVENTION THROUGH ENERGY EFFICIENCY AND DISCHARGE REDUCTION FROM WINERY OPERATIONS

Grant Number: 96248320

EPA Region II

Grant Team:

- PI: Serpil Guran
- Co-PI - Christopher Obropta
- Co-PI – Daniel Ward

Team Members:

-Participating Four Wineries – Alpha, Beta, Gamma and Delta

- **David R. Specca**, Assistant Director, the EcoComplex
  Rutgers Agrivoltaics Program Lead
- **Matt Leconey**, P.E. Rutgers Cooperative Extension Water Resources Program
- **Jeffrey Hammerstedt**, Rutgers Agricultural Research and Extension Center
- **Ky Connor Asral**, Chief, Bureau of Sustainability, New Jersey Department of Environmental Protection

Wine Making & Sustainability

Grape Growing Wine Production

Several Sustainability Categories

- Organic Vineyards and Wines
- Biodynamic Vineyards and Wines
- Fairtrade Vineyards and Wines

Wine Making & Sustainability

Wine Production

Sustainability & Successful Enterprises

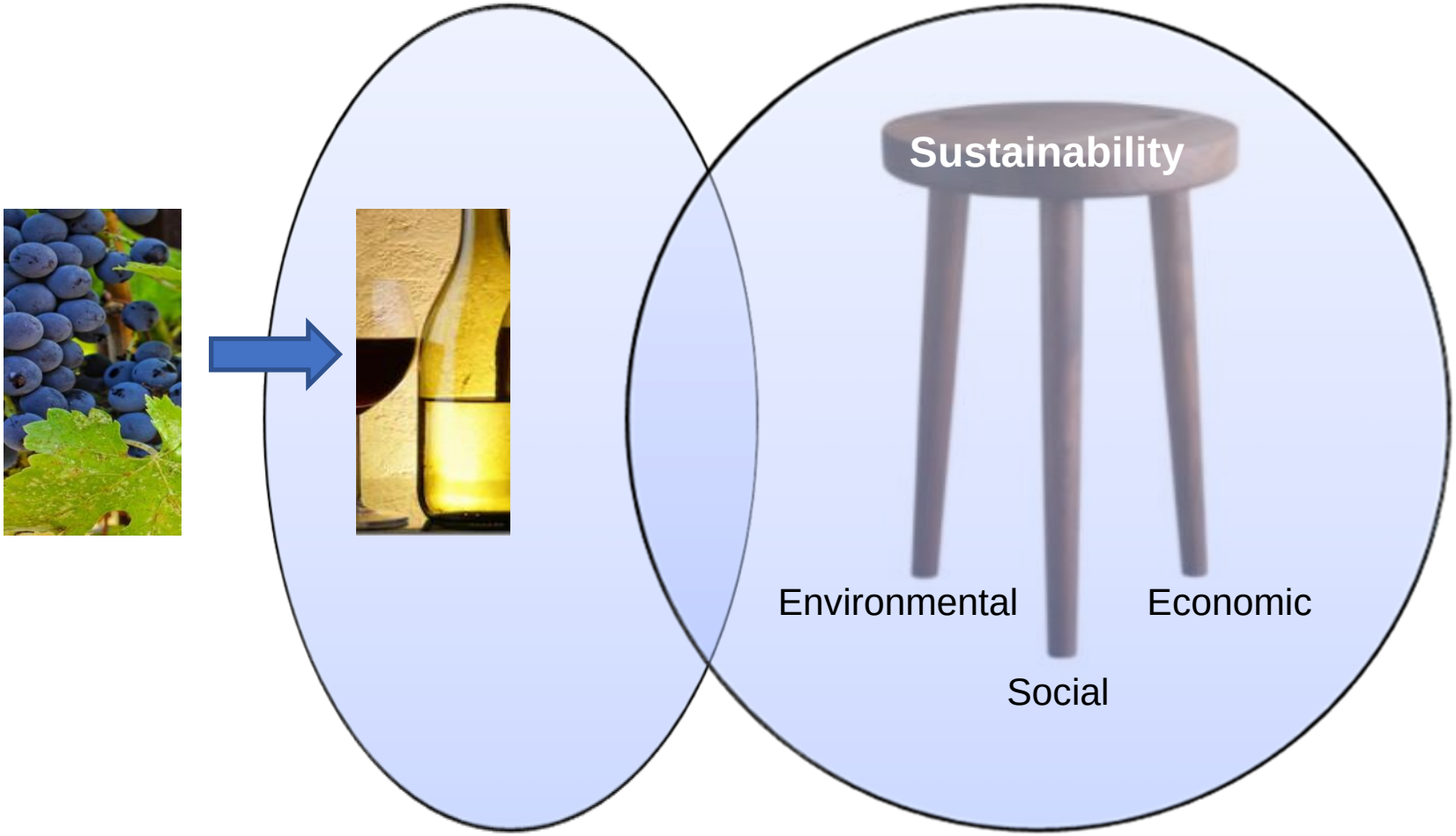
- Search and identify “sweet spots” in their businesses where harmful environmental impacts are minimized and economic and social benefits of return are realized.

- Range of Sustainability approaches
  - **Reducing Pollutants and Waste**,
  - **More Efficient Processes and Products**

  by consuming less **energy and water** without impacting their product quality and quantity.

- New Jersey Wine Making Industry may also benefit by reviewing and considering further improvements in their operations.

WINERY SUSTAINABILITY



Sustainable Wine Making

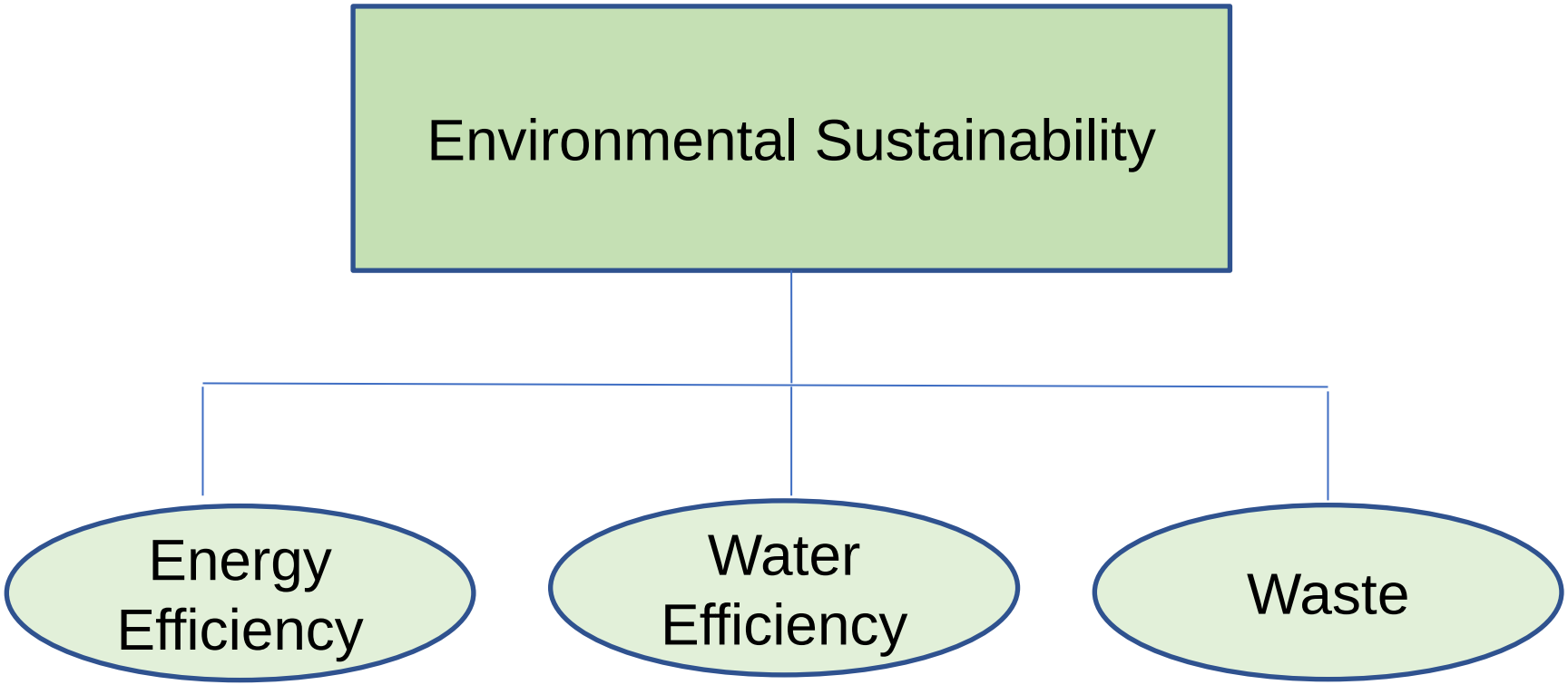
- Environmental Sustainability
  - Less energy consumption
  - Less water consumption
  - Less pollutants
  - Less waste
  - Waste valorization
  - Efficient packaging

- Economic Feasibility
  - Less energy cost
  - Less water cost
  - Reduced waste disposal costs
  - Additional revenues
  - Recognition and increased sales
  - In-house RE generation
  - Less costly practices

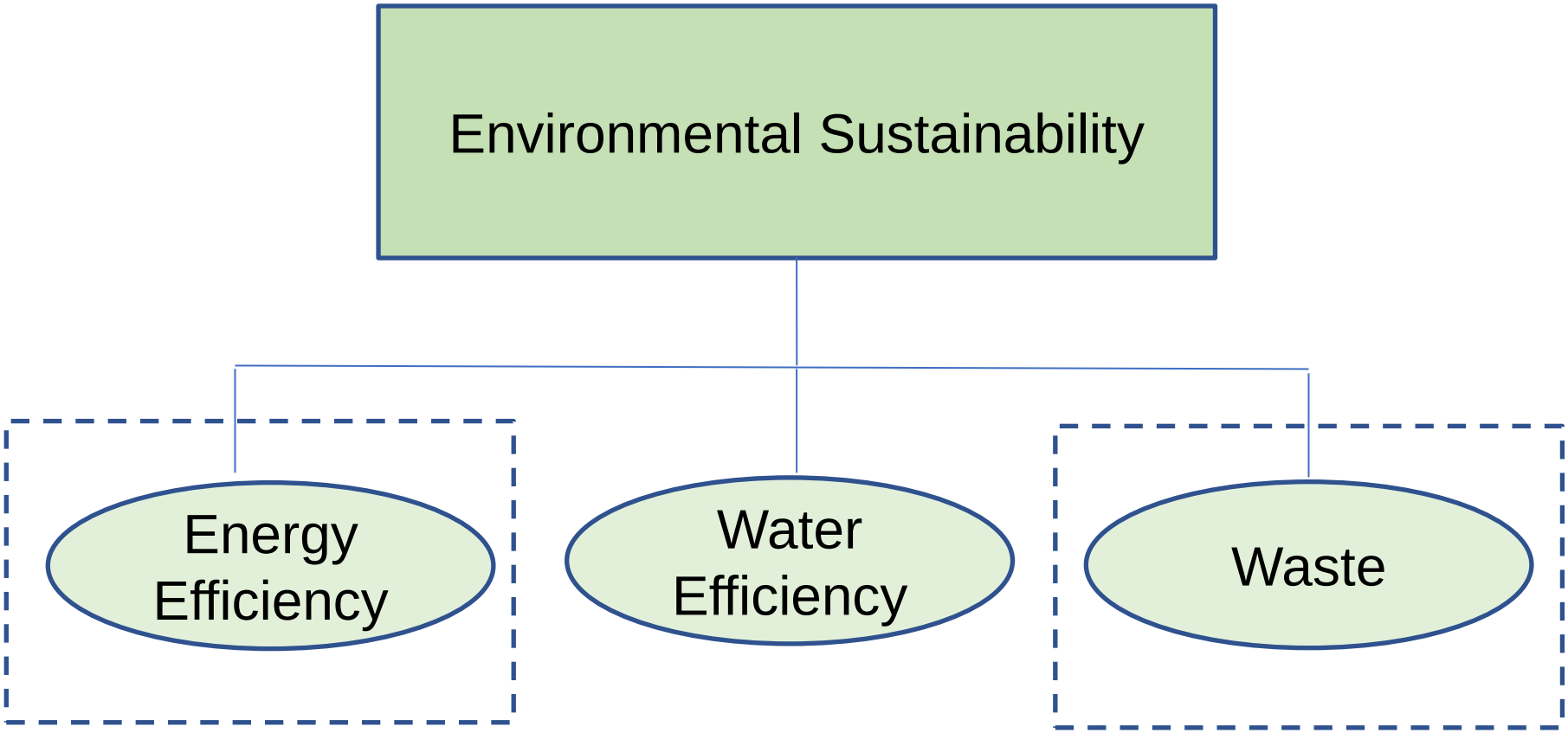
- Social Equity
  - Protection of health and safety
  - Ethical reputation
  - Exploitation and highlighting of local resources, workers and growers
  - Corporate welfare

Baiano, A., 2021,"An Overview on Sustainability in the Wine Production Chain", *Beverages* 7,15.

WINERY SUSTAINABILITY



WINERY SUSTAINABILITY



Why Energy Efficiency?

- Where does energy efficiency fit in within the broader goal of business success and image of a winemaking business?
- How visible is the Energy Efficiency when it is compared to other concepts?

❑ We know there is a concept of "**organically grown grapes**"

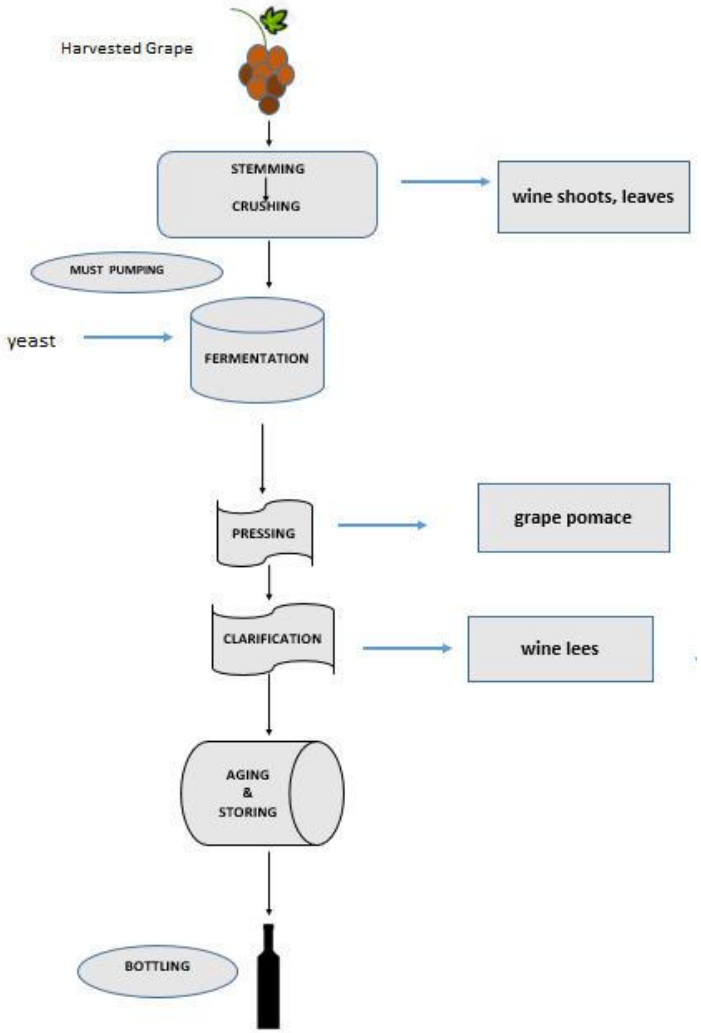
❑ We know that "**Renewable Energy**" is important and supports the image of a winery if the solar panels are visible

- **How visible is the "Energy Efficiency" within sustainability concept?**

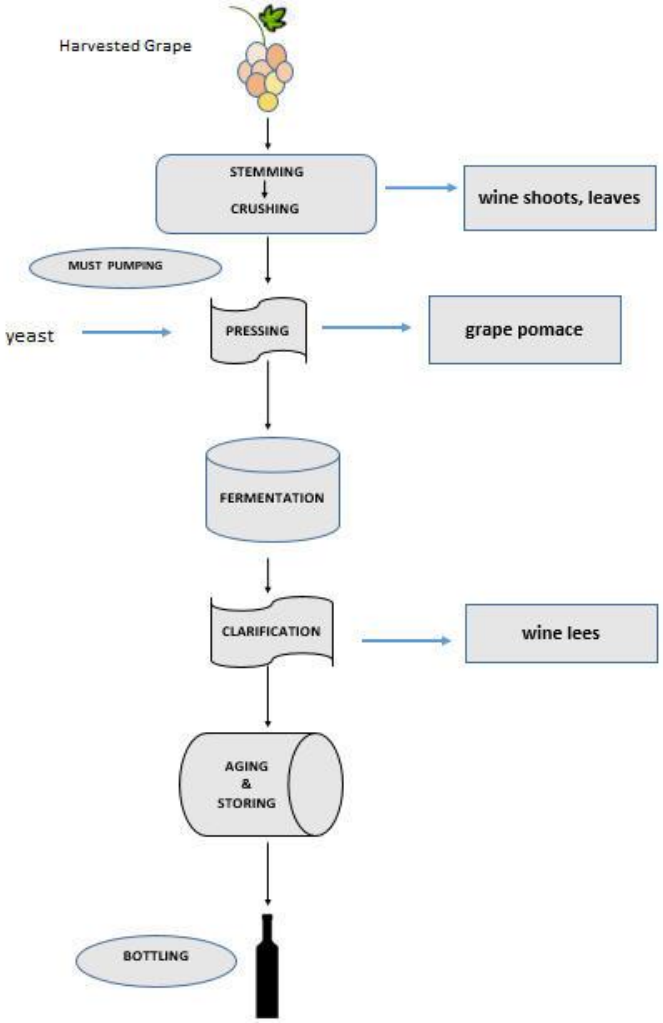
Energy Efficiency (EE) is Very Visible

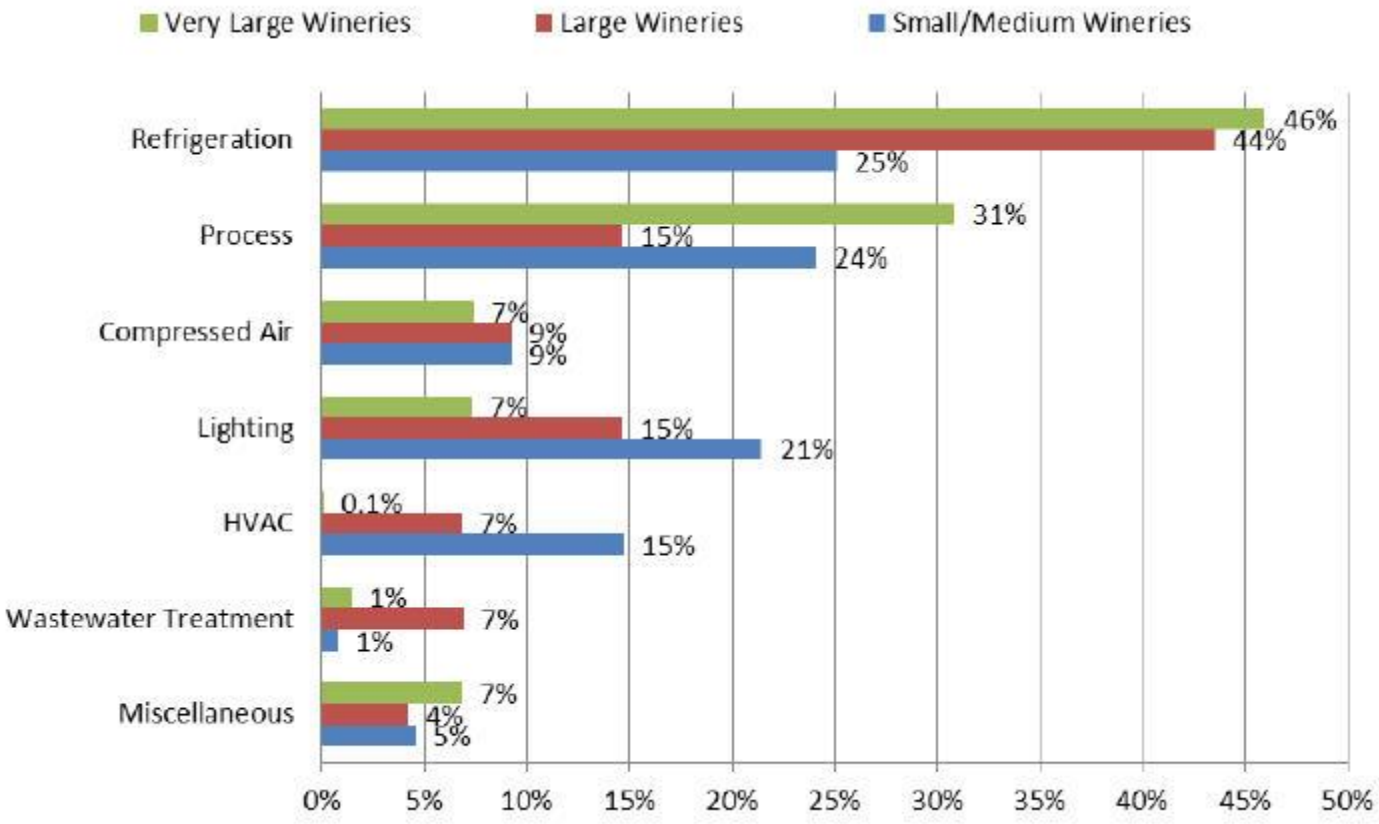
ENERGY EFFICIENCY =

RED WINE MAKING STEPS



WHITE WINE MAKING STEPS





*Wu,Y.Y., Chow,S., and Ganji, A.R., 2013,"Energy Efficiency in Wineries for Retrofit and New Construction Projects" Industrial Energy Technology Conference, 2013

Energy Efficiency Recommendations

- **No Cost:**
  - Program thermostats
  - Conduct routine maintenance checks
- **Low Cost :**
  - Replace Halogen and incandescent lightbulbs with LEDS
  - Seal air leaks
  - Install occupancy sensors
  - Utilize window shades and blinds
- **Medium Cost:**
  - Replace dishwasher
  - Replace water-heater

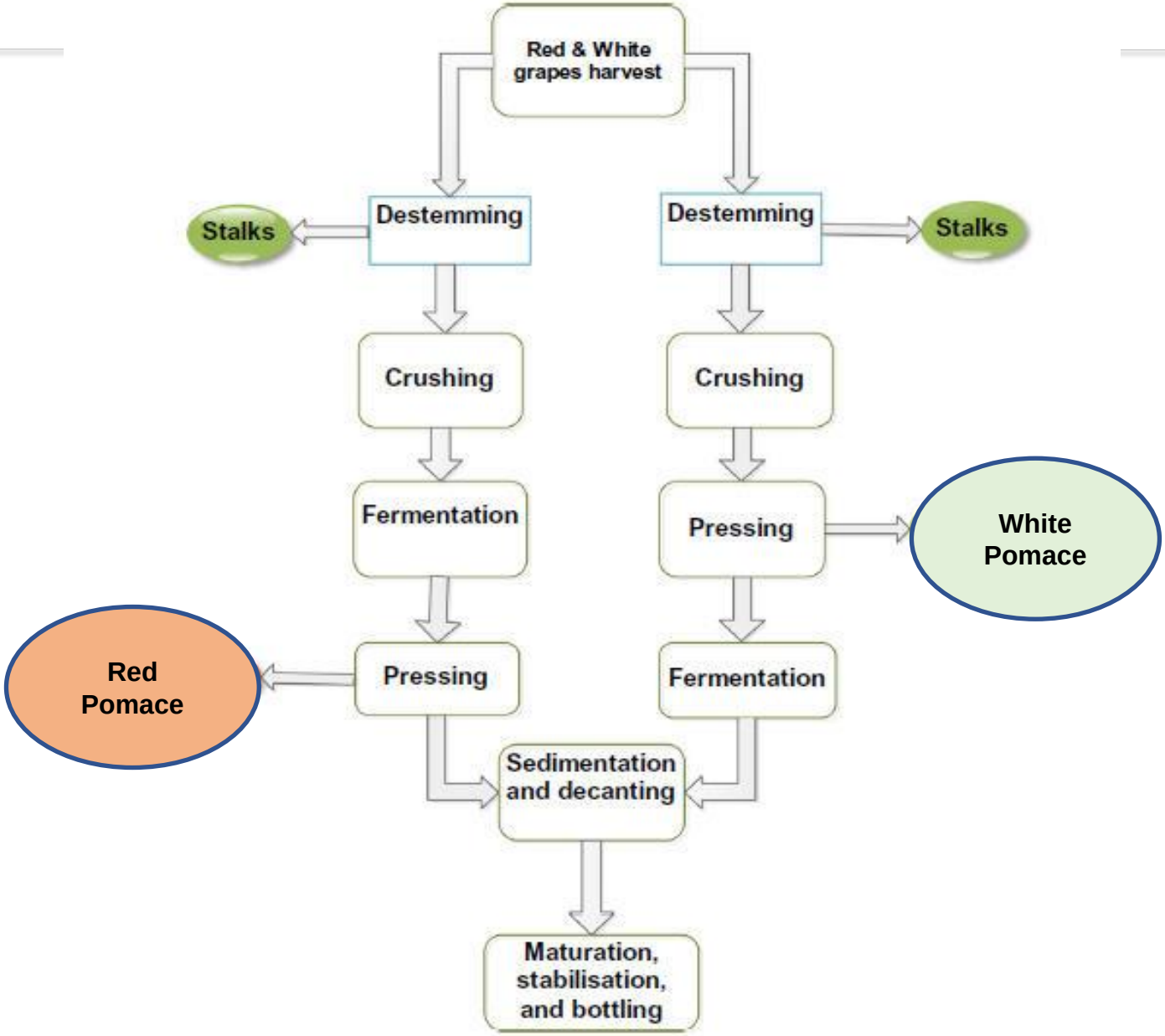
*DeCarr,K., 2015, “Reducing Energy Consumption at North Caroline Wineries: A Case Study of Shadow Springs Vineyards, and Windsor Run Cellars”. Msc Project. Duke University

Energy Efficiency Recommendations

- **Capital Intensive**
  - Replace lighting
  - Install ceiling fans
  - Improve insulation
  - Replace garage door for reduced air leaks
  - Upgrade old an inefficient equipment
- **Utilize State Incentives**
  - Direct Install Program for small business

  https://www.njcleanenergy.com/di
- **Renewable Energy to support your EE**

Winery Organic Waste Management & Potential Valorization



*Muhlack, R.A. et al. 2018,"Sustainable wineries through waste valorization: A review of grape marc utilization for value-added products", Waste Management,72,99-118

Grape Pomace

- Grape Pomace : Grape skins, seeds, stalks , moisture, fibers (cellulose, hemicellulose and lignin) polyphenols, lipids, proteins, oligosaccharides and minerals.
- Grape Pomace represents at least 10-30wt% of grape fresh weight.
- White pomace contains residual sugars (glucose and fructose) as high as 38% (based on dry weight).
- Red wine making pomace is produced by pressing after fermentation and it contains sugars and valuable alcoholic fraction.
- Concentration of sugars and alcohol in pomace vary based on grapes, processes during the crushing and winemaking.
- If a winery, applies a distillation process to recover remaining from pomace, the remainder is called “exhausted or spent” pomace or marc.

Pomace Reutilization

Composting:

- Efficient way to recover nutrients and carbon within the organic solid waste for efficient soil health and carbon capture and storage.

If the operations are large enough and/or wine industry may consider

Other Valorization Options:

Pomace consists of:

- phytochemicals including array of phenolics, pigments, and antioxidants
- Fatty acids, sugars, and lignocellulosics

These compounds can serve as feedstock for chemical industry intermediaries within the “biorefinery concept” and bring economic benefit.

Other Valorization Options

- Alcoholic Fermentation for Beverage Spirit or Bioethanol Recovery
- Anaerobic Digestion for Biogas and Digestate Composting
- Hydrolysis (high moisture and sugar content) for Lactic Acid Production
- Feedstock for Antioxidant and Probiotics Production
- Potential Biosorbents for Removal and/or Recovery of Heavy Metal Pollutants from Industrial Effluent
- Animal Feed.

Thank You!

For more information contact:

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