



Cornell University

Quadruple Bottom Line

Embedding a *Sustainability
Evaluation Framework* across
business level decision making

Cornell University
Spring 2018





Quadruple Bottom Line | Sustainability

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?

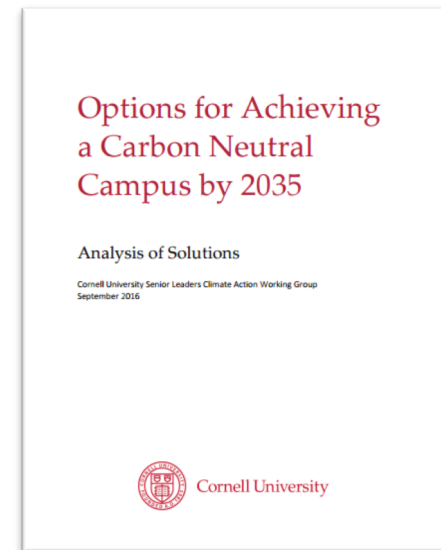


Quadruple Bottom Line | Sustainability

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



Quadruple Bottom Line | Sustainability

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



Cornell University

- 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)

Up-Front Capital Cost	Annualized Capital Cost	Annual Operating Cost	Annual Offsets Cost	Annual Equivalent Cost	Accounting for Methane Leakage		QBL Analysis			
					Annual Offsets Cost	Annual Equivalent Cost	Purpose	Prosperity	People	Planet

Business as Usual (for comparison, not a solution)								\$42					
Heating & Powering Solutions	1.	Earth Source Heat, WWS, Biomass	\$700	\$47	\$24	-	\$71	-	\$71	<div></div>	<div></div>	<div></div>	<div></div>
	2.	Earth Source Heat, WWS	\$730	\$50	\$22	-	\$72	-	\$72	<div></div>	<div></div>	<div></div>	<div></div>
	3.	Air Heat Pumps, WWS	\$930	\$62	\$28	-	\$90	-	\$90	<div></div>	<div></div>	<div></div>	<div></div>
No offsets needed	4.	Ground Source Heat Pumps, WWS	\$920	\$55	\$26	-	\$81	-	\$81	<div></div>	<div></div>	<div></div>	<div></div>
	5.	Nuclear	\$700	\$42	\$34	-	\$76	-	\$76	<div></div>	<div></div>	<div></div>	<div></div>
All offsets needed	6.	Business as Usual + Carbon Offsets	-	-	\$42	\$10	\$52	\$43	\$85	<div></div>	<div></div>	<div></div>	<div></div>

Traditional financial analysis was combined 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

	Purpose	Prosperity	People	Planet
QBL Analysis				
Earth Source Heat + WWS + Biomass Gasification	Green	Yellow	Yellow	Green
Earth Source Heat + WWS	Green	Yellow	Yellow	Green
Air Source Heat Pumps + WWS	Yellow	Red	Yellow	Green
Ground Source Heat Pumps + WWS	Green	Red	Yellow	Green
Nuclear	Red	Red	Red	Yellow
Business as Usual + Carbon Offsets	Yellow	Red	Red	Red

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.





	<i>Impact Area</i>	<i>Categories</i>	<i>Weight</i>
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	9
	Campus Resources	Climate Change	2
		Resource Scarcity	-1
		Risk Mitigation, General	12
		Longevity	3
Planet	Land	Land	-9
	Water	Water	-6
	Ecosystem Services	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

Instructions: Link: [GRI Analysis Framework Worksheet](#)

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 using guidance questions above or those created for specific projects should be provided. Same impact area 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 Analysis - Final analysis should include both quantitative visualization and qualitative notes. Rationale should be provided for categories chosen for impact area, if applicable.



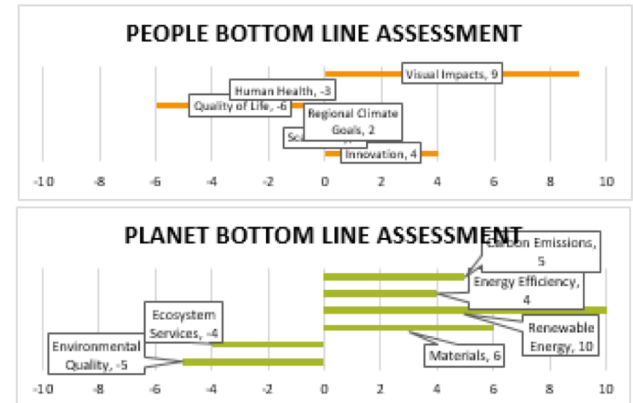
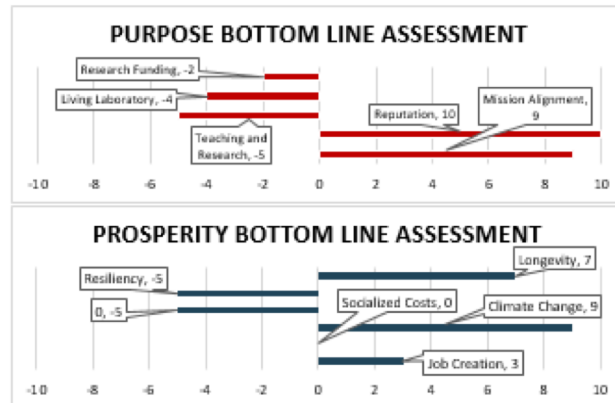
1. Refine Impact Areas

Bottom Line	Impact Category	Rationale	Questions
Purpose	Mission Alignment		How does the project align with Cornell's educational and land grant mission?
Purpose	Regulation		How does it increase Cornell's regulation as a global institution addressing climate change and sustainability solutions?
Purpose	Teaching and Research		Does it create research, teaching opportunities? Is it aligned with existing programs?
Purpose	Teaching and Research	Living Laboratory	How does the project create living laboratory opportunities for students, faculty, and staff?
Purpose	Teaching and Research	Research Funding	Will it attract short, long-term research funding?
Purpose	Leadership	Innovation	Is the solution a novel, available option to share with others? Does it help regional carbon reduction efforts?
Purpose	Leadership	Scalability	
Purpose	Leadership	Regional Climate Goals	
Purpose	Health & Well-Being	Quality of Life	Does it increase the quality of life for employees, students, or the surrounding community? Safety & security? Educational attainment? Equity? Happiness
Purpose	Health & Well-Being	Human Health	
Purpose	Community Character	Visual Impacts	Does it impact visual, infrastructure, transit or community resource development?
Prosperity	Economic Impact	Job Creation	Does it create jobs? Long-term? Local-based? Living wage?
Prosperity	Socialized Costs		Are there socialized costs or benefits associated with the project?
Prosperity	Risk Mitigation	Climate Change	How does the project mitigate future costs or uncertainties from research security, climate change, or other sustainability concerns?
Prosperity	Risk Mitigation	Resiliency	Does it increase Cornell's resiliency for the real world?
Prosperity	Risk Mitigation	Longevity	What elements of the project will allow Cornell to plan for today and its future in an economically feasible way?
Prosperity	Financial Security		What are the final cost, social and lifecycle costs? Does this project minimize lifecycle costs?
Planet	Environmental Quality		Are there environmental and ecological benefits or risks related to land use, water, biodiversity, air quality or waste?
Planet	Ecosystem Services		What are the impacts on surrounding ecosystems provisioning, i.e., production of food and water; regulating, i.e., control of climate and
Planet	Materials		What is the lifecycle impact of materials used in construction and operation?
Planet	Climate Change	Renewable Energy	
Planet	Climate Change	Energy Efficiency	
Planet	Climate Change	Carbon Emissions	How does this solution ensure that Cornell fulfills its commitment to sustainability and mitigating climate impact? Does it reduce the demand for fossil fuel and decrease the transition to low or no carbon energy supply?

2. Qualitative Analysis

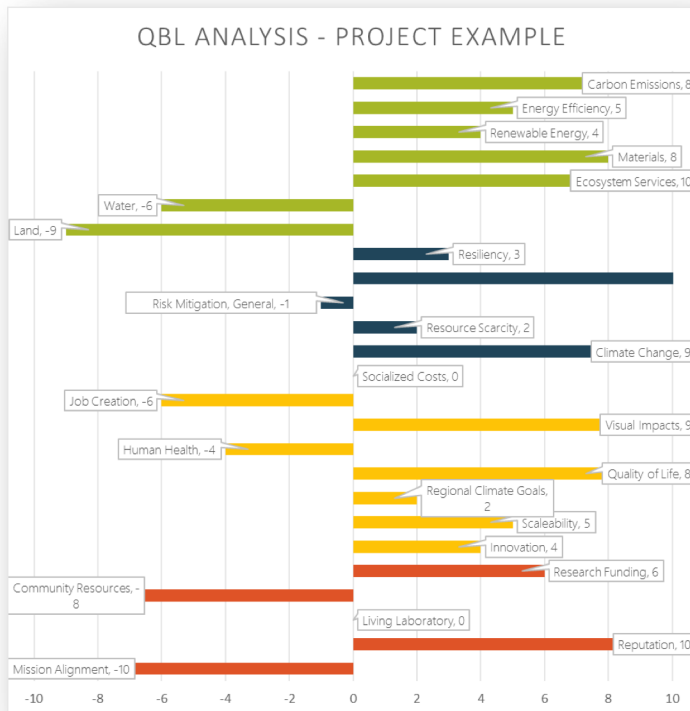
3. Quantitative Assessment

Bottom Line	Impact Category	Impact Rationale	Score (-10 to 10)
Purpose	Mission Alignment	Mission Alignment	5
Purpose	Regulation	Regulation	5
Purpose	Teaching and Research	Teaching and Research	5
Purpose	Teaching and Research	Living Laboratory	5
Purpose	Teaching and Research	Research Funding	5
Purpose	Leadership	Innovation	5
Purpose	Leadership	Scalability	5
Purpose	Leadership	Regional Climate Goals	5
Purpose	Health & Well-Being	Quality of Life	5
Purpose	Health & Well-Being	Human Health	5
Purpose	Community Character	Visual Impacts	5
Prosperity	Economic Impact	Job Creation	5
Prosperity	Socialized Costs	Socialized Costs	5
Prosperity	Risk Mitigation	Climate Change	5
Prosperity	Financial Security	Financial Security	5
Prosperity	Risk Mitigation	Resiliency	5
Prosperity	Risk Mitigation	Longevity	5
Planet	Environmental Quality	Environmental Quality	5
Planet	Ecosystem Services	Ecosystem Services	5
Planet	Materials	Materials	5
Planet	Climate Change	Renewable Energy	5
Planet	Climate Change	Energy Efficiency	5
Planet	Climate Change	Carbon Emissions	5





Quadruple Bottom Line | Sustainability



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



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 people on campus, in the community and in the world? Pros Cons	Prosperity will it enhance overall prosperity for the campus and our region? Pros Cons
Planet does it support a sustainable planet ? Pros Cons	Purpose does it help Cornell fulfill its academic mission and purpose ? Pros Cons

Sustainability Evaluation Framework

Worksheet



Sustainability Evaluation Framework Tool

Instructions: [Link: GRI Analysis Framework Worksheet](#)

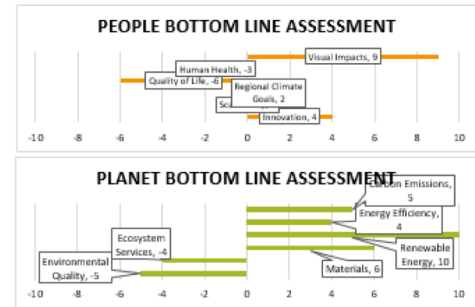
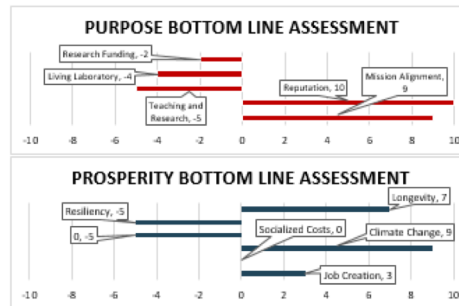
1. **Refine Impact Area or Assessment** - Review appropriate categories for impact assessment in each of the four quadrants.
2. **Qualitative Assessment** - Once impact areas have been refined, qualitative analysis in each area using guidance questions above or those created for a specific project should be provided. Same impact area or content 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 harm (minimum -10).
4. **Provide Final Impact Analysis** - Final analysis should include both quantitative visualization and qualitative matter. Rationale should be provided for category chosen for impact area or, if applicable.

1. Refine Impact Areas

Bottom Line	Impact Category	Bottom Line	Qualitative
Purpose	Mission Alignment		How does the project align with Cornell's educational and land stewardship mission?
Purpose	Regulation		How does it increase Cornell's reputation as a global institution addressing climate change and sustainability outcomes?
Purpose	Teaching and Research		Does it provide research, teaching opportunities? Is it aligned with existing programs?
Purpose	Teaching and Research	Living Laboratory	How does the project create living laboratory opportunities for students, faculty, and staff?
Purpose	Teaching and Research	Research Funding	Will it attract short, long-term research funding?
People	Leadership	Innovation	Is the solution a novel, scalable option to share with others? Does it help regional carbon reduction efforts?
People	Leadership	Scale Ability	
People	Leadership	Regional Climate Goals	
People	Health & Well-Being	Quality of Life	Does it increase the quality of life for employees, students, or the surrounding community? Safety & security? Educational attainment? Equity? Happiness?
People	Health & Well-Being	Human Health	
People	Community Character	Visual Impacts	
Prosperity	Economic Impact	Job Creation	Does it create jobs? Long-term? Local-based? Indirect?
Prosperity	Socialized Costs	Socialized Costs	Are there socialized costs or benefits associated with the project?
Prosperity	Risk Mitigation	Climate Change	How does the project mitigate future costs or uncertainties from research, climate change, or other sustainability outcomes?
Prosperity	Risk Mitigation	Resiliency	Does it ensure Cornell's resiliency for the near future?
Prosperity	Risk Mitigation	Longevity	What elements of the project will allow Cornell to plan for today and the future in an economically feasible way?
Prosperity	Financial Security		What are the financial, social and lifecycle costs? Does this project minimize lifecycle costs?
Planet	Environmental Quality		Are there environmental and ecological benefits or risks related to land use, water, biodiversity, air quality or noise?
Planet	Ecosystem Services		What are the impacts on existing ecosystem provisioning, i.e. production of food and water; regulation, i.e. control of climate and
Planet	Materials		What is the lifecycle impact of materials used in construction and operation?
Planet	Climate Change	Renewable Energy	
Planet	Climate Change	Energy Efficiency	
Planet	Climate Change	Carbon Emissions	How does this solution ensure that Cornell fulfills its commitment to sustainability and mitigating climate impact? Does it reduce the demand for fossil fuel and decrease the fossil fuel use or carbon energy supply?

2. Quantitative Assessment

Bottom Line	Impact Category	Impact Bottom Line	Score (GRI 300)
Purpose	Mission Alignment	Mission Alignment	5
Purpose	Regulation	Regulation	0
Purpose	Teaching and Research	Teaching and Research	5
Purpose	Teaching and Research	Living Laboratory	5
Purpose	Teaching and Research	Research Funding	5
People	Leadership	Innovation	5
People	Leadership	Scale Ability	5
People	Leadership	Regional Climate Goals	5
People	Health & Well-Being	Quality of Life	5
People	Health & Well-Being	Human Health	5
People	Community Character	Visual Impacts	5
Prosperity	Economic Impact	Job Creation	5
Prosperity	Socialized Costs	Socialized Costs	5
Prosperity	Risk Mitigation	Climate Change	5
Prosperity	Financial Security	Resiliency	5
Prosperity	Risk Mitigation	Longevity	5
Planet	Environmental Quality	Environmental Quality	5
Planet	Ecosystem Services	Ecosystem Services	5
Planet	Materials	Materials	5
Planet	Climate Change	Renewable Energy	5
Planet	Climate Change	Energy Efficiency	5
Planet	Climate Change	Carbon Emissions	5





Sustainability Evaluation Framework

What could the framework help us do?

1. 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

Capital Planning & Prioritization

Scope Development

Identification
&
Support

Capital Plan
Review



Review
&
Study

Approved
Capital Plan



Design
Approval



Design Phase

Bid



"BIG IDEA"

BIG IDEA

"PROJECT"

Threshold Criteria

Prioritization Criteria

Project Requirements

Budget Development

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?



Cornell University

*Identification
&
Support
Phase*

*Capital Plan
Review*



BIG IDEA

Threshold Criteria

Threshold Criteria

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

TIME

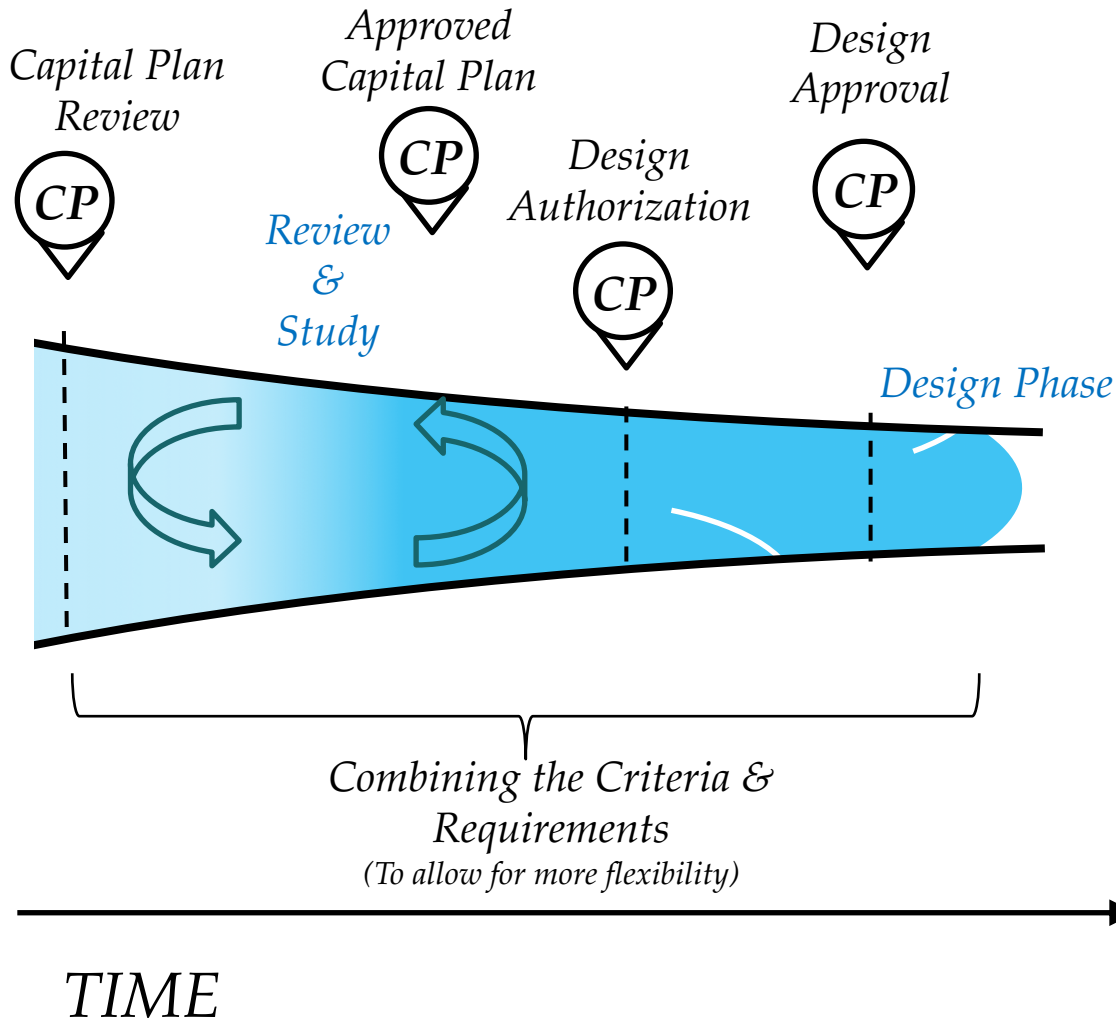


Where does QBL Best Fit?



Cornell University

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



Cornell University

Living Document:

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

Threshold Criteria

Prioritization Criteria

Project Requirements

