

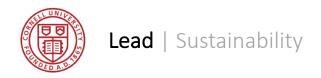
# Quadruple Bottom Line

Embedding a Sustainability
Evaluation Framework across
business level decision making

Cornell University Spring 2018



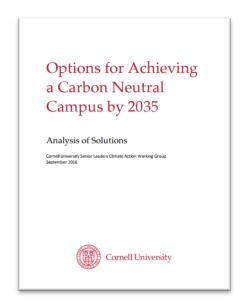
In an institutional climate with many competing priorities, how do we make decisions that protect our organizational interests and balance sustainability and climate change needs?



In order to fully evaluate the benefits and costs to Cornell University in pursuing carbon-neutral heating and power for the campus by 2035, a group of senior leaders created and employed a

"sustainability evaluation framework" or "quadruple bottom line framework"

Often referred to as QBL



#### October 2016

Detailed technical analysis of feasible options for reaching carbon neutrality by 2035 for heat & power

climateaction.cornell.edu



The sustainability evaluation framework is a methodology for project decision making which quantifies the institutional value of a project by balancing four areas of institutional priority and global sustainability concern:

### Purpose · Prosperity · Planet · People



Does the solution help Cornell fulfill its academic mission and purpose?

Does it meet the needs of people on campus, in the community, and in the world?

Does it enhance overall prosperity for the campus and our region?

Does it support a sustainable planet?

# Quadruple Bottom Line



Prosperity Supports Financial Stability

What are the short-term, long-term, and socialized costs to the project? Does a solution mitigate future costs or uncertainties? Will this solution allow Cornell to plan for today and its future in an economically feasible way?

Planet Supports Environmental Needs

How does this solution ensure that Cornell fulfills its commitments to environmental sustainability and mitigating climate impact? What is the carbon reduction impact of this solution? Are there additional environmental and ecological benefits or risks related to land use, water, biodiversity, air quality or waste?

Purpose Supports Cornell's Mission

How does the solution align with Cornell's educational and land grant missions? Does it create research and teaching opportunities? Is it aligned with existing programs? Will the solution attract research funding? Does it increase Cornell's reputation as a global institution addressing climate change, and finding solutions to challenging research questions across disciplines?

People Supports Community Goals and Potential

Is the solution a useful, scalable option to share with others? Does it help regional carbon reduction efforts? Does it create jobs? Does it increase or decrease quality of life through visual, infrastructure, transit or community resource development?

# Where Has QBL Been Used?

Green Mostly positive impact Yellow Neutral impact Red Poor impact

			(AEC = Annual Cost + Capital Cost spread over 30 years)  Accounting for Methane Leakage			QBL Analysis						
		Up- Front Capital Cost	Annualized Capital Cost	Annual Operating Cost	Annual Offsets Cost	Annual Equivalent Cost	Annual Offsets Cost	Annual Equivalent Cost	Purpose	Prosperity	People	Planet
Jsua	Il (for comparison, not a solution)	*		\$42								
1.	Earth Source Heat, WWS, Biomass	\$700	\$47	\$24	-	\$71	-	\$71	•	•	•	•
2.	Earth Source Heat, WWS	\$730	\$50	\$22	-	\$72	-	\$72	•	•	•	•
3.	Air Heat Pumps, WWS	\$930	\$62	\$28	-	\$90	-	\$90	•	•	•	•
4.	Ground Source Heat Pumps, WWS	\$920	\$55	\$26	-	\$81	-	\$81	•	•	•	•
5.	Nuclear	\$700	\$42	\$34	-	<b>\$76</b>	-	\$76	•	•	•	•
6.	Business as Usual + Carbon Offsets	-	-	\$42	\$10	\$52	\$43	\$85	•	•	•	•
	1. 2. 3. 4.	<ul> <li>WWS, Biomass</li> <li>Earth Source Heat, WWS</li> <li>Air Heat Pumps, WWS</li> <li>Ground Source Heat Pumps, WWS</li> <li>Nuclear</li> <li>Business as Usual +</li> </ul>	<ol> <li>Earth Source Heat, WWS, Biomass</li> <li>Earth Source Heat, WWS</li> <li>Earth Source Heat, WWS</li> <li>Air Heat Pumps, WWS</li> <li>Ground Source Heat Pumps, WWS</li> <li>Nuclear</li> <li>Business as Usual +</li> </ol>	<ol> <li>Earth Source Heat, WWS, Biomass</li> <li>Earth Source Heat, WWS</li> <li>Earth Source Heat, WWS</li> <li>Air Heat Pumps, WWS</li> <li>Ground Source Heat Pumps, WWS</li> <li>Muclear</li> <li>Business as Usual +</li> </ol>	1. Earth Source Heat, \$700 \$47 \$24 \$24 \$25 \$25 \$26 \$25 \$26 \$26 \$270 \$47 \$26 \$34 \$26 \$34 \$34 \$34 \$34 \$34 \$35 \$36 \$36 \$36 \$36 \$36 \$36 \$36 \$36 \$36 \$36	1. Earth Source Heat, WWS, Biomass 2. Earth Source Heat, WWS 3. Air Heat Pumps, WWS 4. Ground Source Heat \$920 \$55 \$26 - Pumps, WWS 5. Nuclear \$700 \$42 \$34 - \$42 \$10	1. Earth Source Heat, \$700 \$47 \$24 - \$71 \$71 \$72 \$730 \$50 \$22 - \$72 \$73 \$730 \$62 \$28 - \$90 \$730 \$55 \$26 - \$81 \$75 \$75 \$75 \$75 \$75 \$75 \$75 \$75 \$75 \$75	1. Earth Source Heat, WWS, Biomass 2. Earth Source Heat, WWS 3. Air Heat Pumps, WWS 4. Ground Source Heat \$920 \$55 \$26 - \$81 - Pumps, WWS 5. Nuclear \$700 \$42 \$34 - \$76 - \$6. Business as Usual + - \$42 \$10 \$52 \$43	1. Earth Source Heat, \$700 \$47 \$24 - \$71 - \$71 \$71 \$72 \$72 \$72 \$72 \$73 Air Heat Pumps, WWS \$930 \$62 \$28 - \$90 - \$90 \$90 \$47 \$90 \$55 \$26 - \$81 - \$81 \$90 \$55 Nuclear \$700 \$42 \$34 - \$76 \$76 \$76 \$76 \$85 \$85 \$85 \$85 \$85 \$85 \$85 \$85 \$85 \$85	Sual (for comparison, not a solution)	Sual (for comparison, not a solution)	Sual (for comparison, not a solution)

Traditional financial analysis was <u>combined</u> with a QBL analysis to help clarify the benefits of different solutions

## Quadruple Bottom Line Project Analysis

Options for a Climate Neutral Campus by 2035 Cornell University 2016

Heating & Powering Solutions	Purpos	Prospe	People	Planet
	QB	LA	naly	sis
Earth Source Heat + WWS + Biomass Gasification	0	0	0	0
Earth Source Heat + WWS	0	0	0	0
Air Source Heat Pumps + WWS	0	0	0	0
Ground Source Heat Pumps + WWS	0	0	0	0
Nuclear	0	0	0	0
Business as Usual + Carbon Offsets	0	0	0	0

Analysis clearly shows the "full benefit" to the institution in pursuing Earth Source Heat, and clear lack of institutional priority alignment in pursuing "business as usual" with offsets

# Sustainability Evaluation Framework



# Where could the framework be used?

- 1. To compare different projects, solutions, or products against each other (*Options Report, campus energy solutions*)
- 2. At the beginning, middle, and end of project development to ensure tradeoffs or changes to one area do not drastically reduce benefits or add hidden costs to the University in another area
- 3. Flexibly. More comprehensive for larger projects, or scaled down for smaller projects. Most important to ensure the four impact areas are at least discussed and considered.





	Impact Area	Categories	Weight
Purpose	Mission Alignment		-4
	Reputation		10
	Teaching and Research	Living Laboratory	3
		Community Resources	-8
		Research Funding	6
People	Leadership	Innovation	4
		Scalability	5
		Regional Climate Goals	2
	Health & Well-Being	Quality of Life	8
		Human Health	-4
		Visual Impacts	9
	Economic Impact	Job Creation	-6
Prosperity	Socialized Costs		0
	Risk Mitigation	Climate Change	9
		Resource Scarcity	2
		Risk Mitigation, General	-1
	Campus Resources	Longevity	12
		Resiliency	3
Planet	Land	Land	-9
	Water	Water	-6
	<b>Ecosystem Services</b>	Ecosystem Services	10
	Materials	Materials	8
	Climate Change	Renewable Energy	4
		Energy Efficiency	5
		Carbon Emissions	8

### Quadruple Bottom Line

Sustainability

Tools for using the framework include an Excel spreadsheet and 'how-to' guide with sample categories and questions to prompt analysis

climateaction.cornell.edu



#### Sustainability Evaluation Framework Tool

#### Instruction: Link: GEL Analysis Framework Workshoot

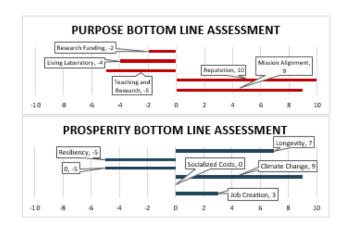
- 1. Refine Impact Areas for Assessment Assess appropriate categories for impact assessment in each of the four quadrants.
- 2. Qualitativo Azzozzmont Onco impact arear have been refined, qualitative analyzir in each area uzinq quidance quertions above or those created for aspecific projects hould be provided. Some impact arear or extent may be unknown.
- 3. Quantitative Assessment Provide an assessment of the overall impact in each category. Overall positive benefit (maximum 10), neutral benefit, or detrimental costs (minimum -10).
- 4. Provide Final Impact Analyzir Final analyzir should include both quantitative virualization and qualitative notes. Rationale should be provided for categories charen for impact areas, if applicable.

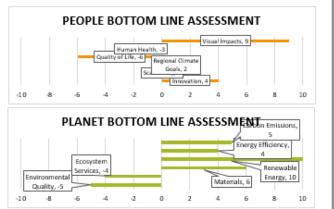


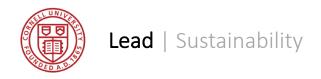
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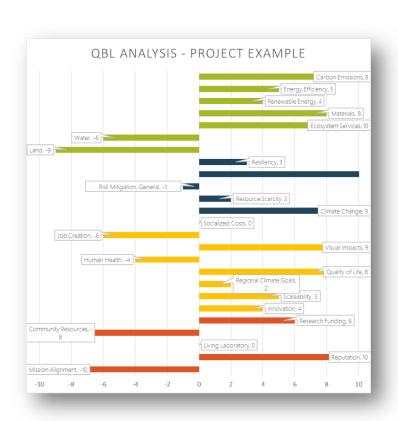
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Free, open-source tools include visualization of priority areas as identified by project team

climateaction.cornell.edu

# Quadruple Bottom Line | Sustainability Sample Exercise for Group

Should we reduce conference travel 75% in the next 5 years?\*

\*And drastically increase support for virtual conferencing opportunities. Institution should aim to be a leader among Universities in this area.

People does it meet the needs of pe campus, in the community a world?	=	<b>Prosperity</b> will it enhance overall <b>prosperity</b> for the campus and our region?		
Pros	Score 1-5	Pros	Score 1-5	
Cons		Cons		
Planet does it support a sustainable Pros	planet?	Purpose does it help Cornell fulfill its academic mission and purpose?  Pros		
Cons	Score 1-5		Score 1-5	
		Cons		

# Sustainability Evaluation Framework

### Worksheet



#### Sustainability Evaluation Framework Tool

#### Instruction: Link: OEL Analysis Framswork Workshoot

1. Refine Impact Areas for Assessment - Assess appropriate categories for impact assessment in each of the four quadrants.

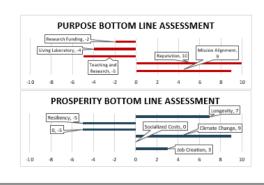
2. Qualitative Assessment - Once impact areas have been refined, qualitative analysis in each area wina quidance questions above or those or eated for a specific project should be provided. Some impact areas or extent may be unknown

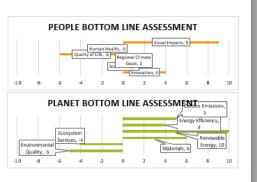
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# Sustainability Evaluation Framework What could the framework help us do?

- Systematically evaluate and document carbon neutrality and sustainability impacts (due diligence)
- 2. Ensure all sustainability needs are balanced and considered
- 3. Early identification of risks or previously unseen benefits to communicate to stakeholders
- 4. Embrace complex costs and benefits





### Sustainability Evaluation Framework

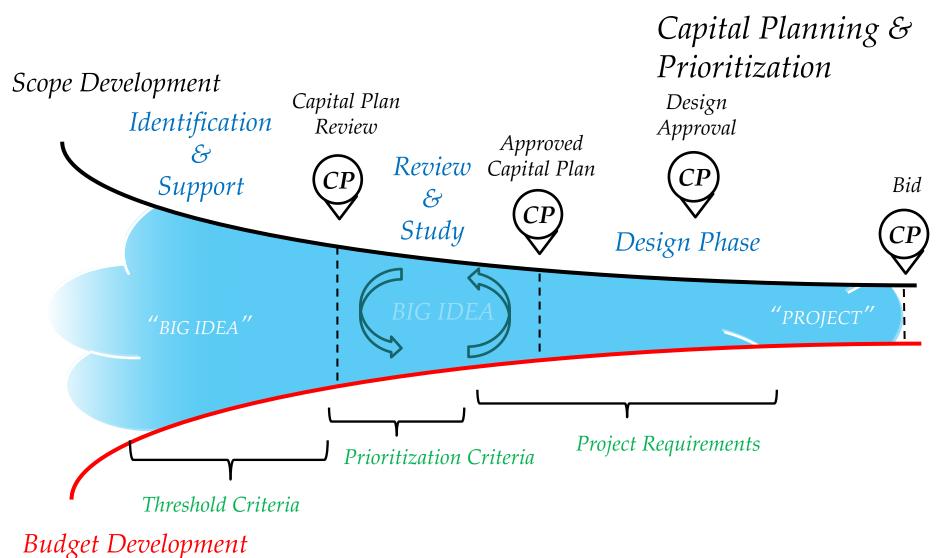
Questions under consideration...

- Not everyone is an expert in every area. Should all input be valued equally? How should non-expert feedback be integrated?
- QBL analysis often brings up questions we do not have the answers to. How do we address creating new ways of knowing, new areas of data, without becoming lost in a rabbit trail of "what if..."?
- Often easier to think of negative impacts rather than positive impacts
- Where should the framework be incorporated? At what level?



### Using QBL in the Life Cycle of a Project





TIME

# Capital Planning & Prioritization

#### Threshold Criteria

- Conformance with the Campus Master Plan
- Process & Voice



#### Prioritization Criteria

- Academic Mission
- Cornell character/identity
- Def Maint & Regulatory Compliance
- Life on Campus
- Building Functionality and Site Use

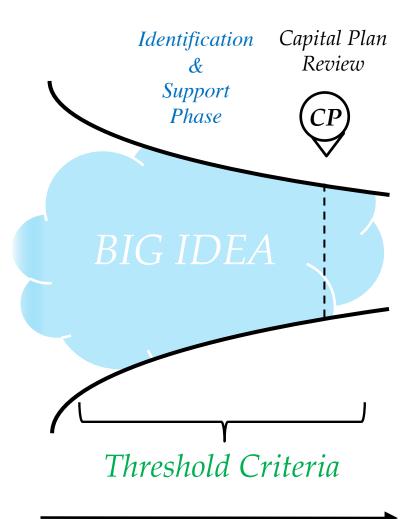
### **Project Requirements**

- Sustainability
- Process & Voice
- Positive Spillovers & Externalities
- Community Engagement, Integration, and Grant Opportunities
- Innovation



# Where Does QBL Best Fit?





### Threshold Criteria

- Conformance with the Campus Master Plan
  - (Quadruple Bottom Line)
- Process & Voice



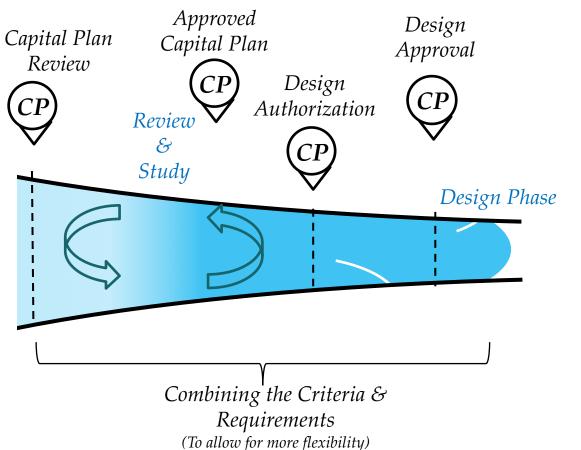
TIME

# Where does QBL Best Fit?





# Prioritization Criteria **Project Requirements**



- Academic Mission
- Cornell character/identity
- Deferred Maint. & Compliance
- Life on Campus
- Building Functionality & Site Use

### (Quadruple Bottom Line)

- Sustainability
- Process & Voice
- Positive Spillovers & Externalities
- Community Engagement, Integration, and Grant **Opportunities**
- Innovation

# Basis of Design Document



# Living Document:

- Defines the Scope of the Project
- Documents Prioritization Process
- Records Decisions

Threshold Criteria

Prioritization Criteria



Project Requirements