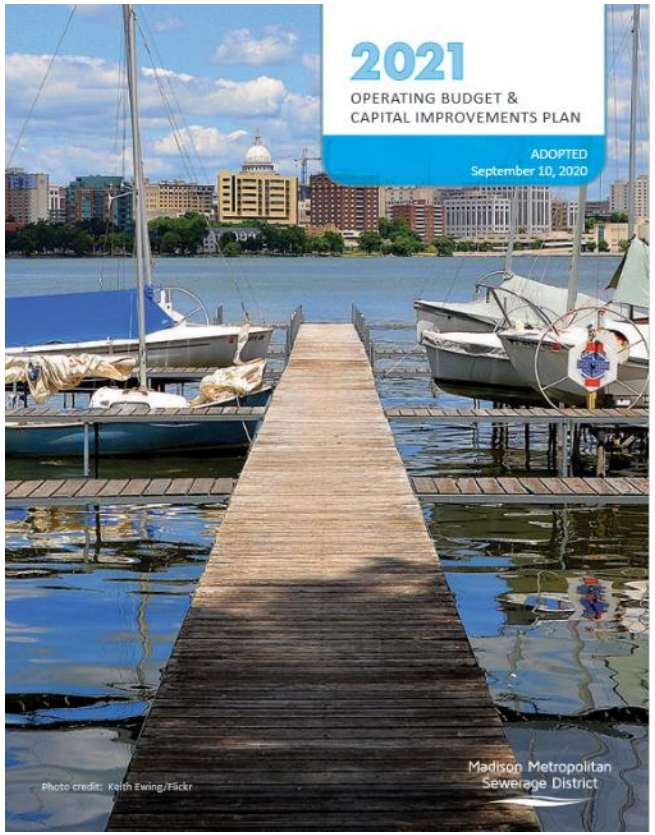
Energy Management Master Plan Update

Commission Meeting
24 June 2021

Madison Metropolitan Sewerage District

Context

- The 2020 Energy Management Master Plan is ongoing
- This presentation serves as background info for upcoming Capital Improvements Planning



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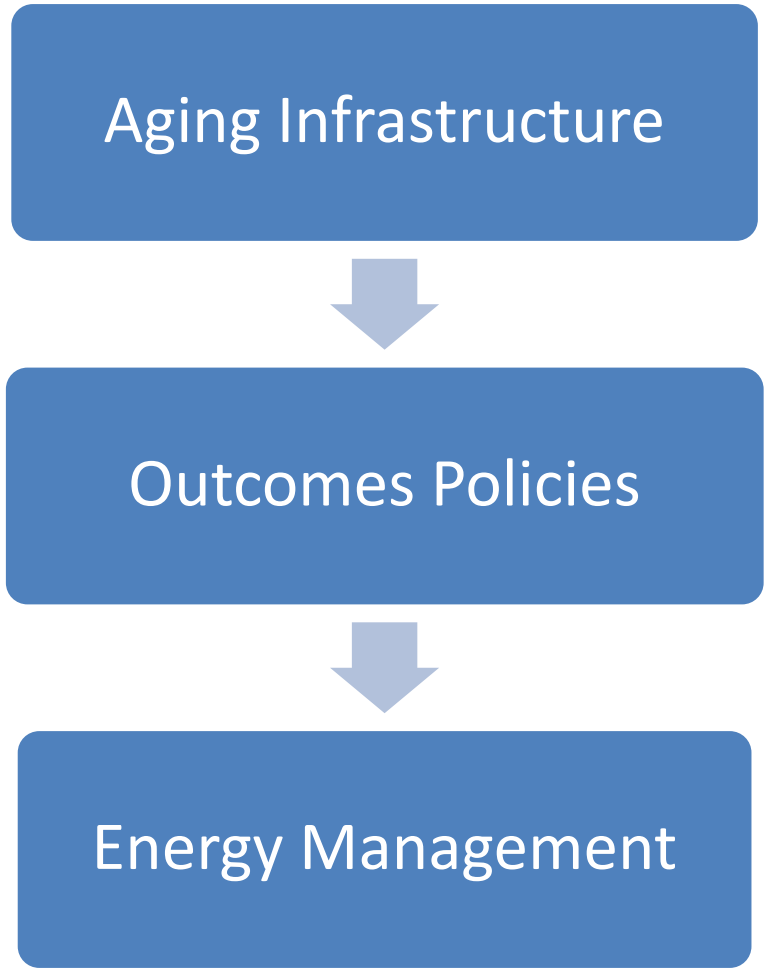
Project Motivation



- Aging infrastructure is the primary driver
- Not seeking projects just to make energy improvements

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Background Review

- Outputs:
  - Quantify status quo & future energy needs
  - Identify alternative strategies to advance District goals and policies
  - Prioritize alternatives based on impact, complexity, and cost
  - Provide business cases for alternatives with highest expected value

Background Review

- In Scope:
  - NSWTP areas not in other projects
  - Considerations:
    - Reliability & resiliency
    - GHG
    - Cost
    - Efficiency & demand
    - Increase renewable energy use
    - Increase renewable energy generation

- Outside Scope:
  - NSWTP areas in other projects
  - Pumping stations/collection
  - Considerations
    - Energy independence
    - Energy neutrality
    - Backup generators

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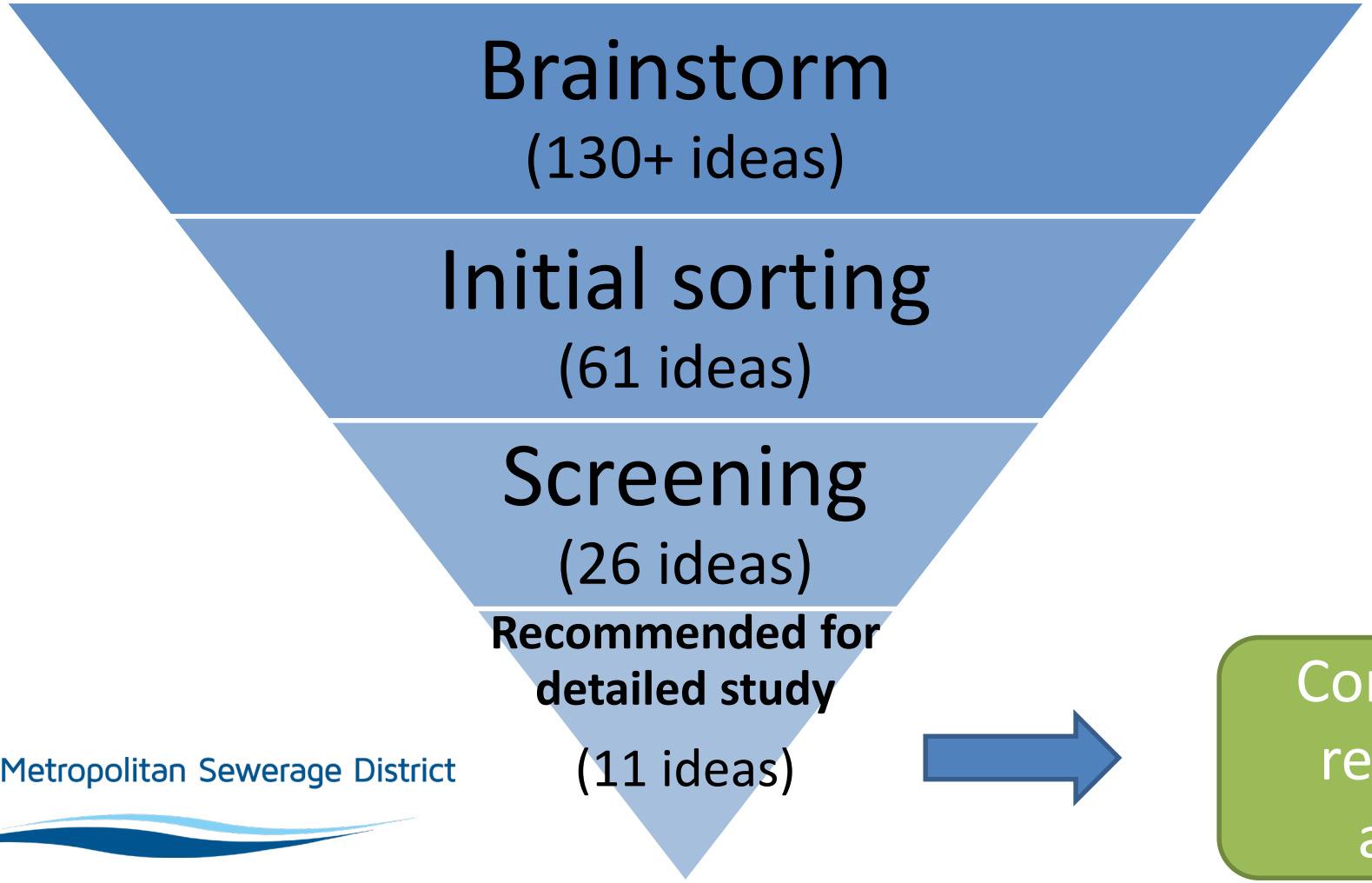
Technology & Solution Evaluation

- Technology:
  - Equipment & Processes
    - Energy using
    - Energy generating
- Solutions:
  - Partnerships
  - Business models
  - Grants/funding

Evaluation Process



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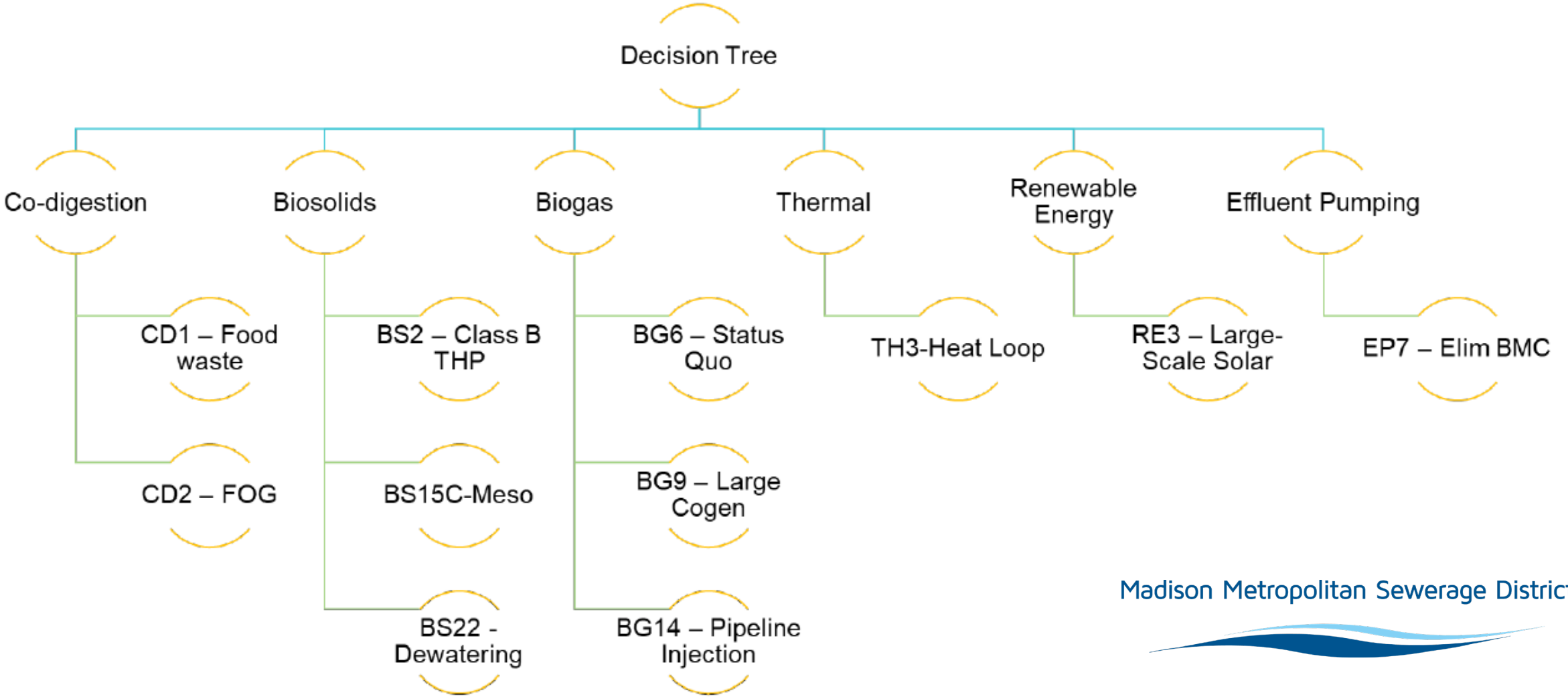
Combinations of recommended alternatives

Evaluation Decision Tree



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Combinations

1. Enhanced Baseline*
2. Maximize renewable energy production and consumption
3. Grid independence
4. Reduce infrastructure complexity*

* considered with and without large solar

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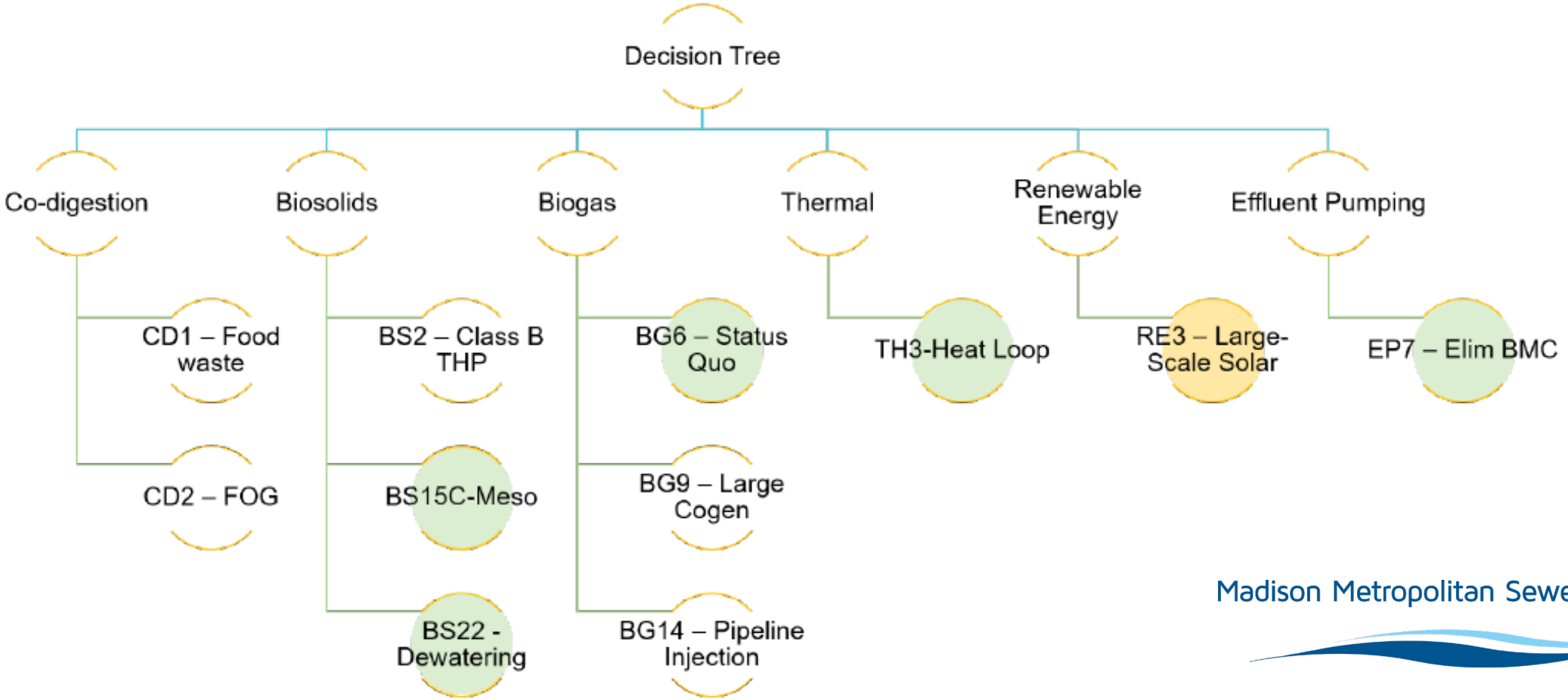
Combinations

- Enhanced Baseline



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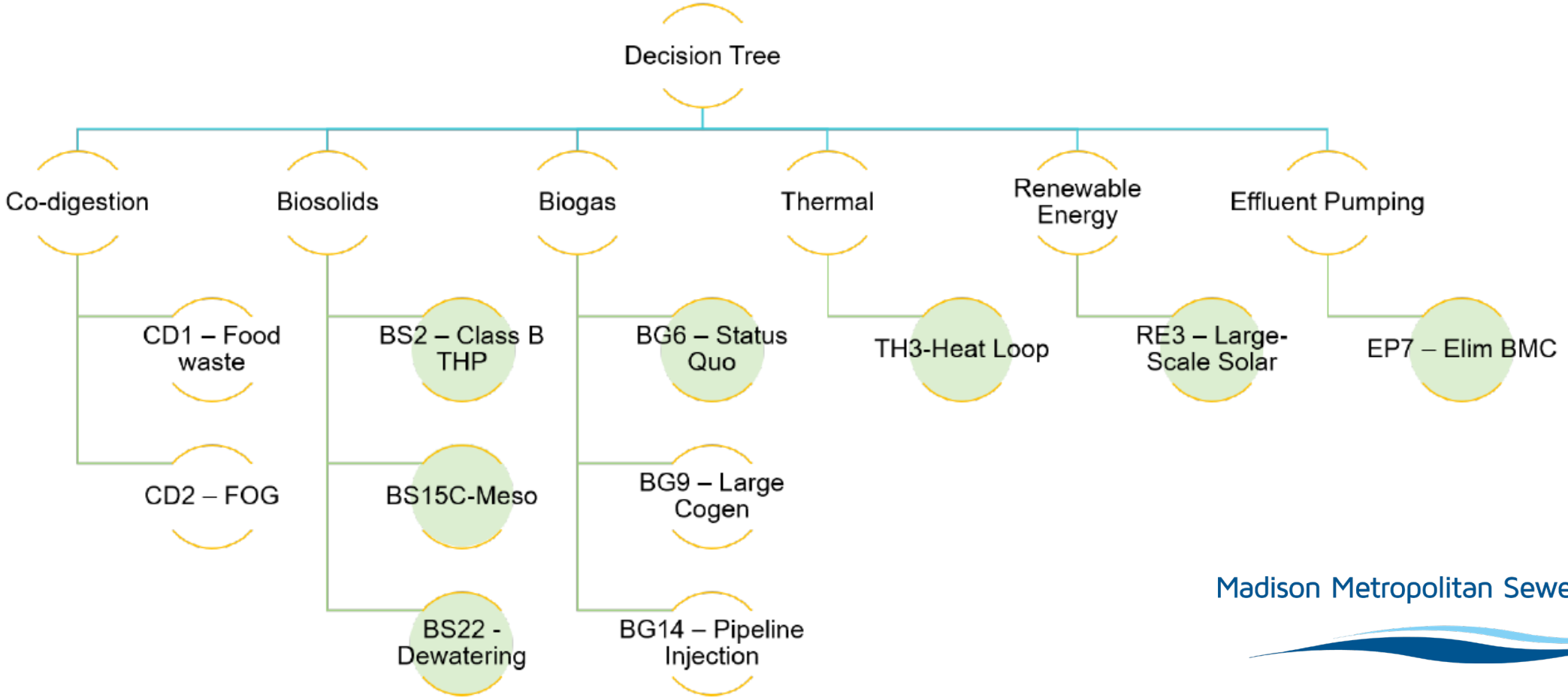
Combinations

- Maximize renewable energy production and generation



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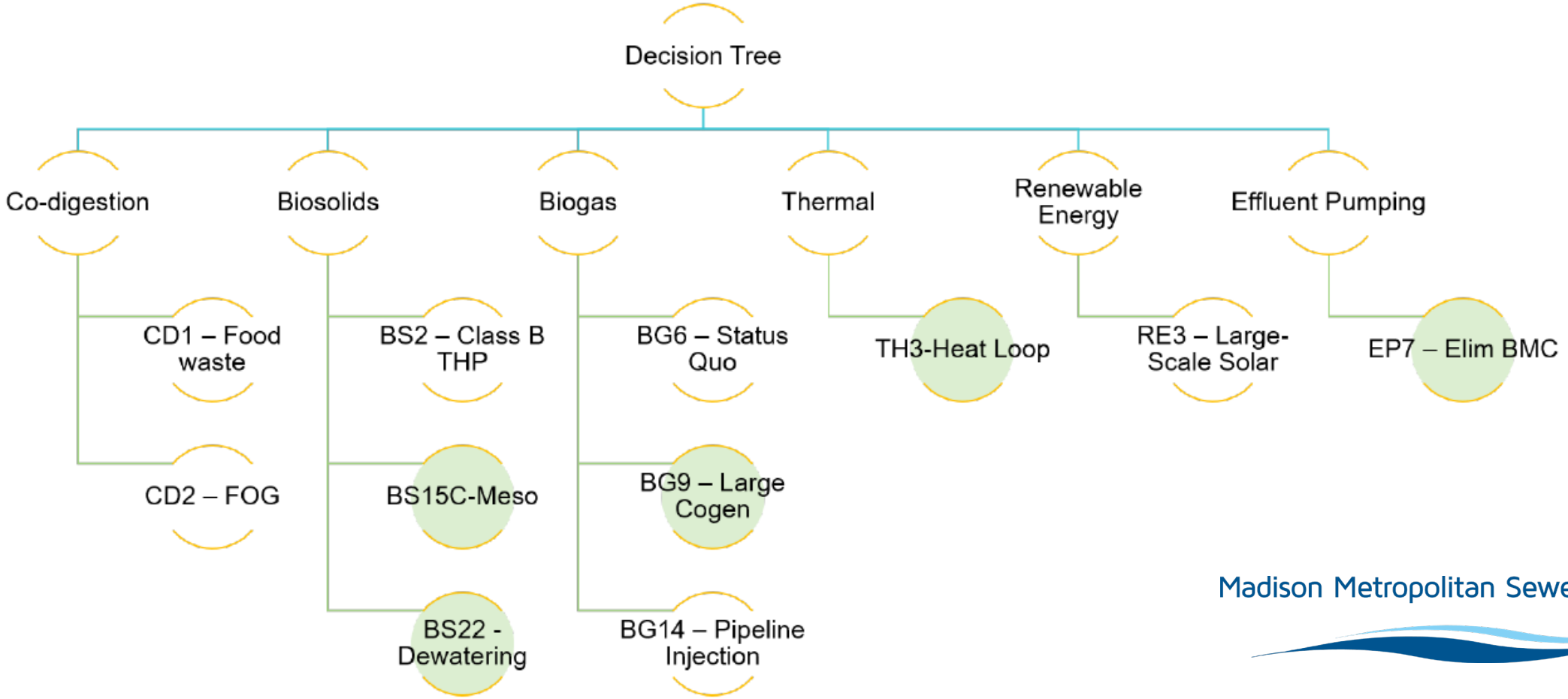
Combinations

- Grid Independence



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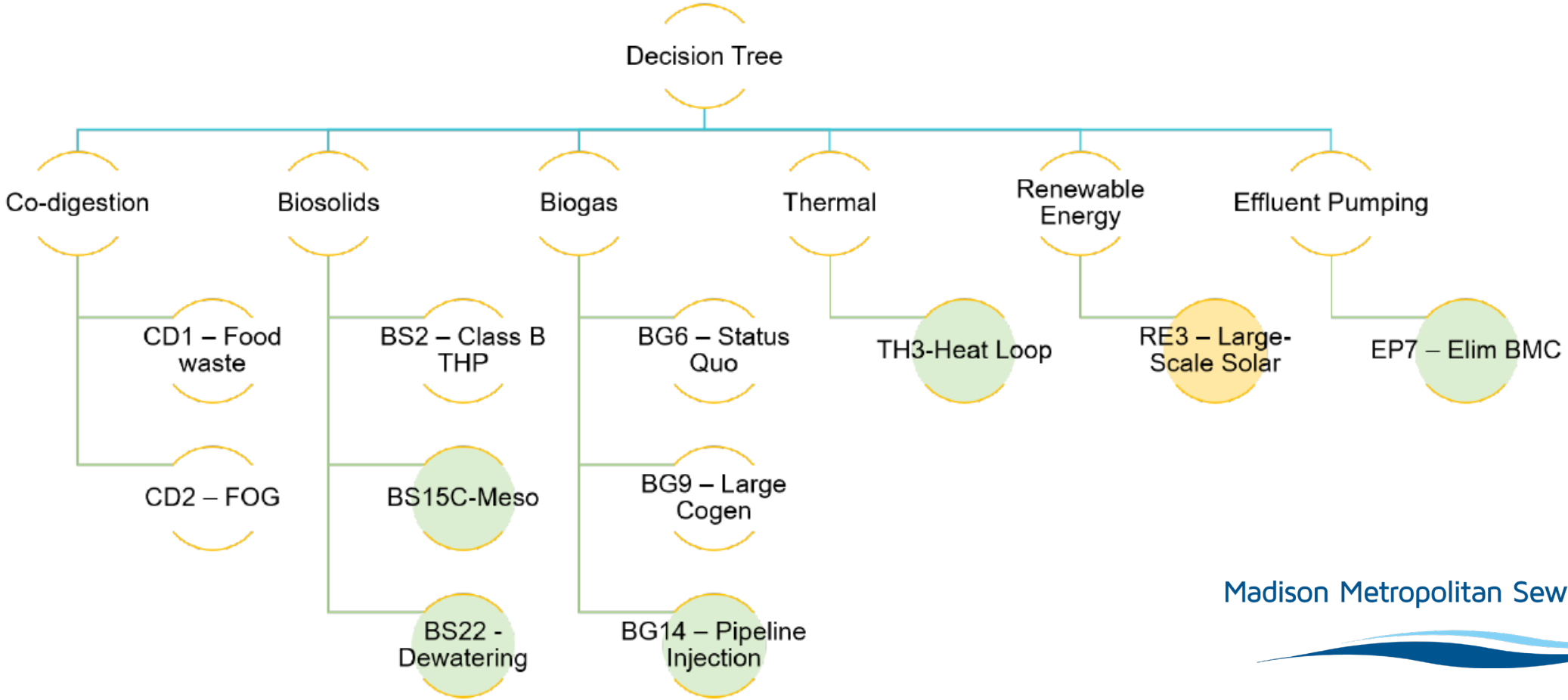
Combinations

- Reduce Infrastructure Complexity



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Combinations

1. Enhanced baseline*
2. Maximize renewable energy production and consumption
3. Grid independence
4. Reduce infrastructure complexity*

* considered with and without large solar

Preliminary Conclusions

- Heat & Power
  - Greatest infrastructure needs
- Exporting biogas
  - Lower lifecycle cost
  - Reduces infrastructure
  - Higher cost volatility
- Greatest GHG impact
  - Use biogas for co-generation
- Increasing renewable generation
  - Look at RER with MG&E
- Energy resiliency
  - Backup generation most effective
- Energy independence
  - Not cost acceptable
  - Increases infrastructure complexity
- Effluent pumping
  - Discontinue BMC forcemain
    - Less pumping
    - Less treatment

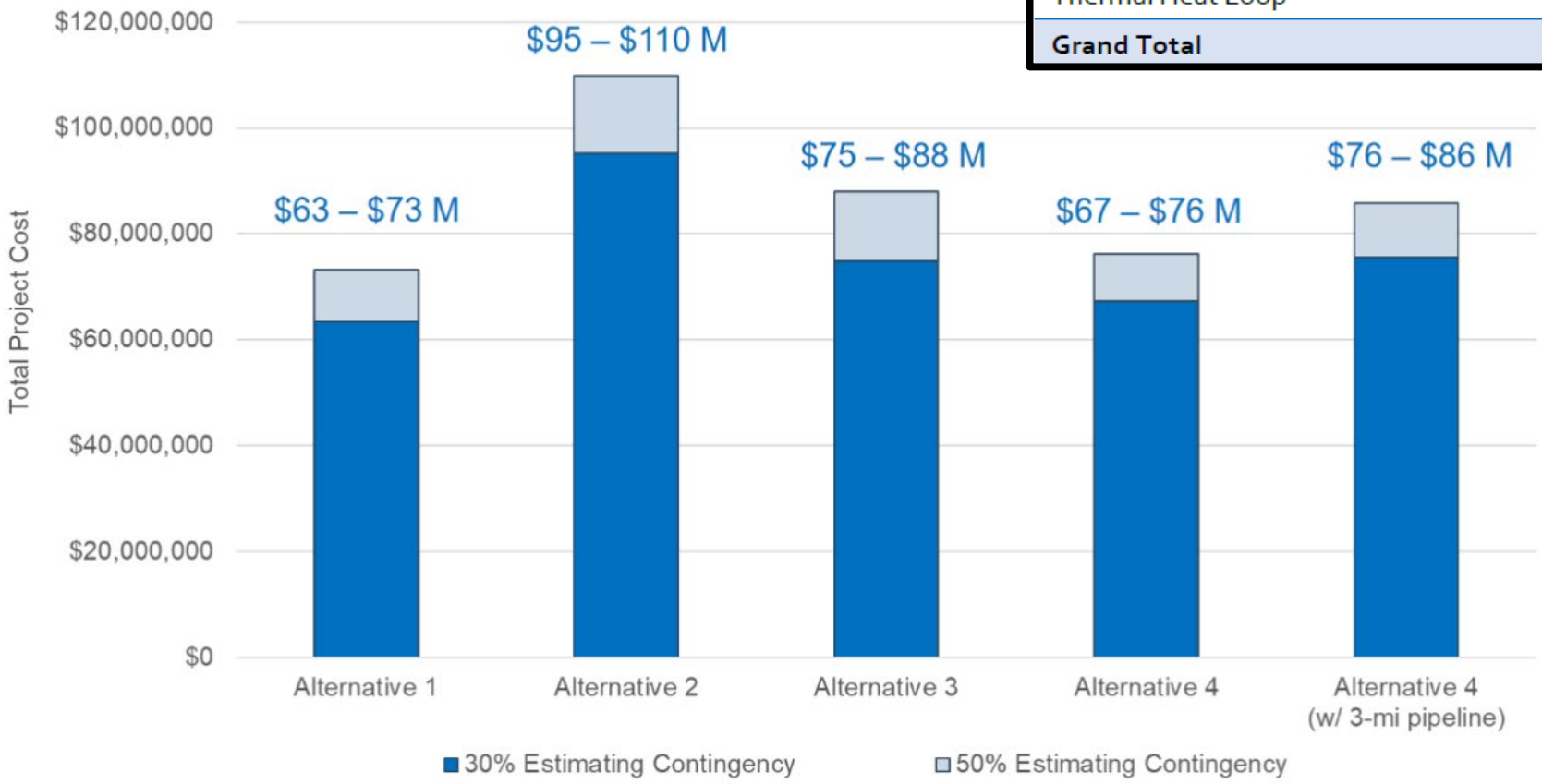
Preliminary Conclusions

- Using vs Selling Biogas:
  - Overall economic result is similar for each
  - Energy implications are very different
  - Each pathway advances District outcomes, but in different ways
  - Need leadership/commission guidance

Preliminary Conclusions

Process Area	Baseline Capital Costs [1]	Avoided Baseline Costs
Biosolids	$31,200,000	$12,200,000
Biogas	$8,500,000	$8,500,000
Co-Digestion	$100,000	$100,000
Thermal Heat Loop	$200,000	$200,000
Grand Total	**$40,000,000**	**$21,000,000**

Summary of Project Costs



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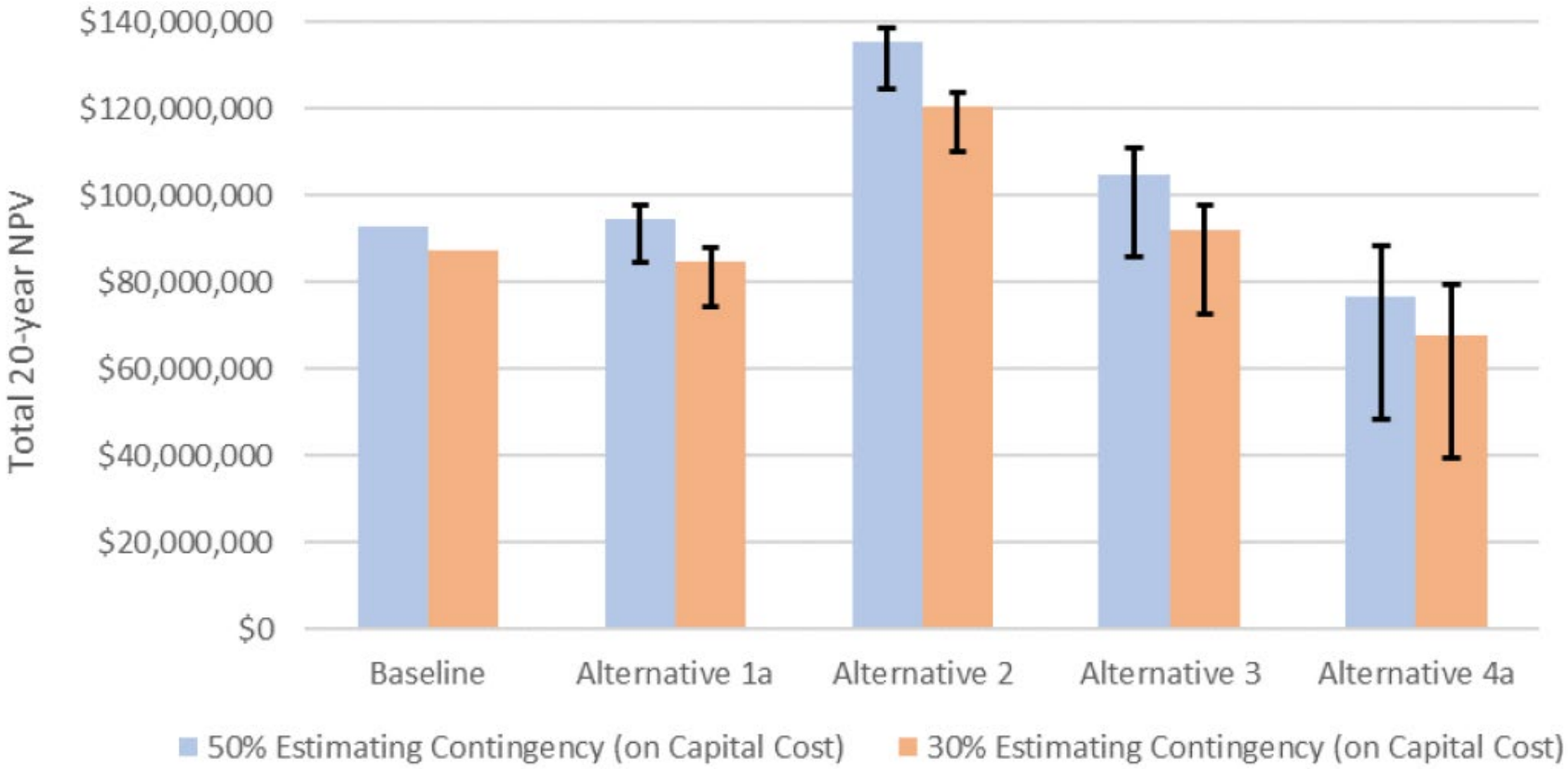
Preliminary Conclusions

Sensitivity Analysis Combined NPV



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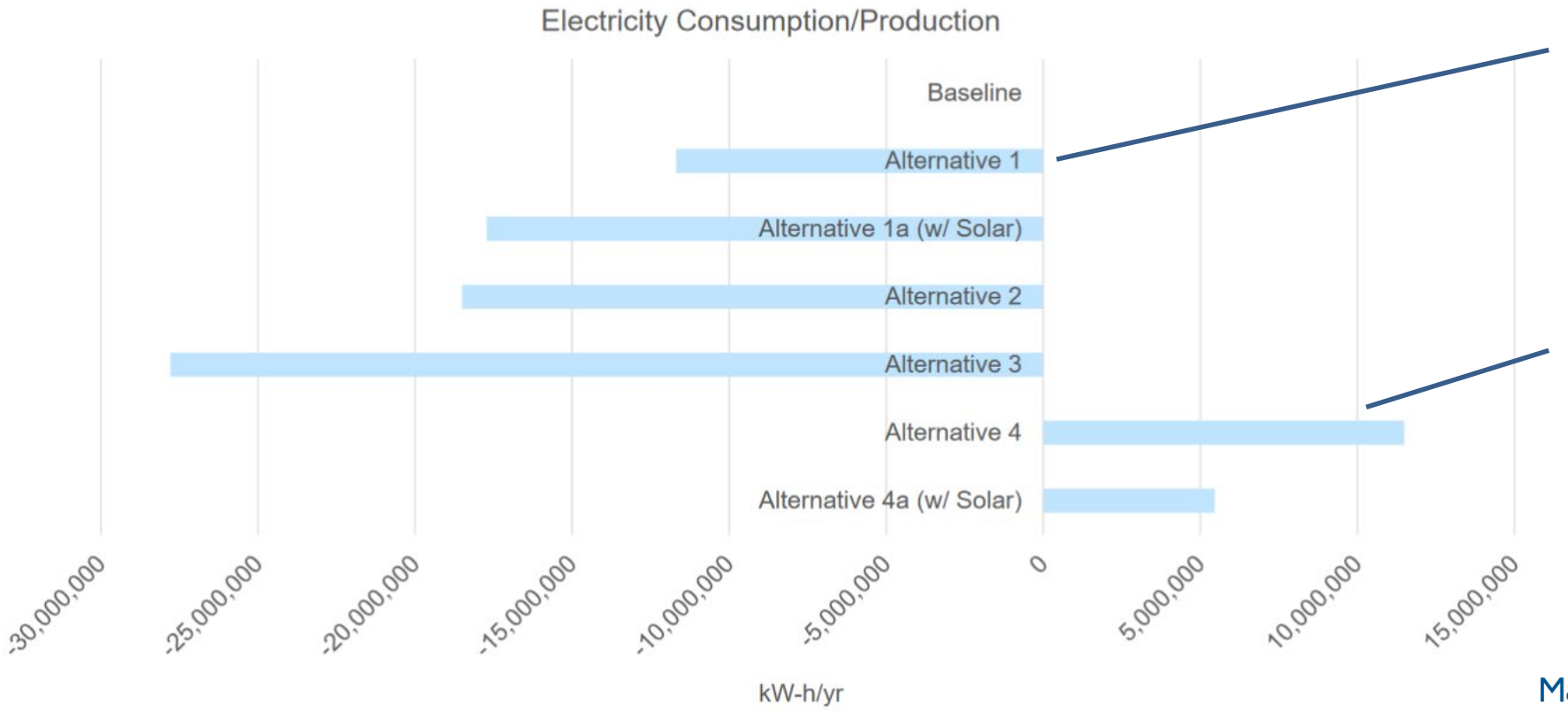
Preliminary Conclusions

Net Change in Electricity Production or Purchase



Producing more energy

Purchasing more energy

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Preliminary Conclusions

2040 GHG Emissions (MT CO_{2e}/year)

Status Quo	Alternative 1 w/ large solar (use biogas on site)	Alternative 4 w/ large solar (sell biogas)
34,340	20,320	27,420

*assumes MG&E energy mix does not change

**can purchase “green energy” for extra $0.01/kWh

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Preliminary Conclusions

- Large Scale Solar
  - Renewable Energy Rider (RER) program
    - Partnership with MG&E
    - MG&E owns and operates the infrastructure
    - MMSD provides land
    - Can include NSWTP and pumping stations
    - Establishes long-term, stable power price
    - Supports development of renewable energy generation

Preliminary Conclusions

- Reliability
  - All combinations yield **system reliability** improvements through simplification or replacement of aging infrastructure
    - Simplify digestion
    - Simplify/improve heat loop
    - Replace boilers and cogeneration
    - Simplify effluent pumping
    - Replace biosolids dewatering and reduce biosolids hauling

Preliminary Conclusions

- Resilience
  - Solar does not add energy resilience
    - Need to include battery storage
  - Cogeneration adds limited resilience (i.e. not reliable)
    - Very few utilities rely on cogeneration for backup power
    - Requires complicated programming/controls
    - Black start of cogeneration is difficult

Preliminary Conclusions

- Resilience
  - Backup generators are the simplest, least cost means of adding system resilience
    - Generator lease
      - ~$35,500/year per MW
      - MG&E owns and maintains
    - Generator purchase
      - ~$400,000 per MW (10-12 year payback)
      - MMSD owns and maintains

Next Steps

- Complete master plan (August 2021)
- Facility planning, design and construction
  - Implemented in several phases

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Questions
&
Discussion

Questions

- Is any portion of this study considered unacceptable and needing reconsideration?
- Is there an implication in either of the recommended pathways that the commission is uncomfortable with or does not fully understand?