Quantifying the Sustainability of Waste Management Systems



WTERT
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ASSUMPTIONS AND MOTIVATIONS

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- Disposal of municipal solid waste leads to significant environmental burdens
- There is a desire to manage wastes sustainably
- We need goals and tools to measure progress towards sustainable waste management

OUTLINE

(1) Municipal Solid Waste Data & Metrics

(2) Measuring Sustainability

- Resource Conservation Efficiency (RCE)

(3) Conclusions

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CREATING A QUALITY METRIC

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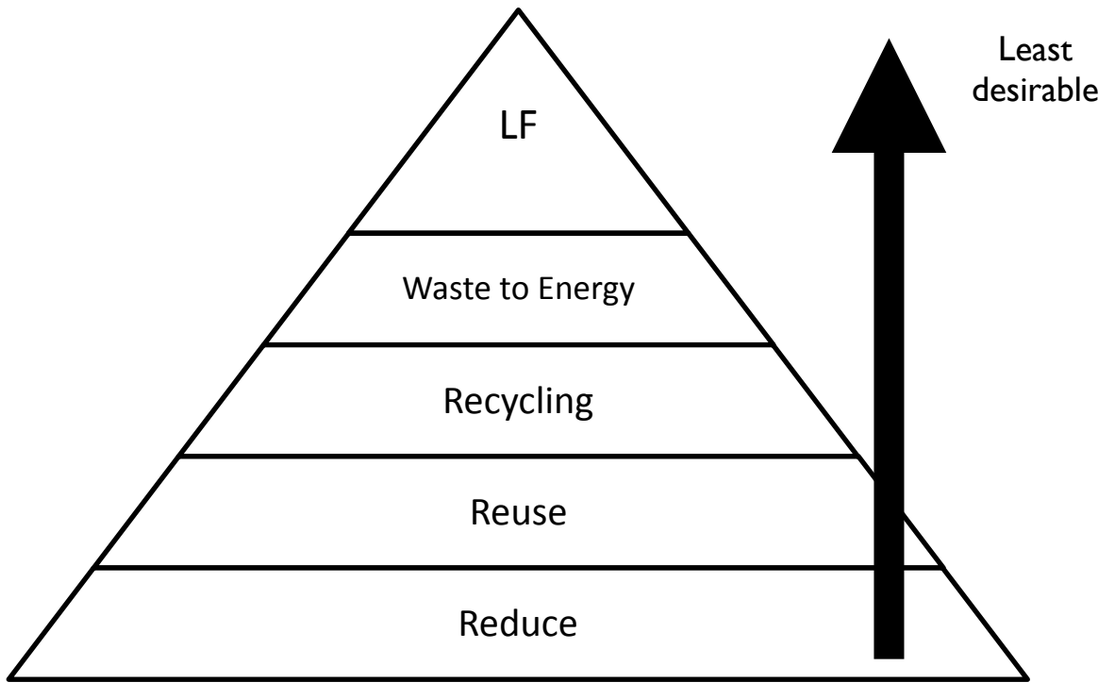

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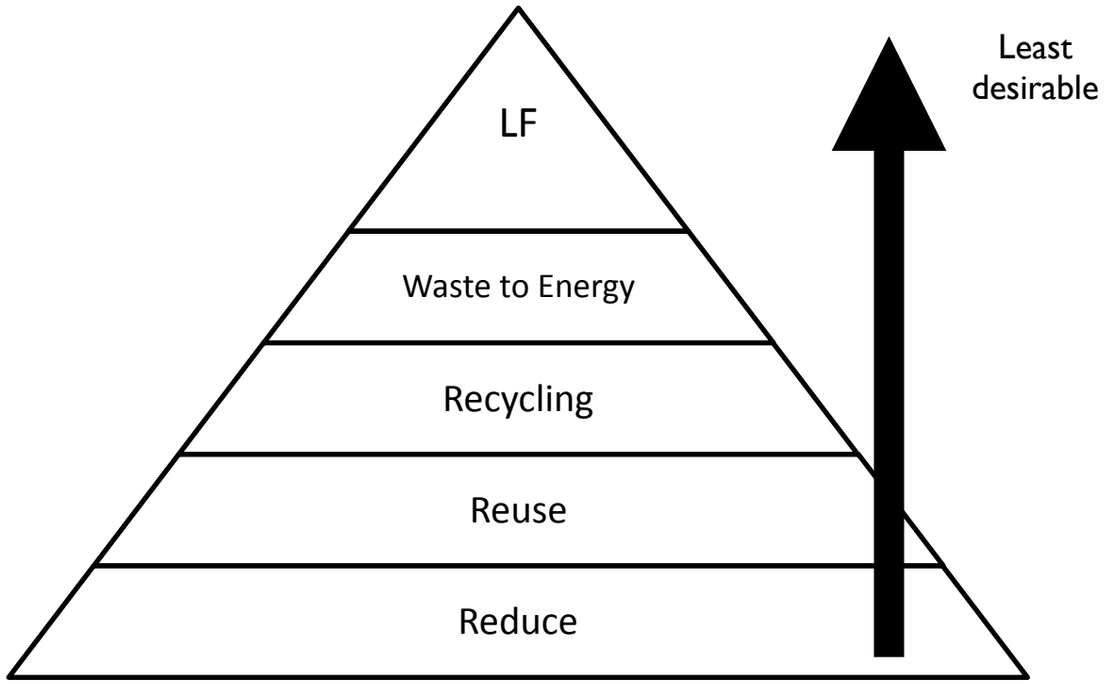

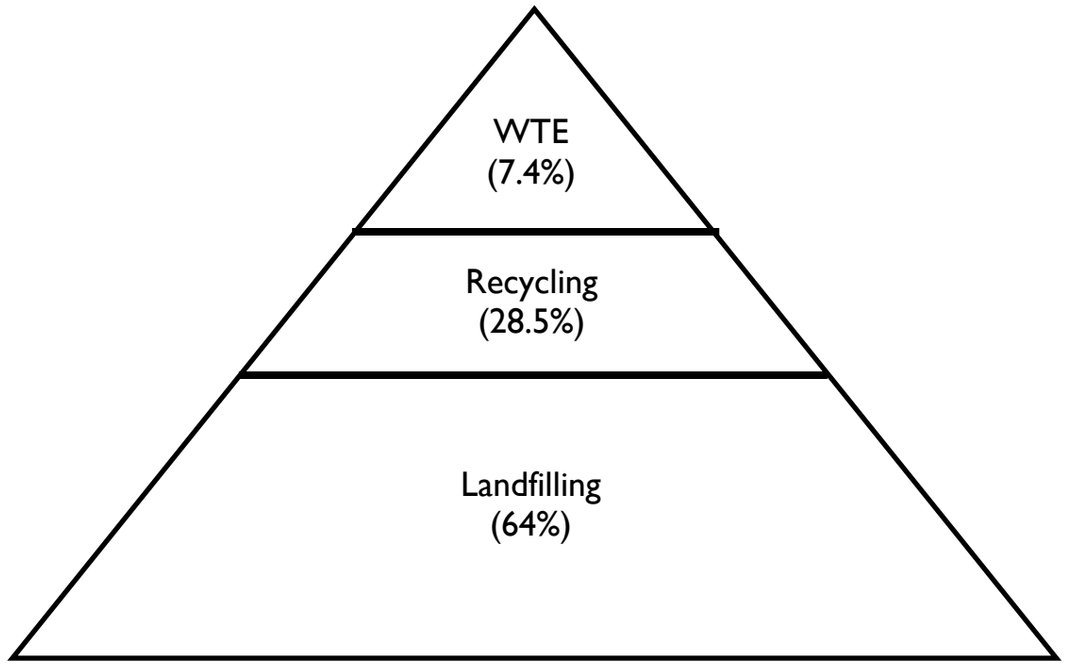

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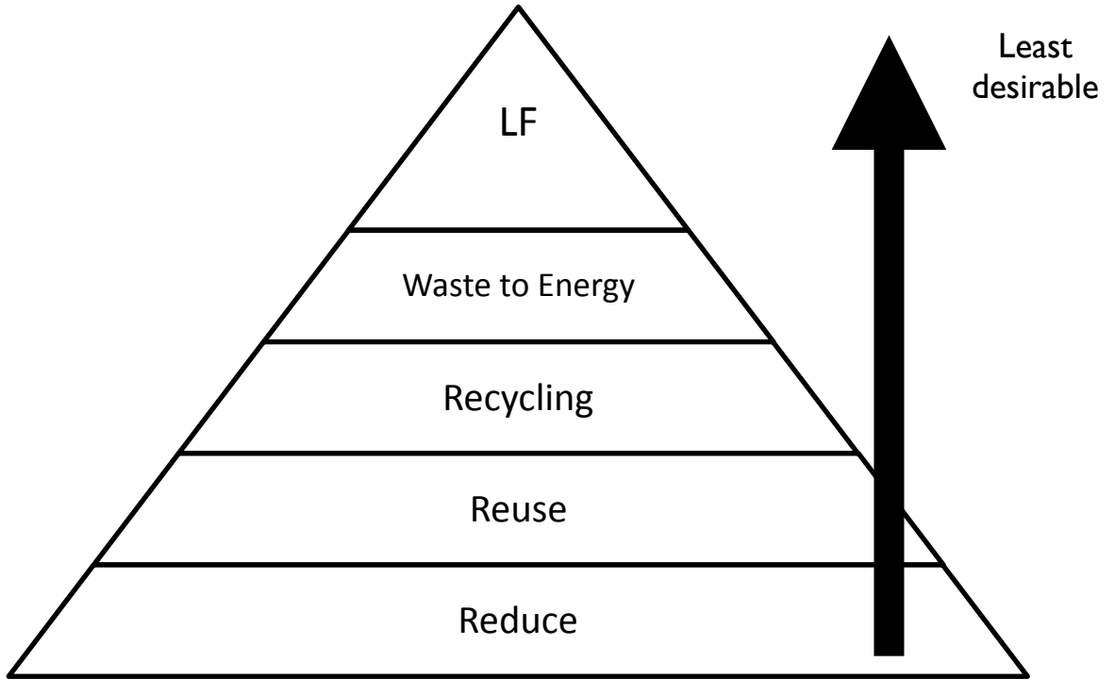

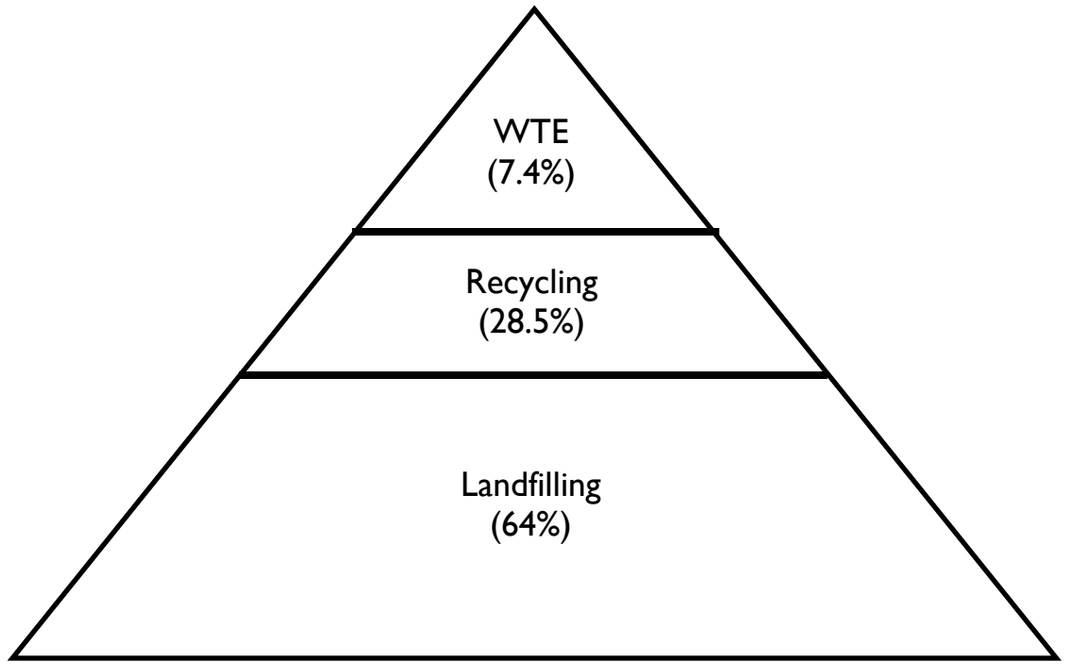

Components of a Quality Metric

- Functional
- Robust
- Easy & quick to use

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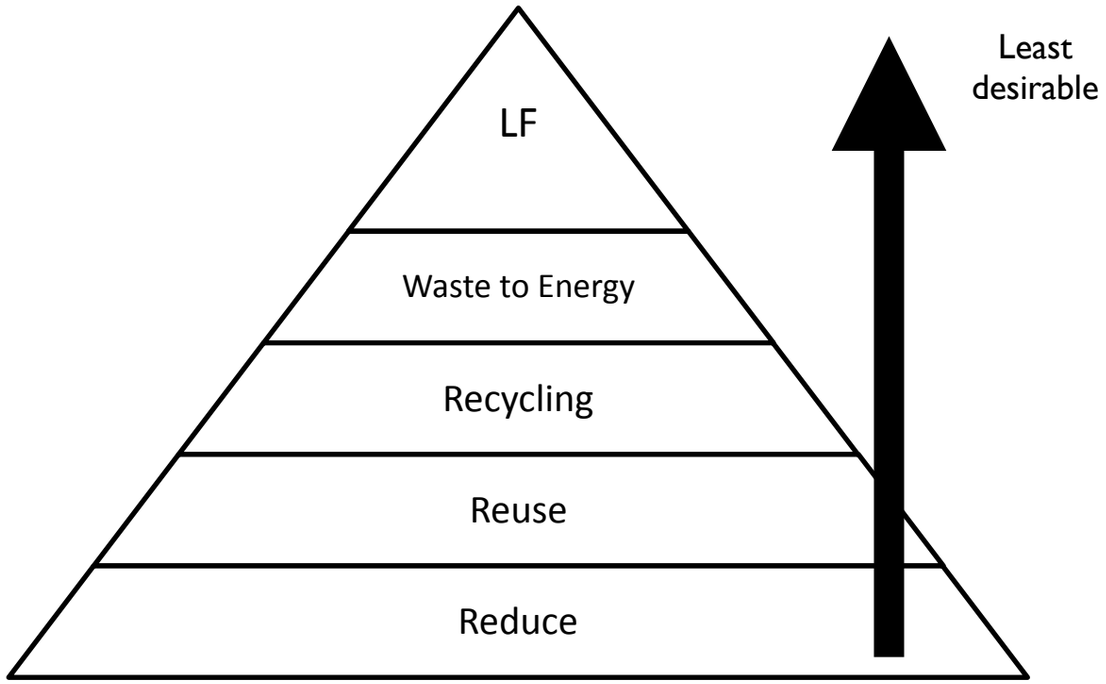

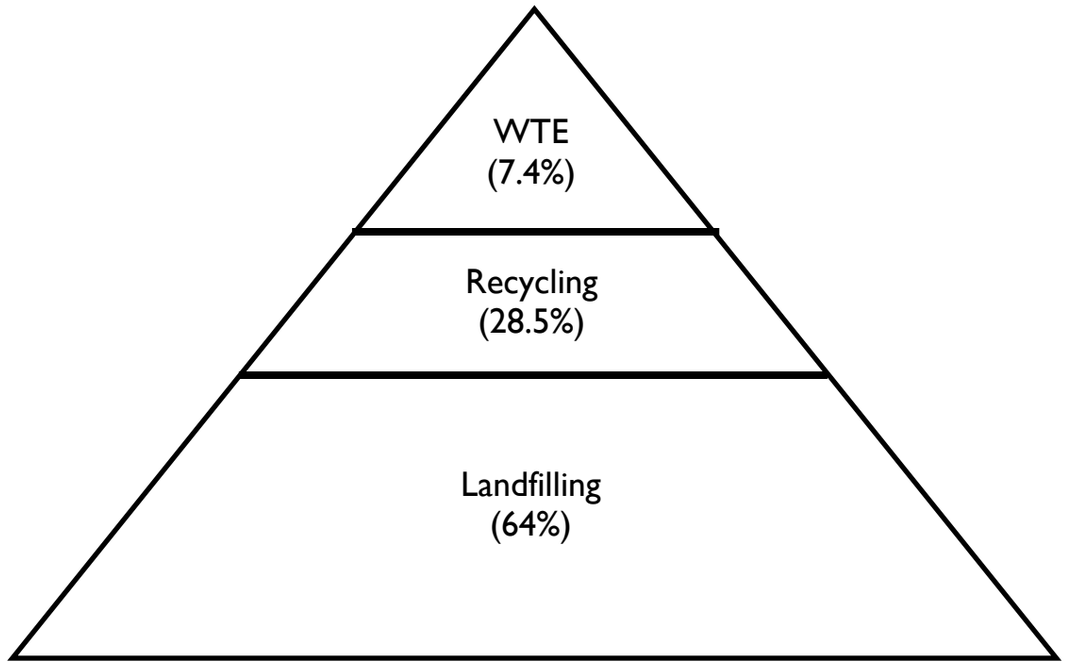

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Why Develop a New Waste Metric?

- Quantify & benchmark sustainability
- Identify ways to improve systems
- Help set goals
- Track progress towards goals

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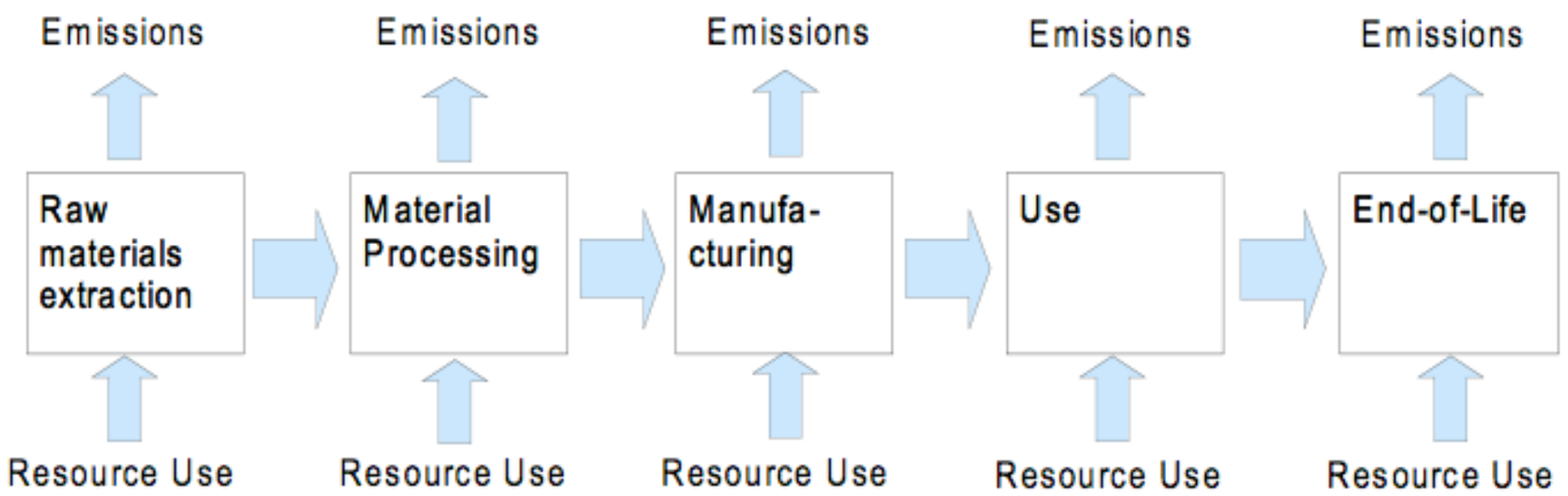
MOTIVATIONS AND BACKGROUND FOR RESOURCE CONSERVATION EFFICIENCY



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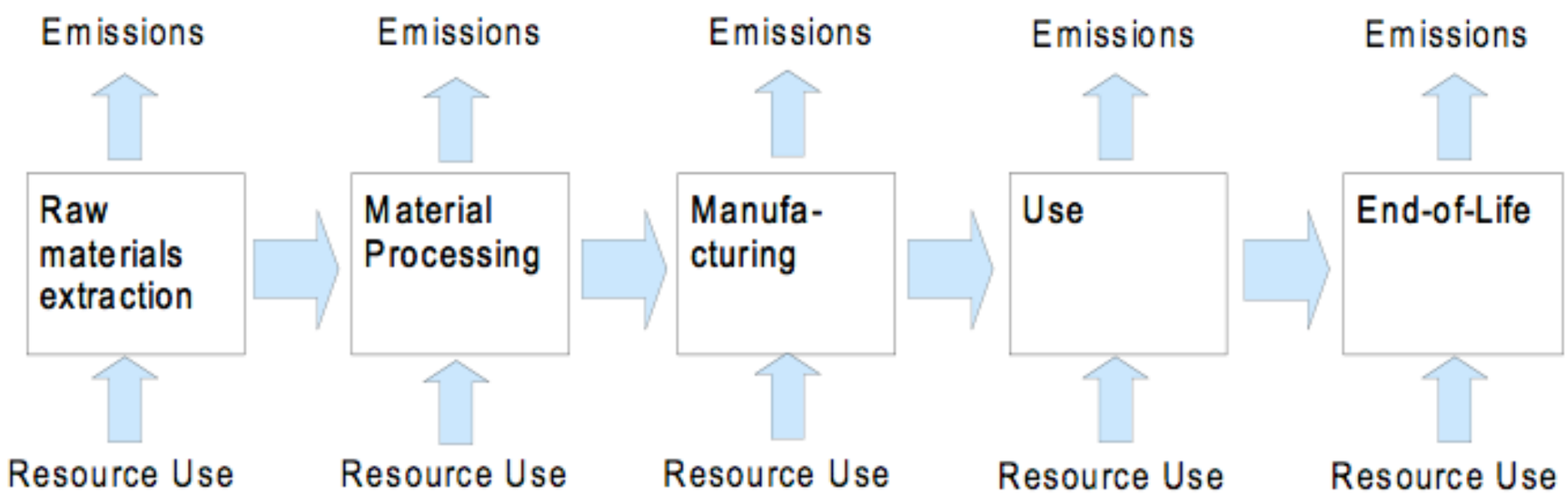

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- Life cycle energy inputs trend with environmental impacts

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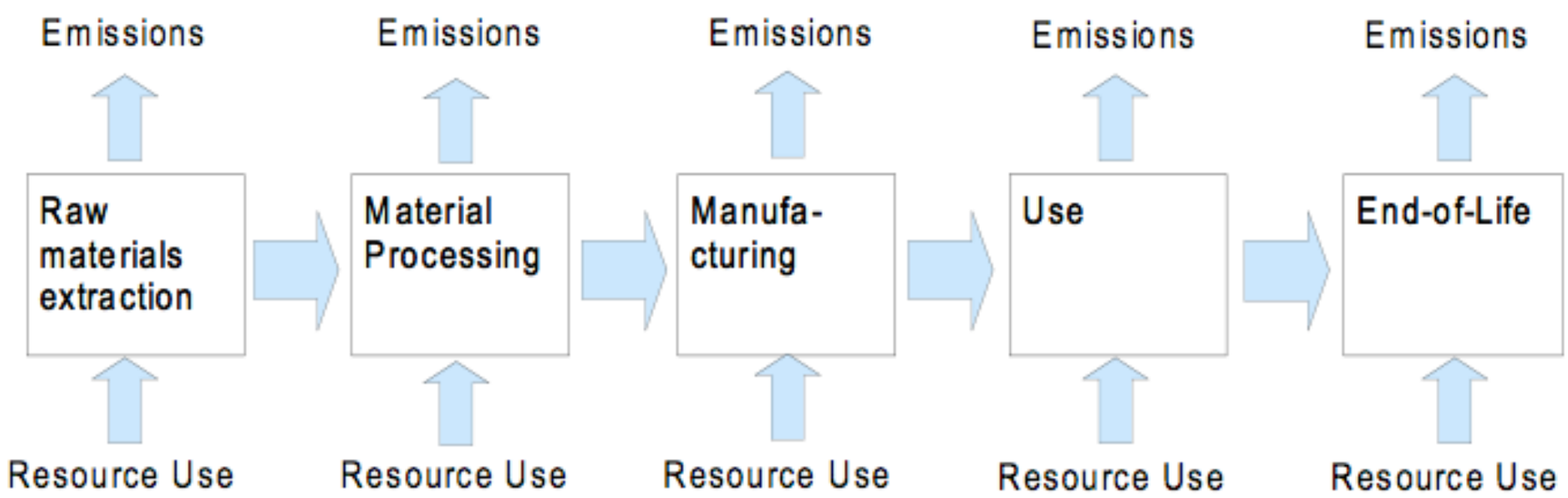


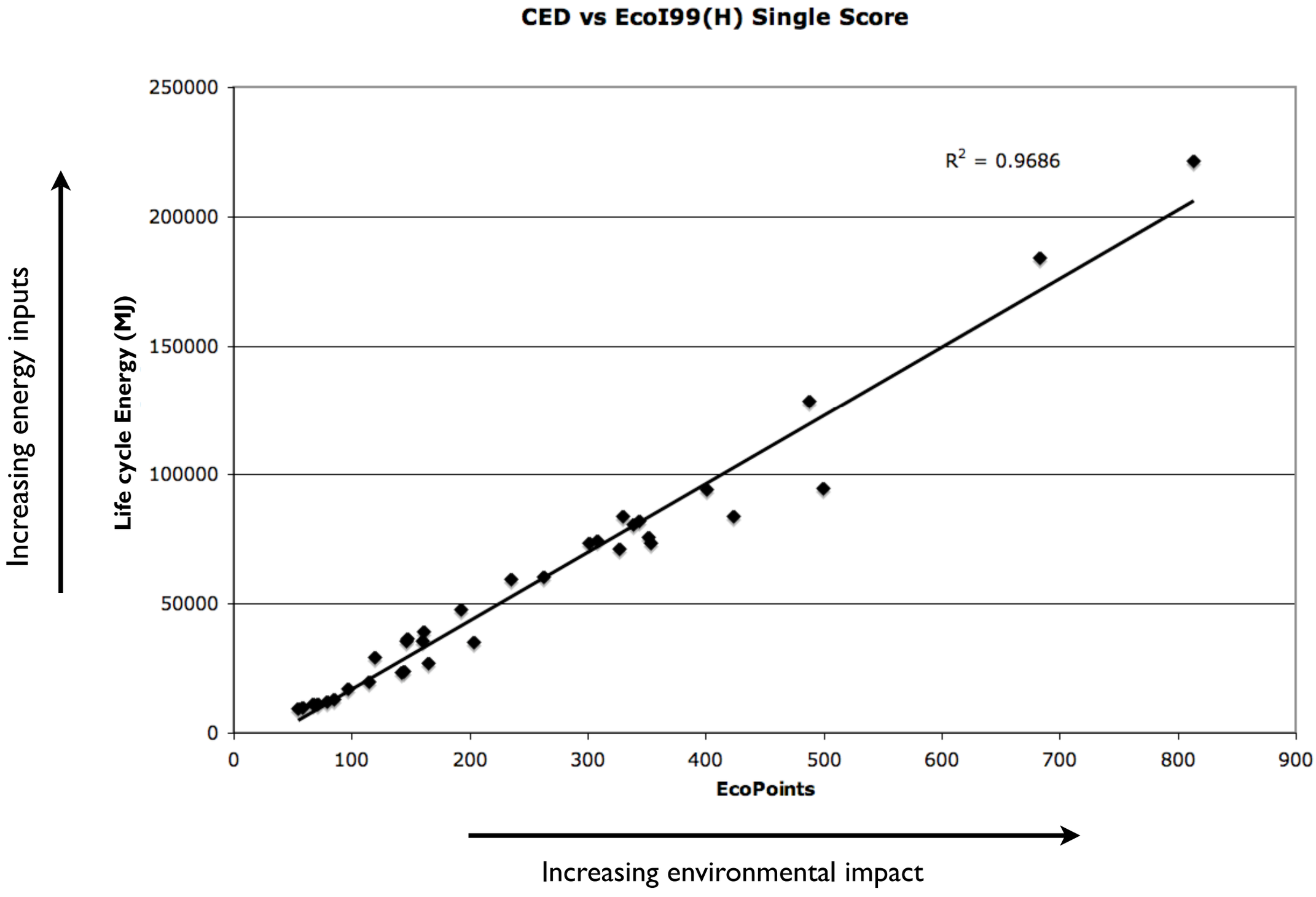
Assumptions Leading to Metric

- Life cycle energy inputs trend with environmental impacts

Background Research

- Is life cycle energy in fact a good indicator for sustainability of waste systems?
  - Use of life cycle impact analysis

IS LIFE CYCLE ENERGY USEFUL AS A PROXY FOR A FULL LCA OF WASTE SYSTEMS?



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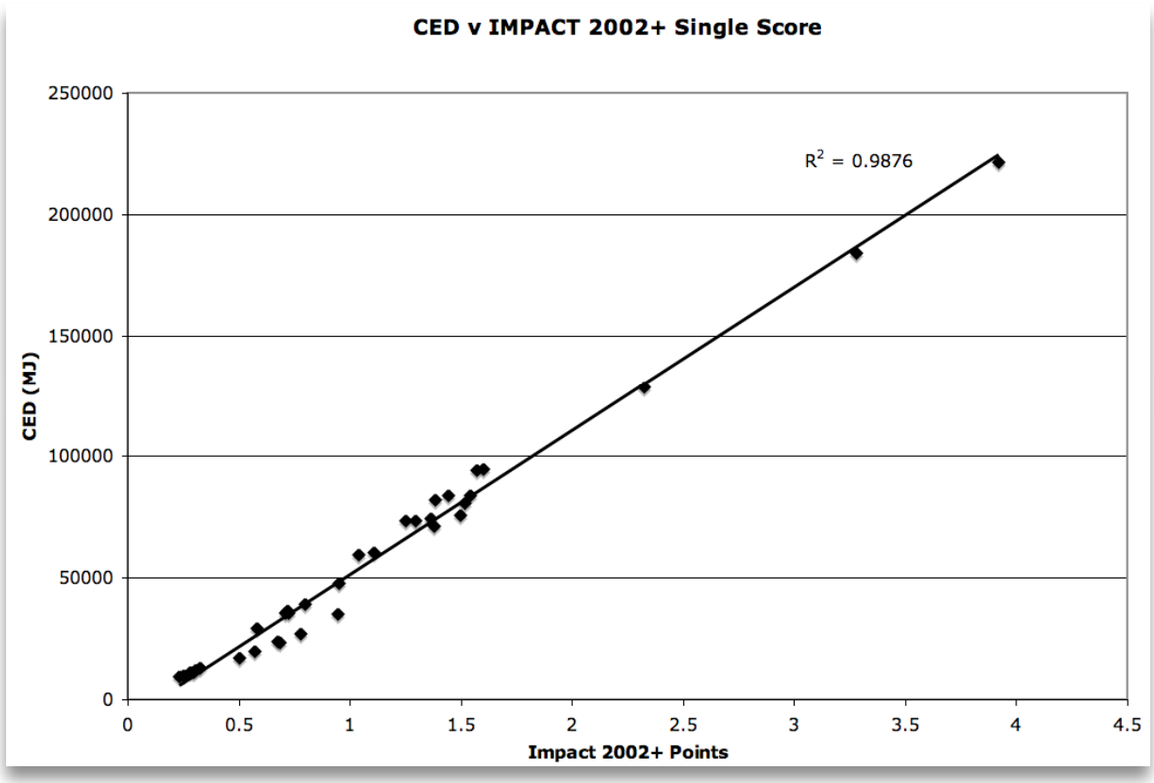

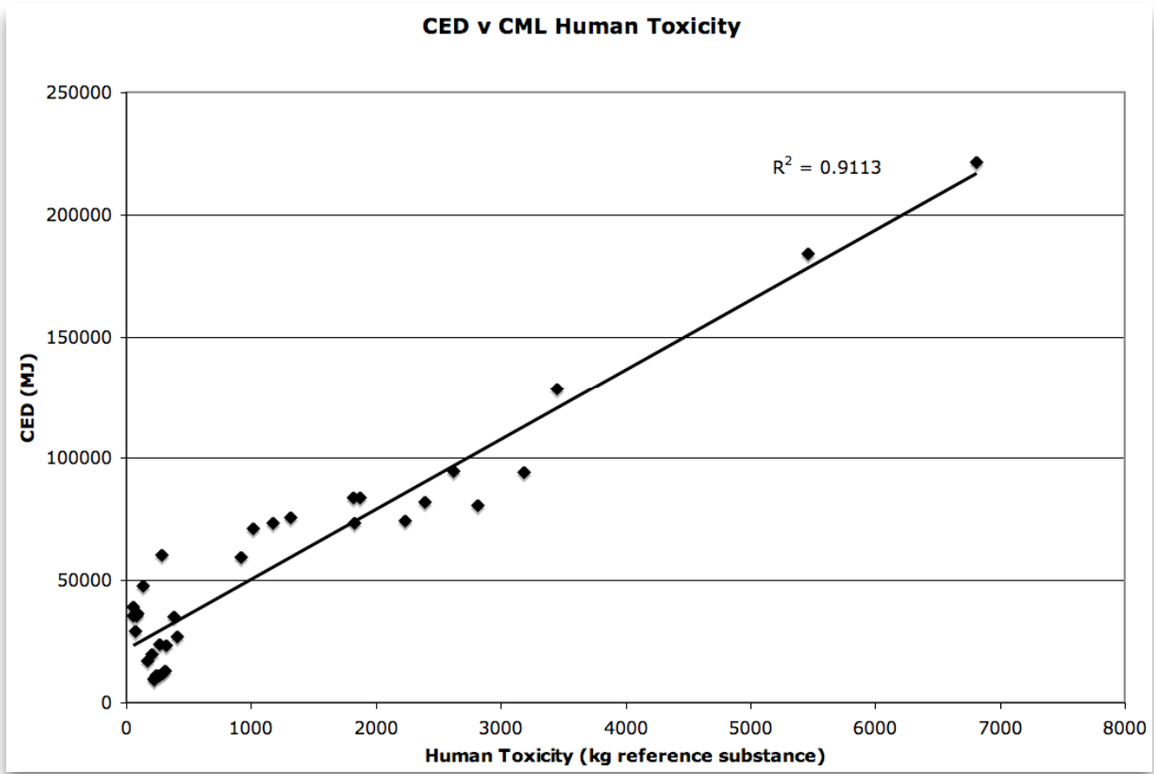

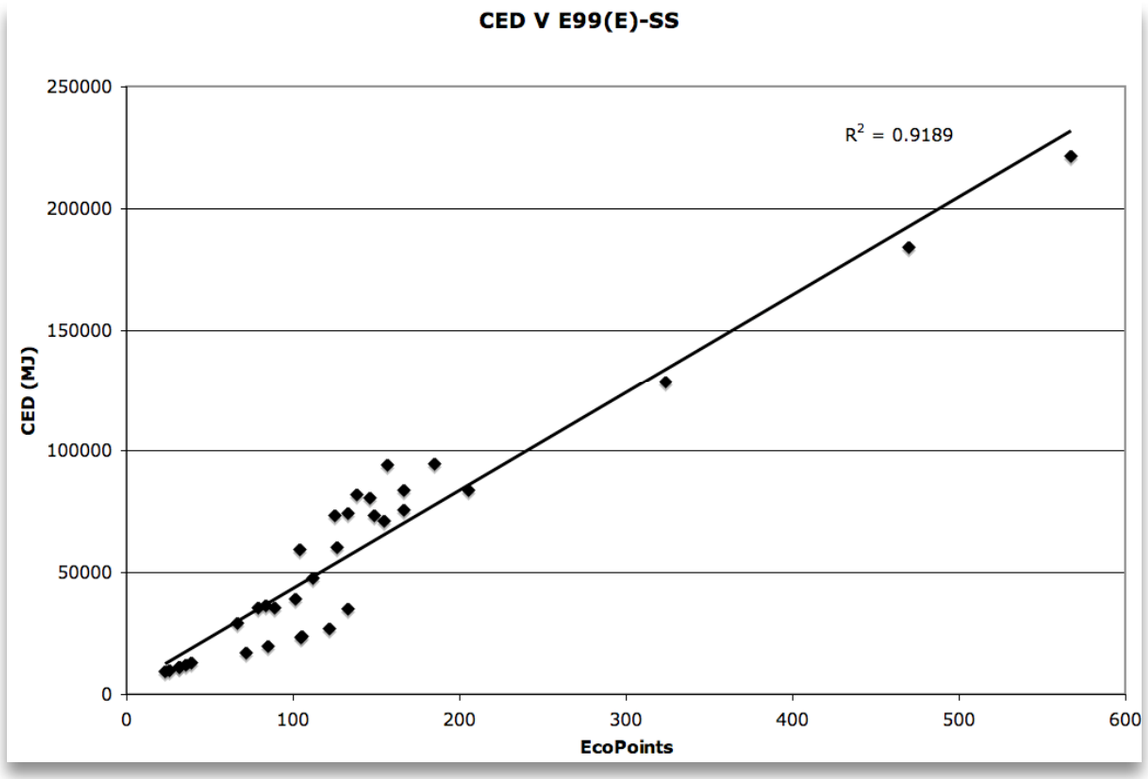

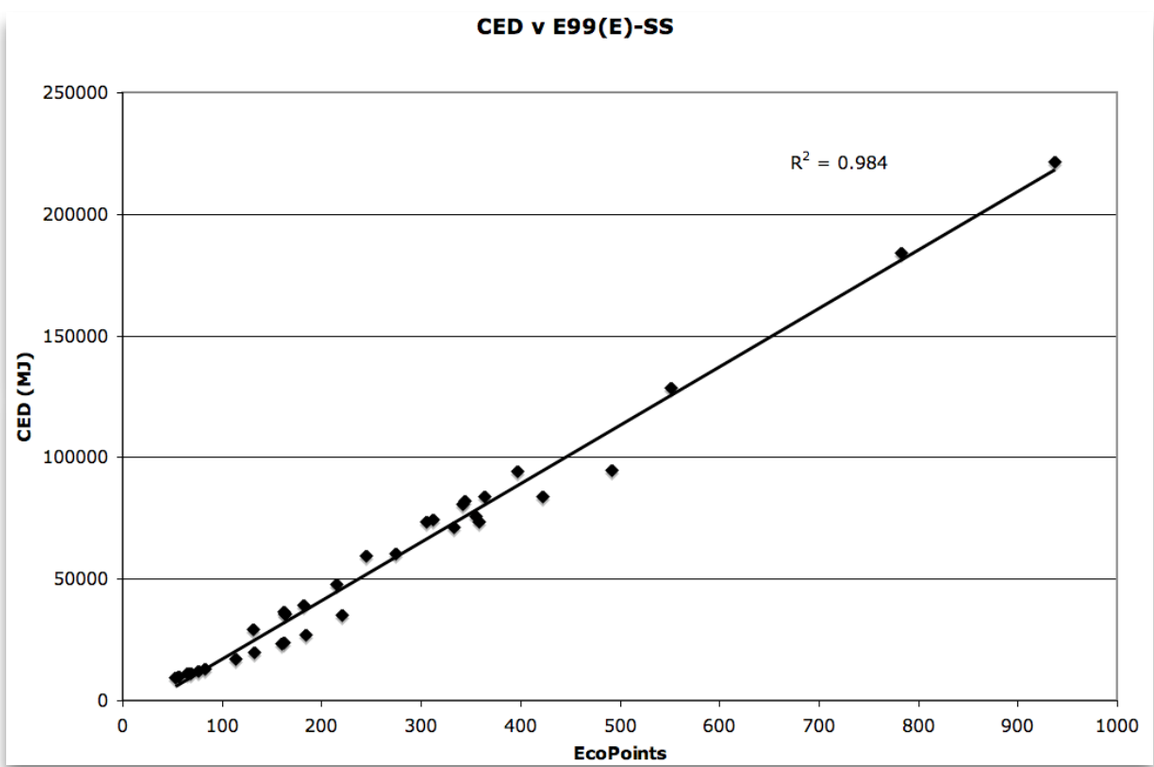

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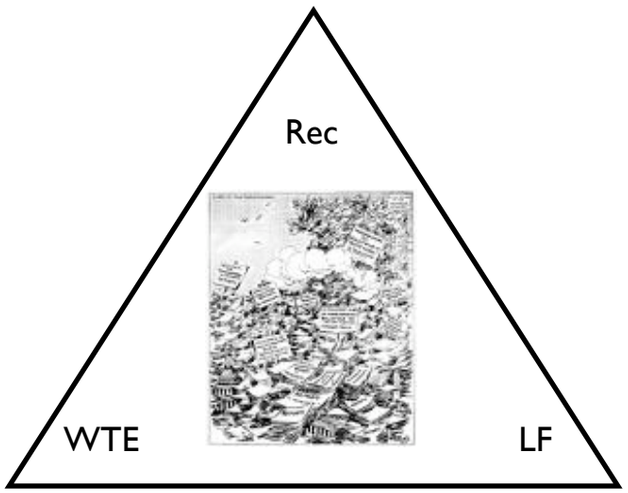

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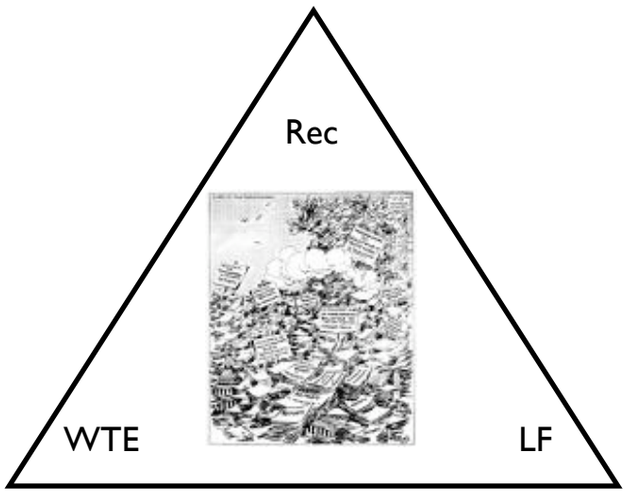

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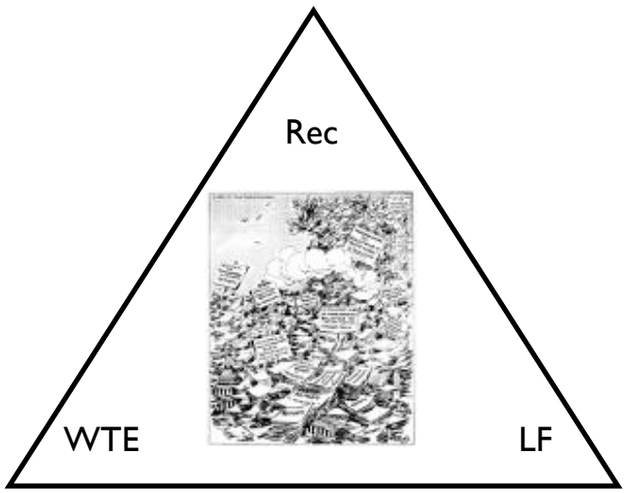

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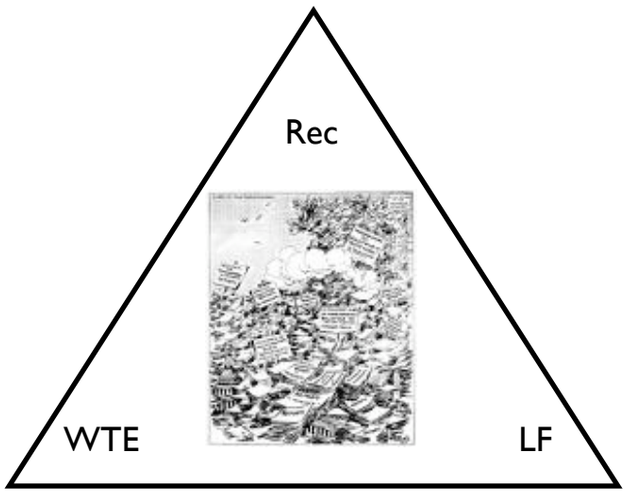

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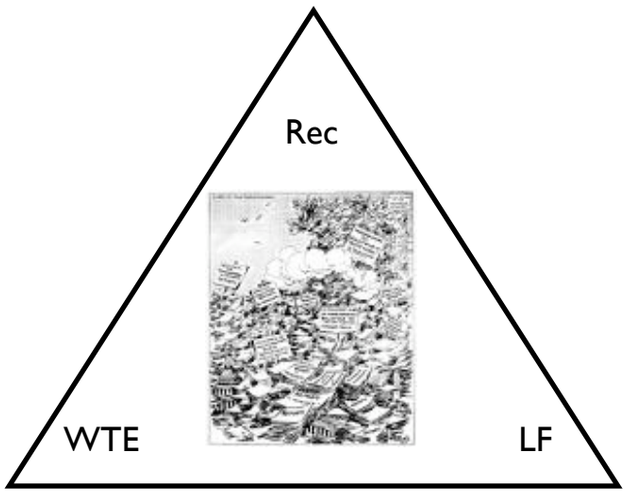

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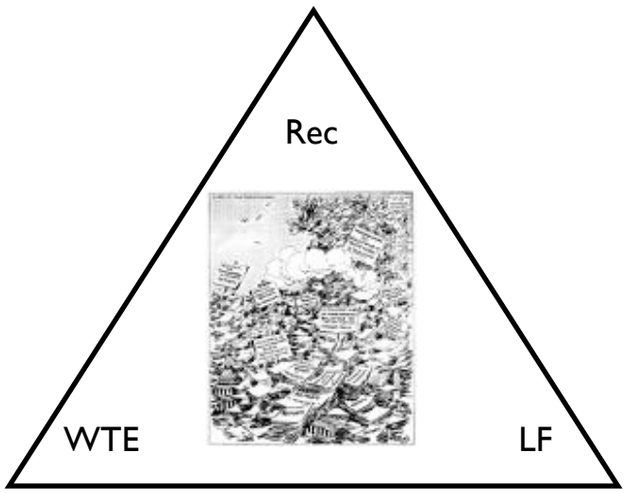

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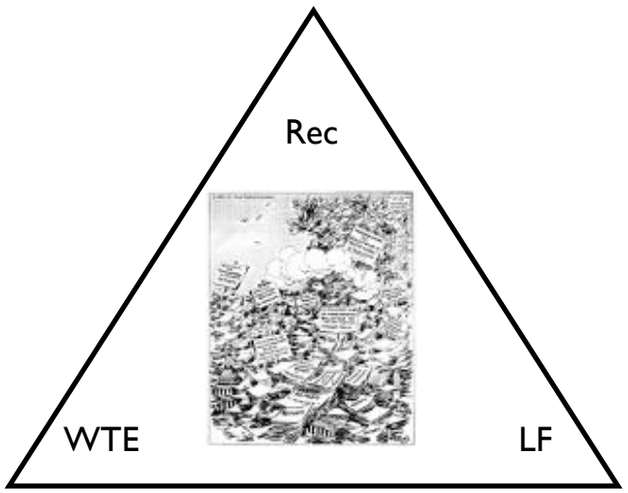

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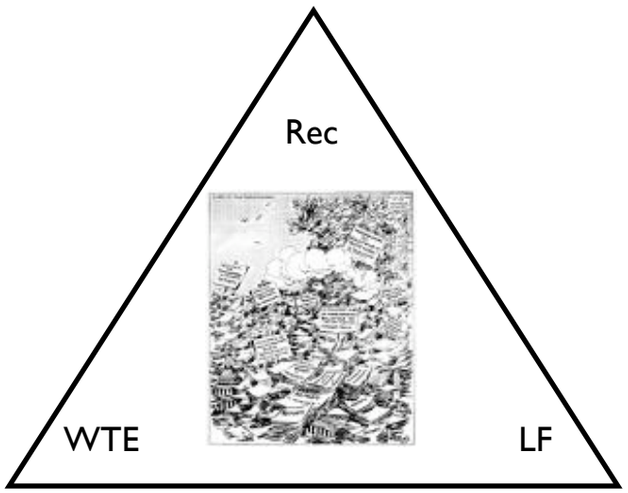

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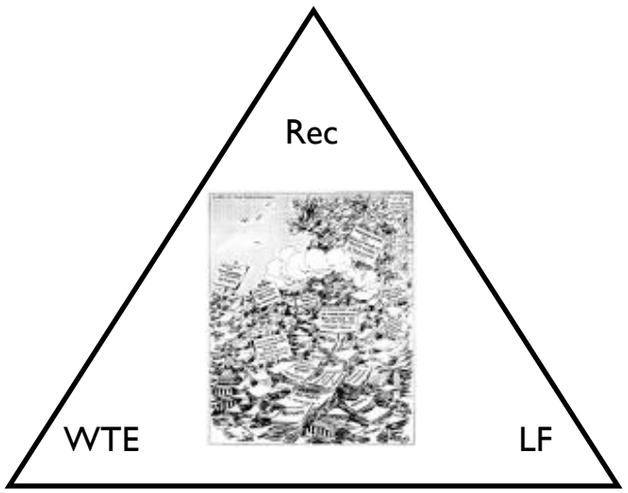

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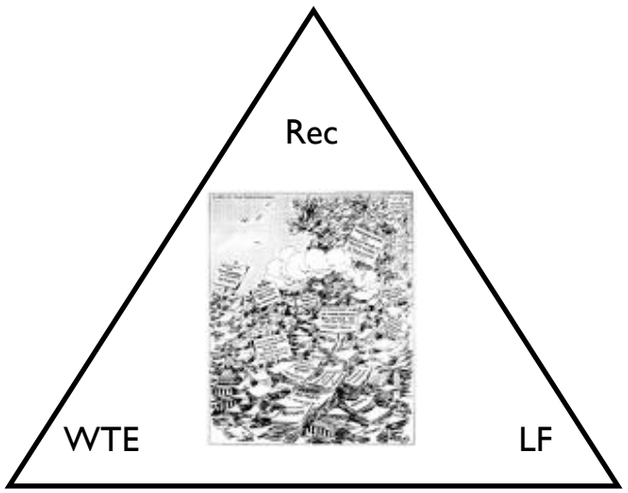

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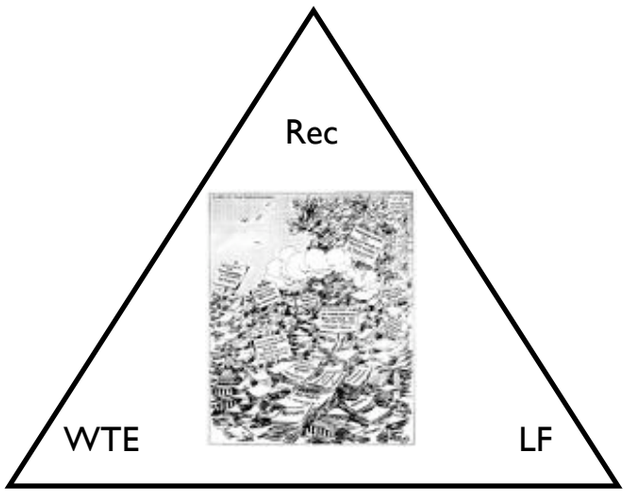

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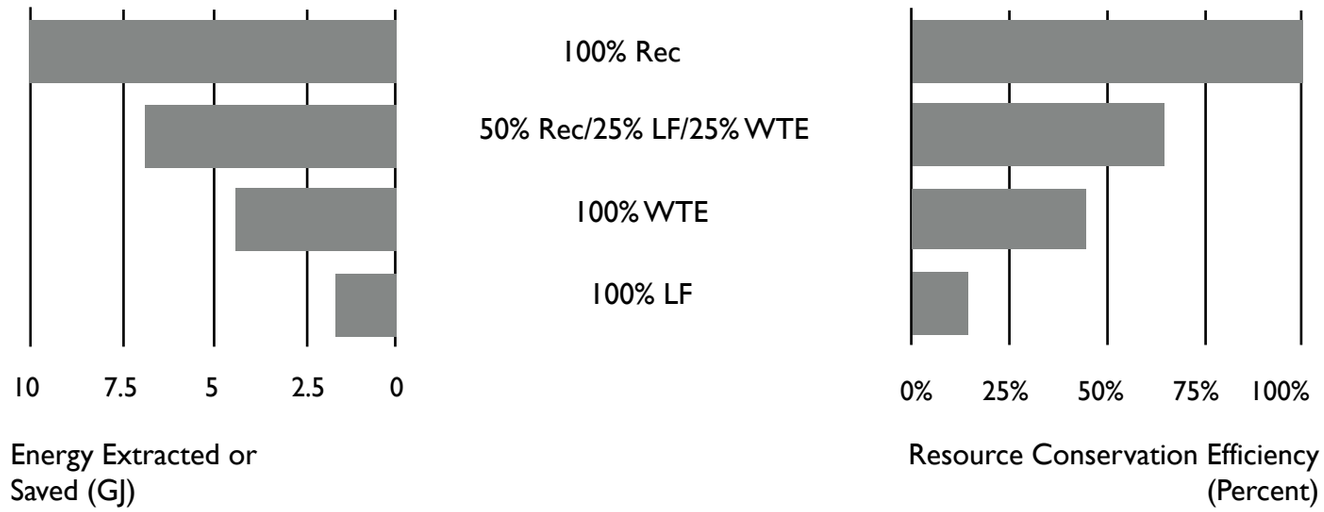

REFERENCE TABLE OF LIFE CYCLE ENERGY VALUES TO FACILITATE RCE ANALYSIS

- Set of values determined by literature search
- Allows easy application of resource conservation efficiency metric by policy makers & other waste management stakeholders

Material	Rec energy (GJ/ton)	WTE energy (GJ/ton)	LF energy (GJ/ton)	EMAX,sav Process
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High Grade Paper	21.8	5.5	1.4	Recycling
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Polycoated paper	0	5.5	1.4	WTE
Soiled paper	2	1.8	1.4	Recycling
Other paper	0	5.5	1.4	WTE
Glass	4	0	0	Recycling
PET	33.1	8.9	0	Recycling
HDPE	38.7	16.4	0	Recycling
PP	34.2	12.6	0	Recycling
Aluminum	188.1	170.1	0	Recycling
Steel	16.4	14.8	0	Recycling
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APPLICATION: COMPARING RCE VALUES BETWEEN TWO CITIES - HONOLULU & SAN FRANCISCO

San Francisco

- Recycles at high rate for US cities
- Does not utilize WTE for remainder
- High landfilling rates

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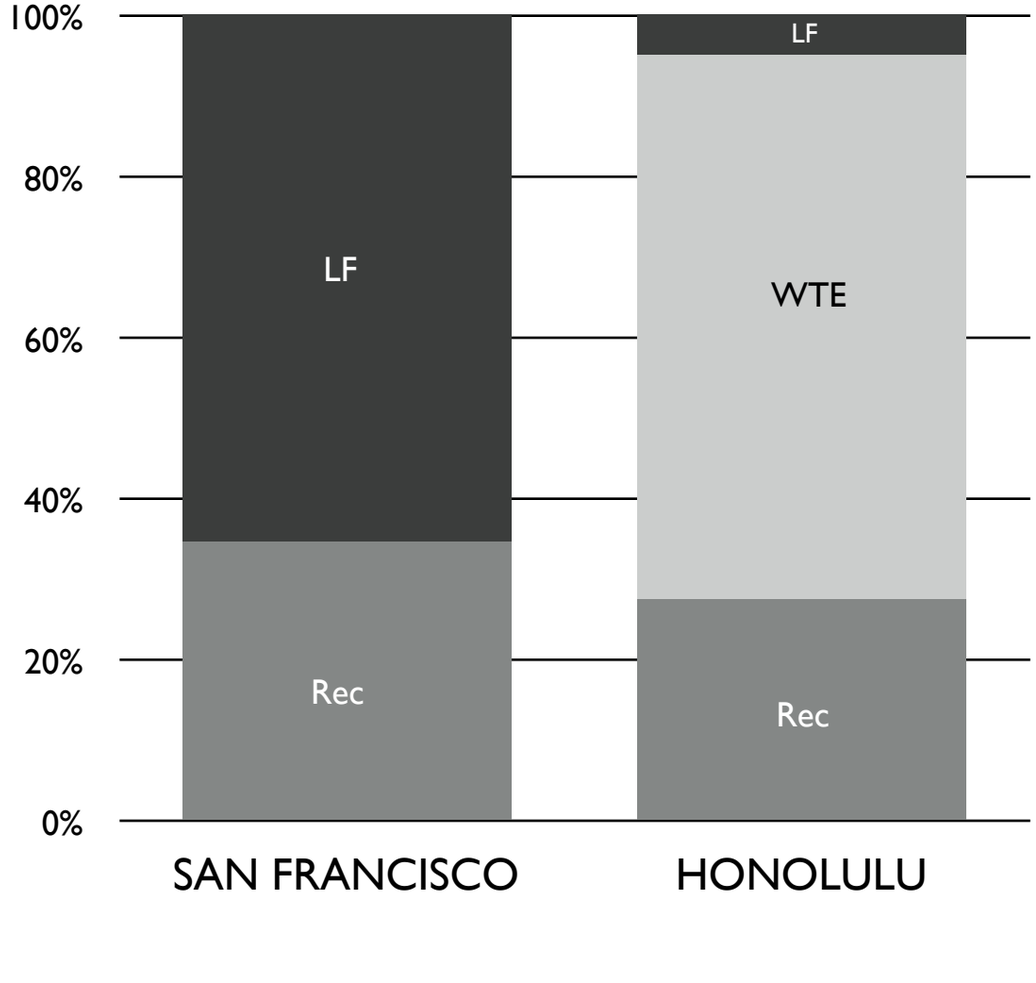
FIGURE 5a. WASTE MANAGEMENT PERCENTAGES



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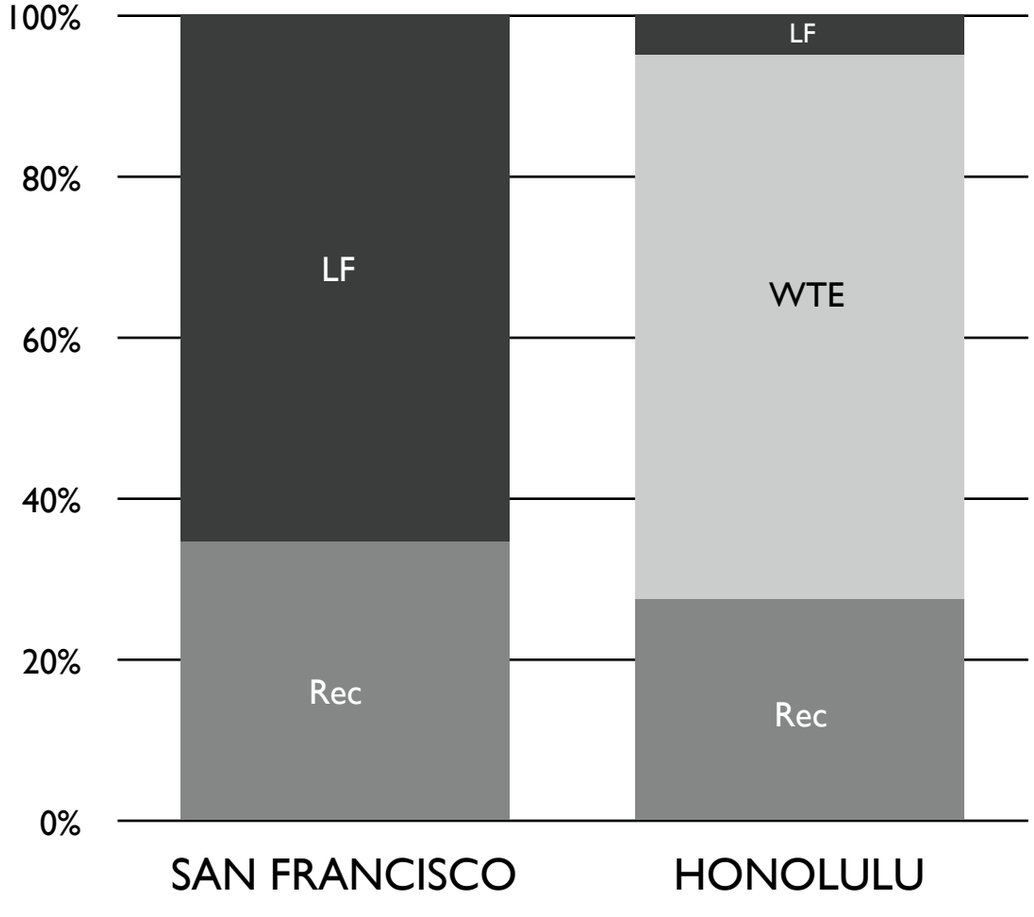
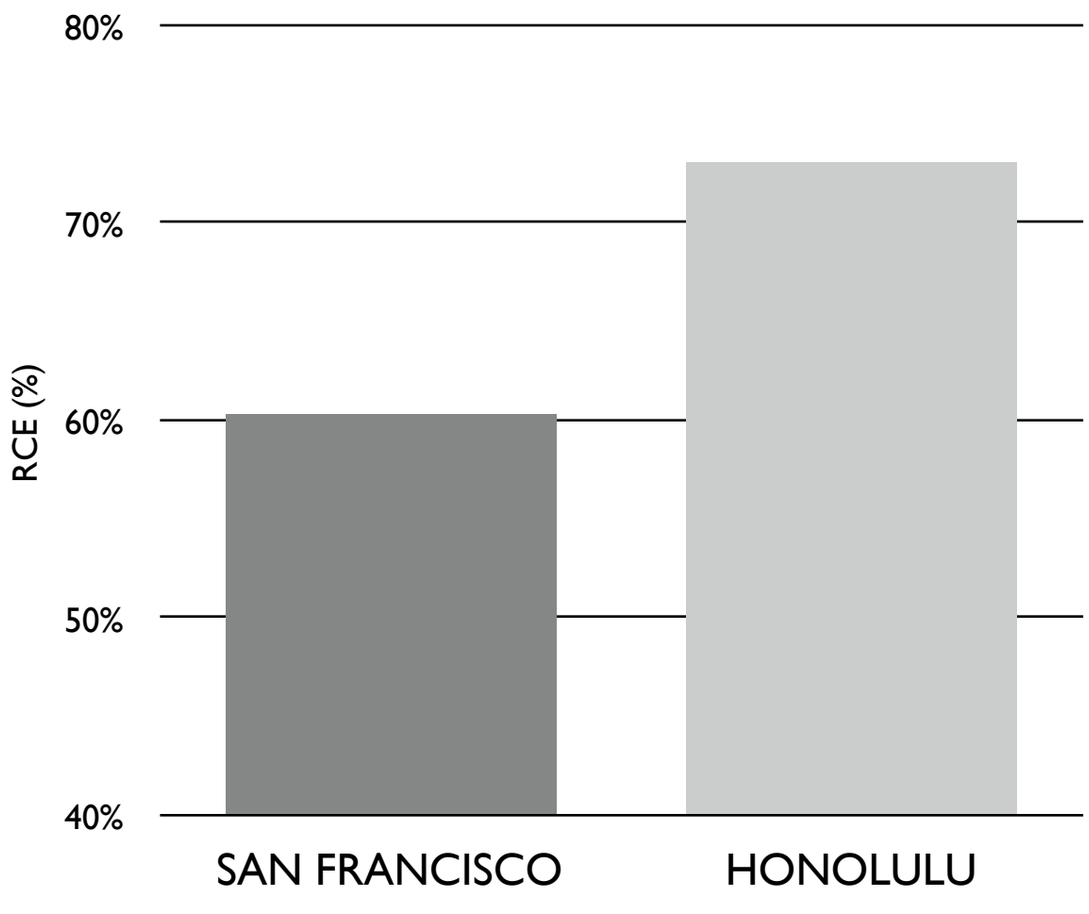
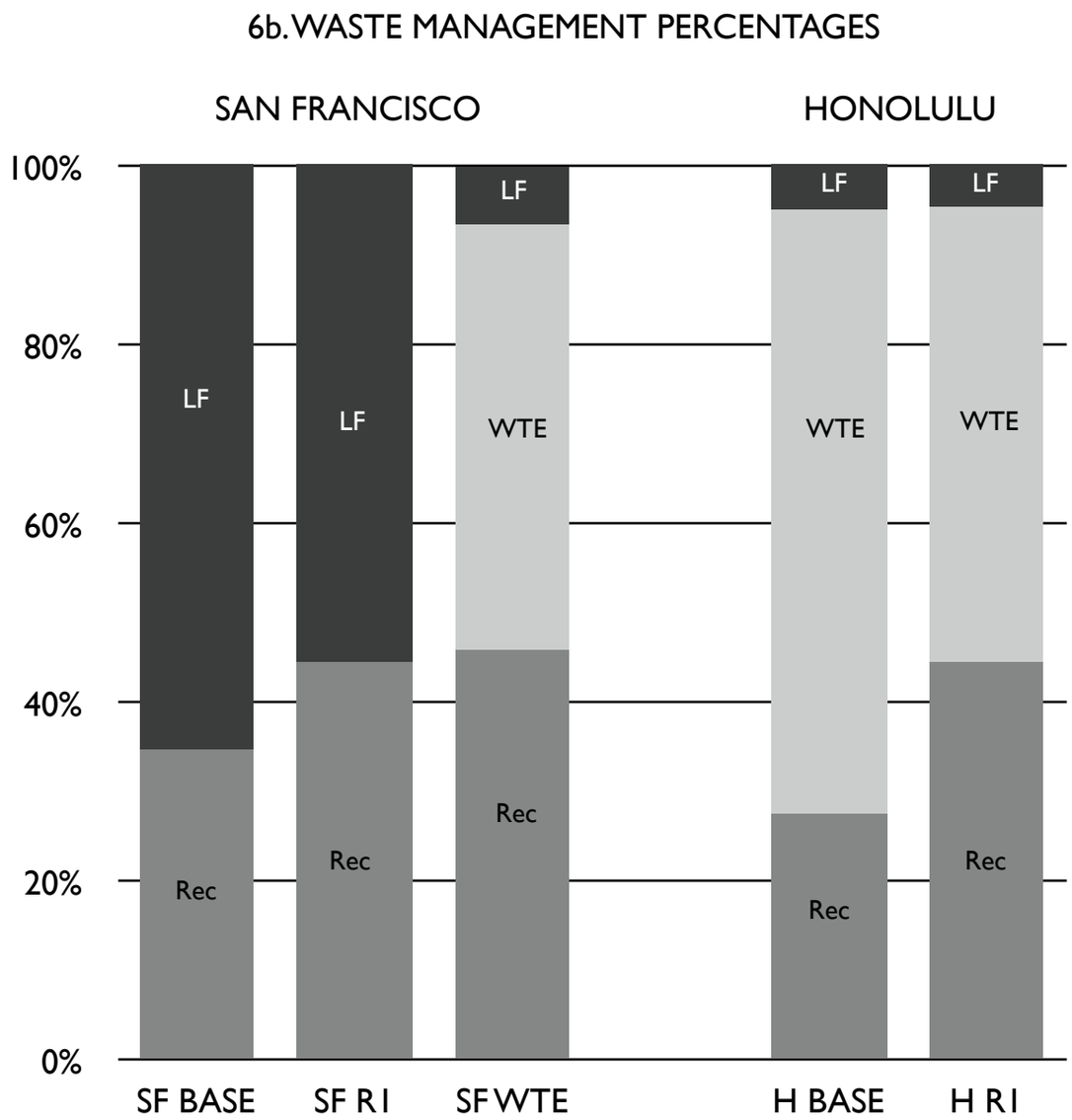


FIGURE 5b. RESOURCE CONSERVATION EFFICIENCY



COMPARING TWO CITIES: SUGGESTED IMPROVEMENTS (RCE AS A DESIGN AID)



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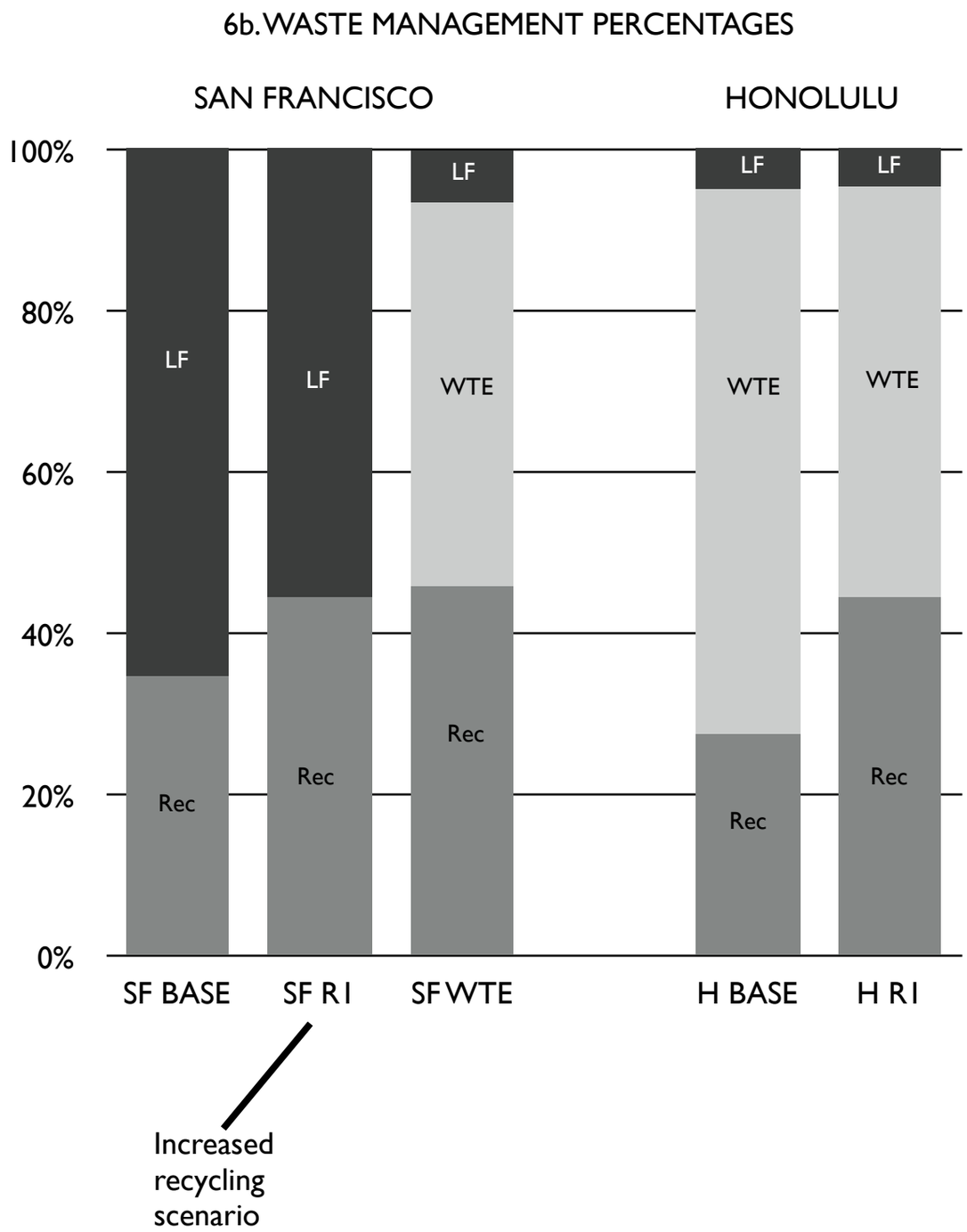

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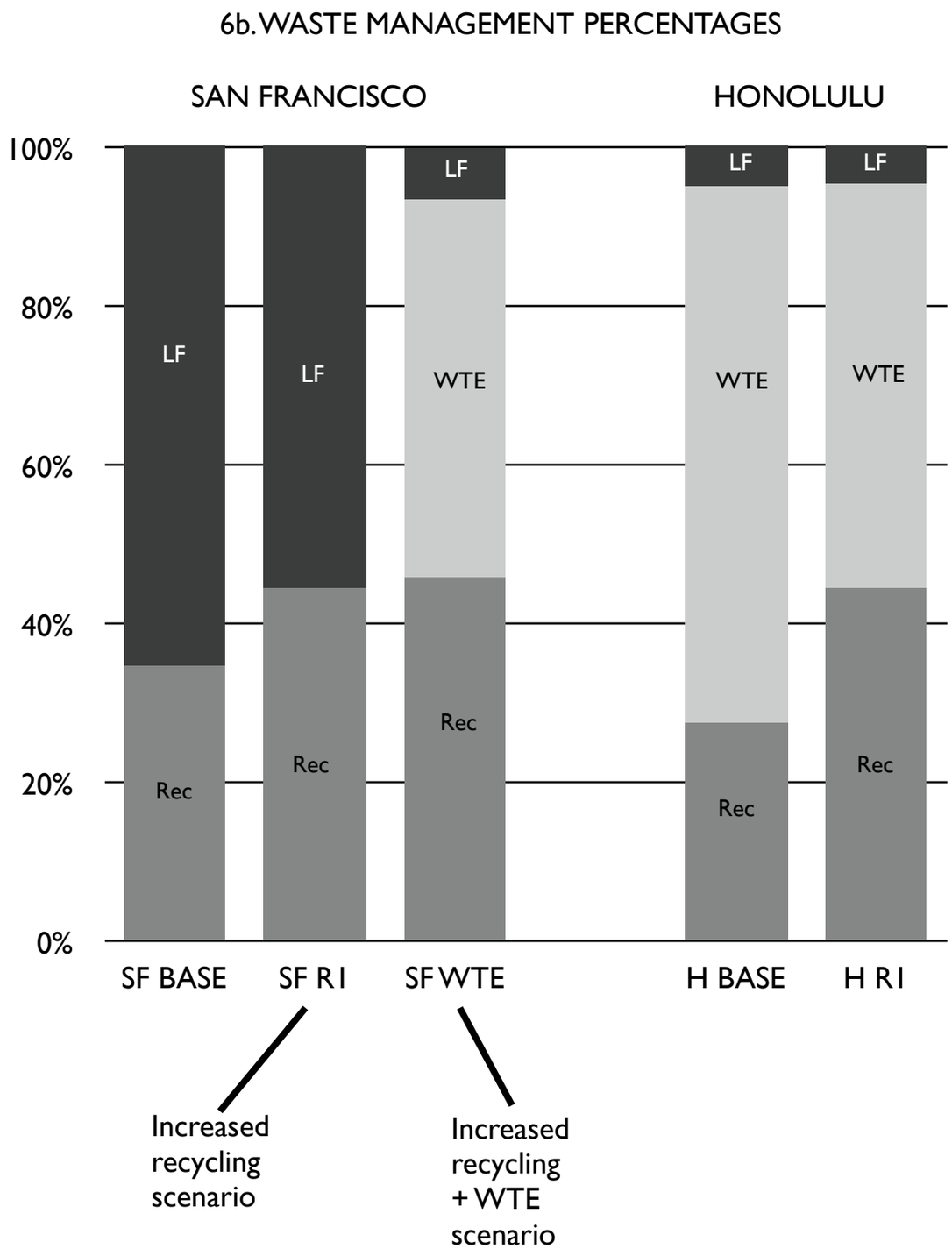

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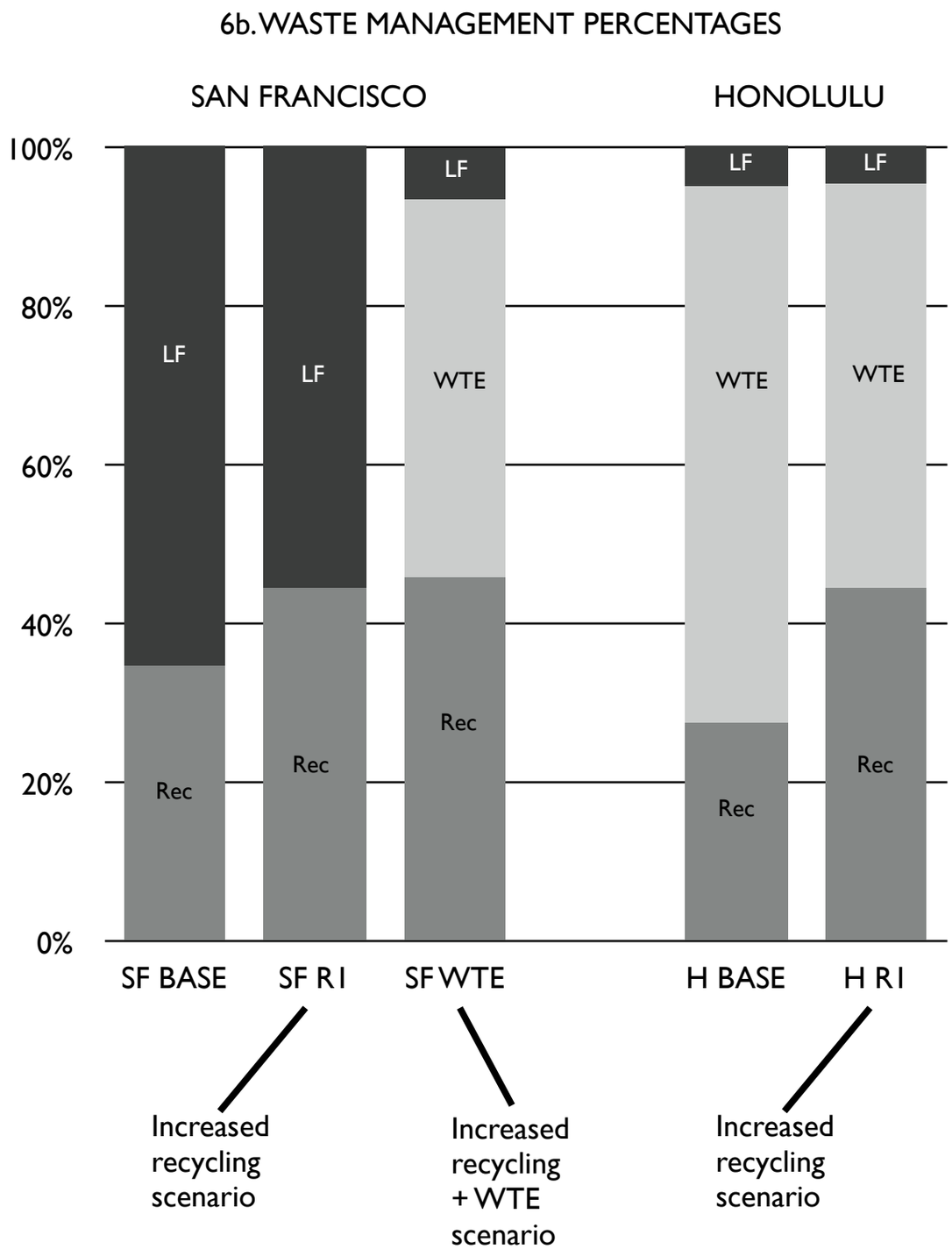

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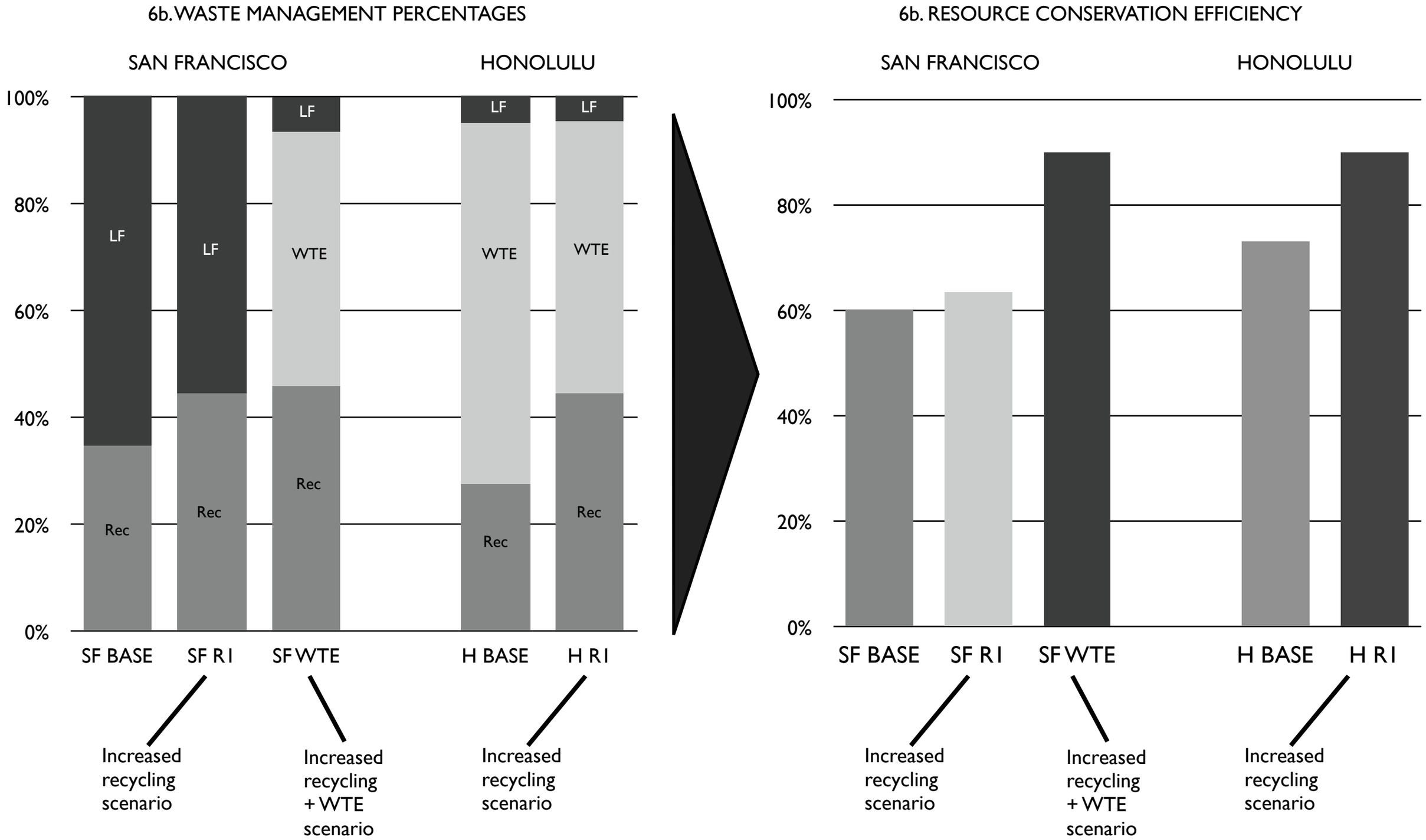

OUTLINE

(1) Municipal Solid Waste Data & Metrics

(2) Measuring Environmental Effectiveness

- Resource Conservation Efficiency

(3) Conclusions

CONCLUSIONS - RESOURCE CONSERVATION EFFICIENCY SUMMARY

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- May be useful as a screening-level environmental effectiveness indicator

- Allows stakeholders to easily and intuitively assess and make changes to waste strategies

- Shows that a combination of recycling & waste to energy is optimal

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