Construction Phase Carbon Impact

VERMONT INTEGRATED ARCHITECTURE, PC

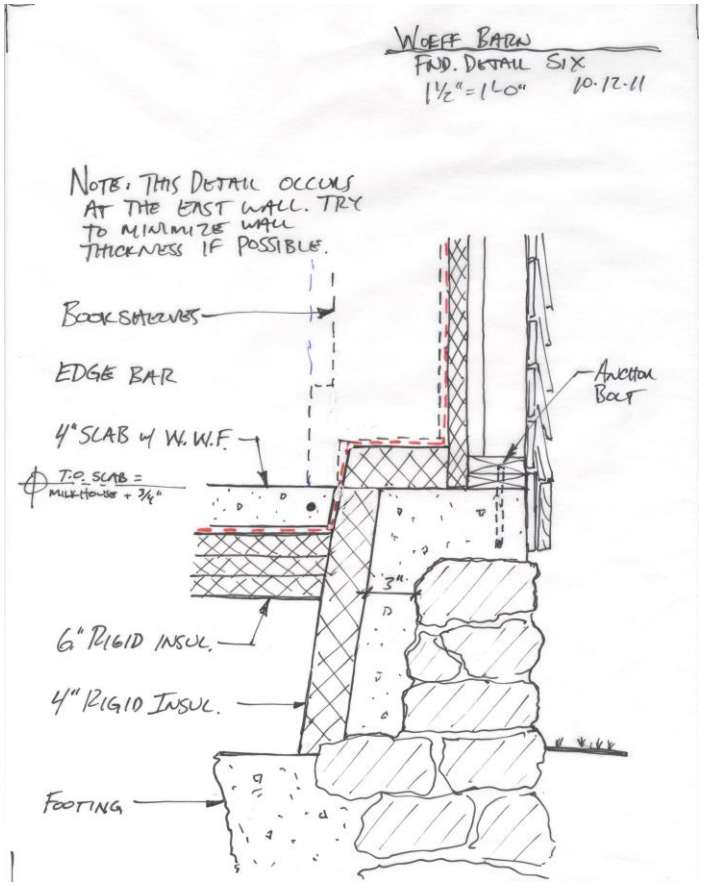
Better Buildings by Design Conference
February 5, 2020

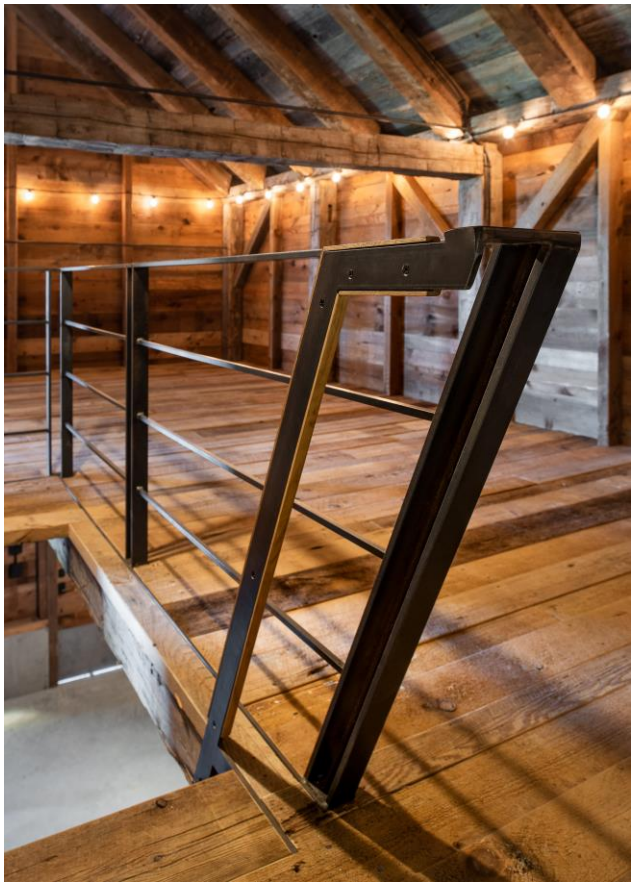
Amy Sheldon
VT House Rep.
Chair of the Natural Resources, Fish and Wildlife Committee

VERMONT INTEGRATED ARCHITECTURE, PC

INTRODUCTIONS

Better Buildings by Design Conference
February 7, 2018





CAVEATS

Better Buildings by Design Conference

February 5, 2020

WHY?

Better Buildings by Design Conference

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WHY?

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WHY?

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BlackRock. About Us Newsroom Insights Investor Relations Sustainability Careers

Making sustainability our standard

Sustainability, and climate change in particular, are poised to transform investing.

Larry Fink's letter to CEOs

A fundamental reshaping of finance

Climate change is driving a profound reassessment of risk and we anticipate a significant reallocation of capital.

WHY?

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WHY?

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DOING WELL IN SOME AREAS:

DENSITY

DOING WELL IN SOME AREAS:

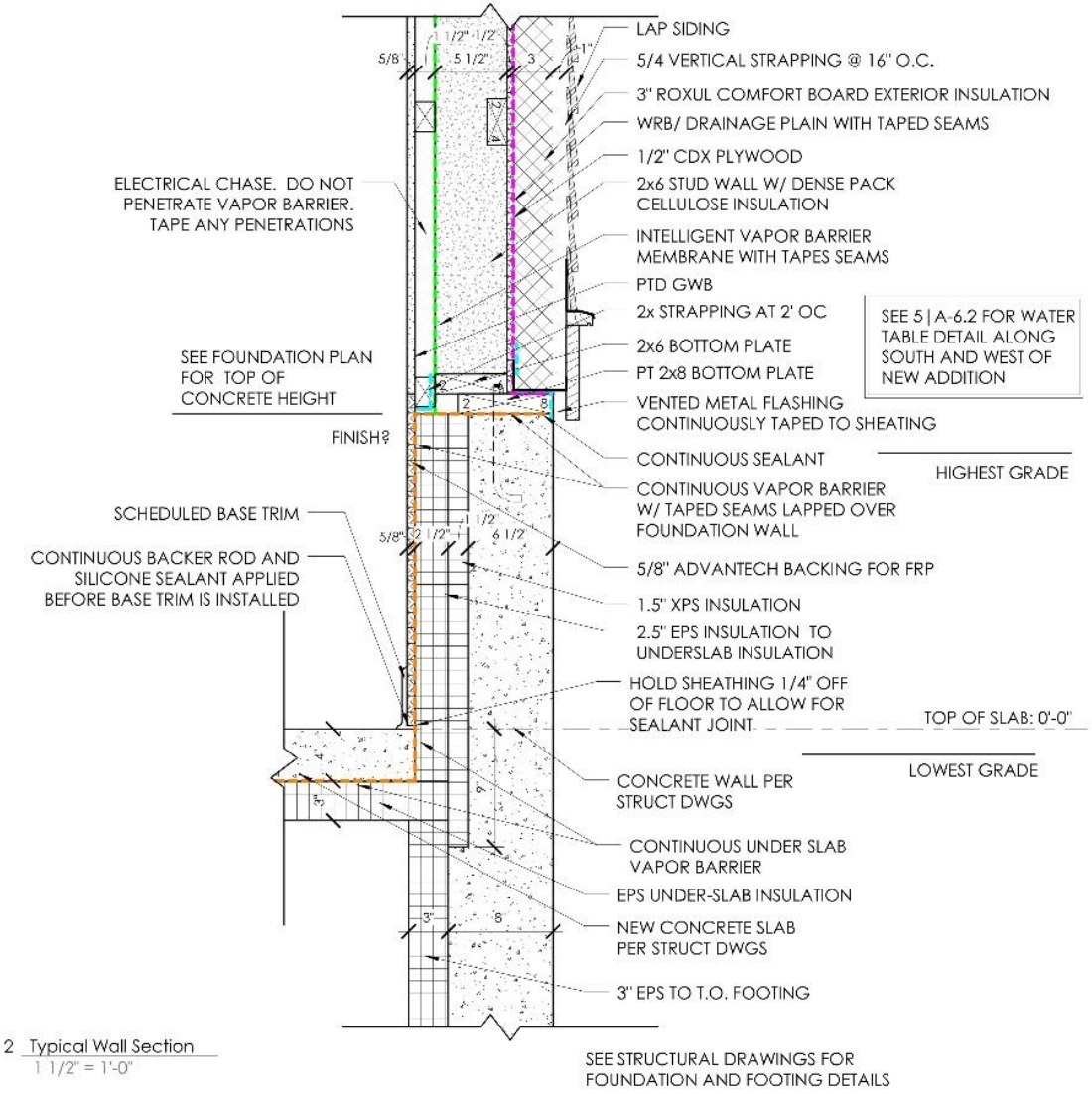
SIZE

DOING WELL IN SOME AREAS:

STRUCTURAL MATERIALS

DOING WELL IN SOME AREAS:

ENVELOPES



DOING WELL IN SOME AREAS:

AIR
SEALING

DOING WELL IN SOME AREAS:

HVAC

DOING WELL IN SOME AREAS:

LIGHTING + POWER

WHY?

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CONSTRUCTION ENERGY AND CARBON:

IMPACTS

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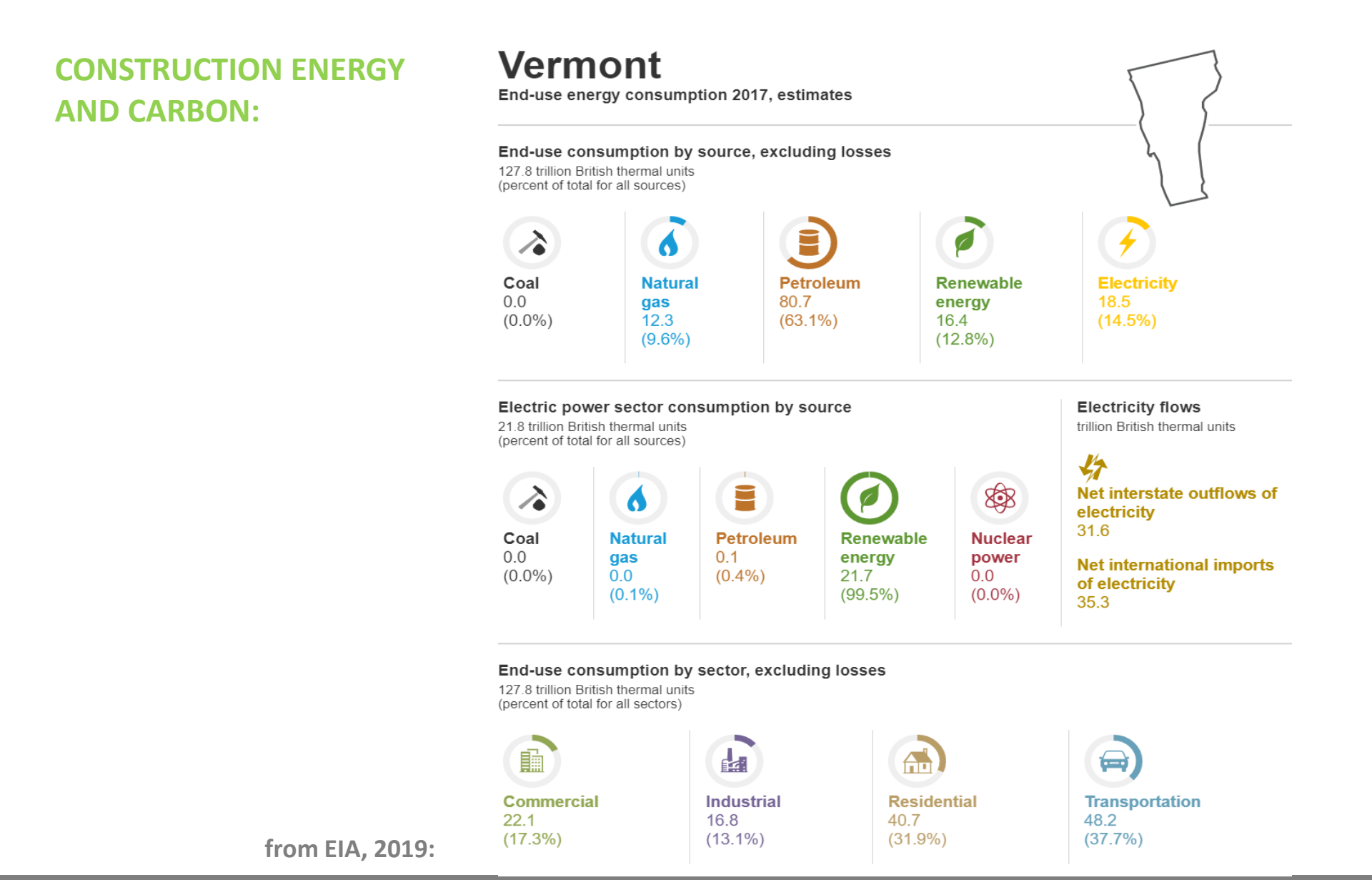
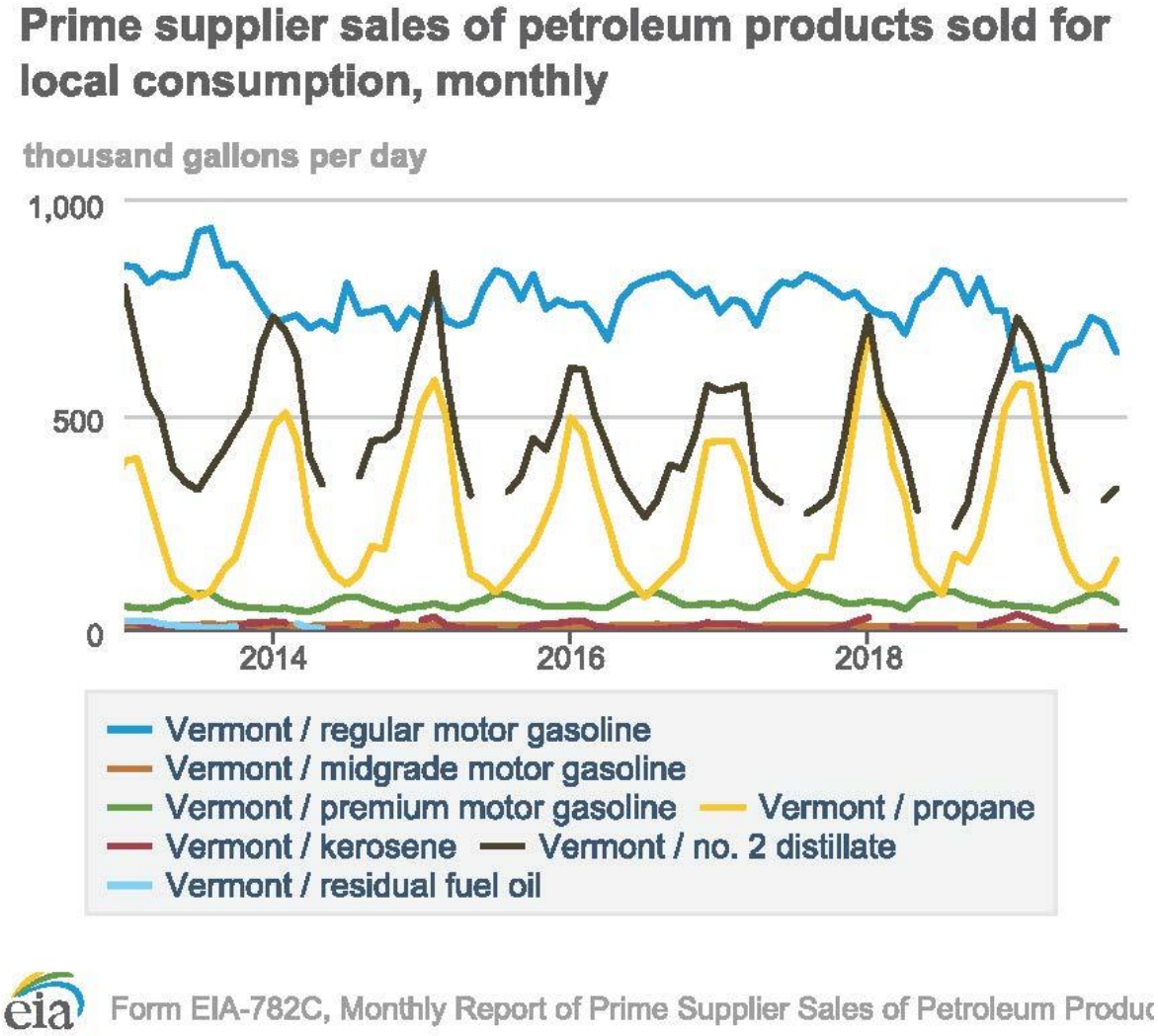
CONSTRUCTION ENERGY AND CARBON:

from EIA, 2019:

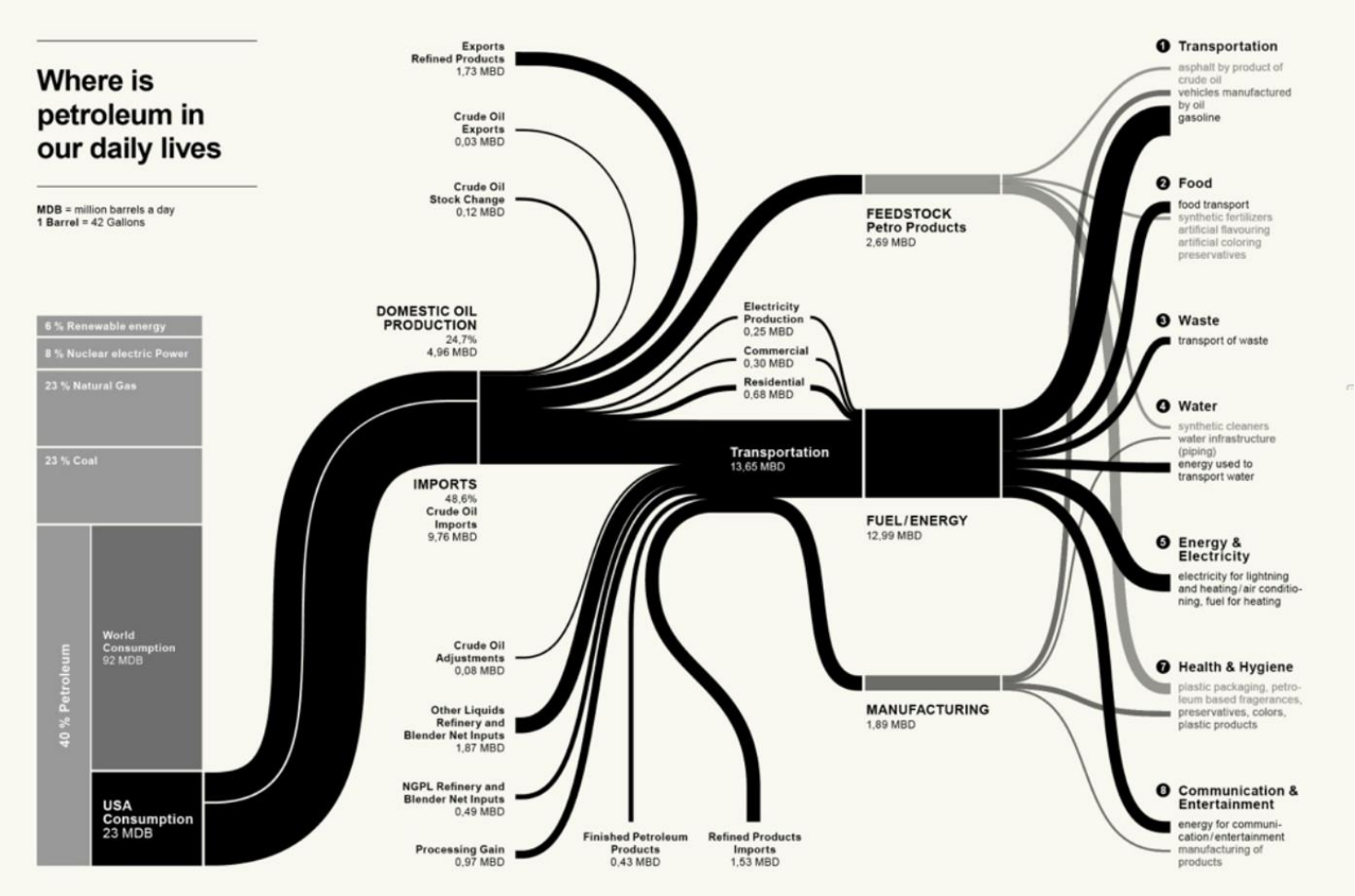


CONSTRUCTION ENERGY AND CARBON:



from EIA, 2019:

CONSTRUCTION ENERGY AND CARBON:



from visualinformation.info, 2019:

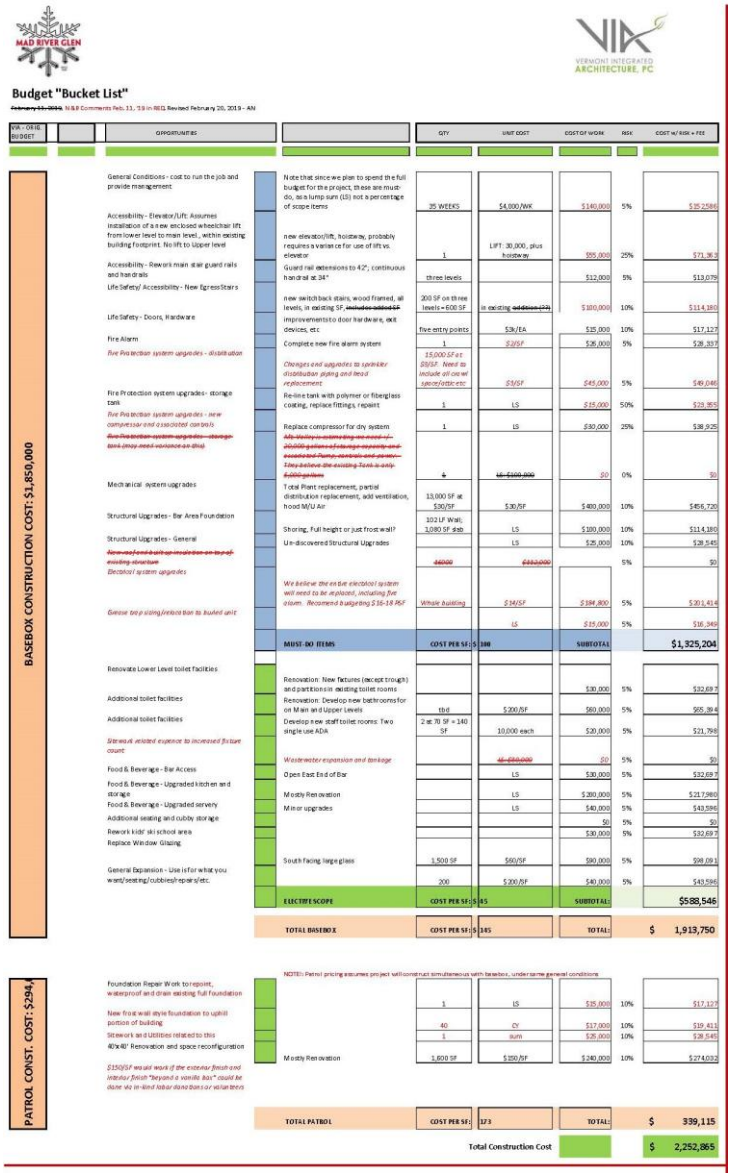
TRANSPORTATION

WINTER

HEAVY EQUIPMENT

COST OF MONEY

GIVE CARBON THE SAME ATTENTION THAT WE GIVE TO DOLLARS



MAD RIVER GLEN

VERMONT INTEGRATED ARCHITECTURE, PC

Budget "Bucket List"

~~February 10, 2020~~ N&B Comments Feb. 11, '19 in RED Revised February 26, 2019 - AN

VA - ORIG BUDGET		OPPORTUNITIES		QTY	UNIT COST	COST OF WORK	RISK	COST w/ RISK + FEE
BASEBOX CONSTRUCTION COST: $1,850,000		General Conditions - cost to run the job and provide management	Note that since we plan to spend the full budget for the project, these are must-do, sea lump sum (LS) not a percentage of scope items	35 WEEKS	$4,000/WK	$140,000	5%	$352,580
		Accessibility - Elevator/Lift: Assumes installation of a new enclosed wheelchair lift from lower level to main level , within existing building footprint. No lift to Upper level	new elevator/lift, hoistway, probably requires a variance for use of lift vs. elevator	1	LIFT: 30,000 , plus hoistway	$55,000	25%	$71,363
		Accessibility - Rework main stair guard rails and handrails	Guard rail extensions to 42", continuous handrail at 34"	three levels		$12,000	5%	$13,079
		Life Safety/ Accessibility - New Egress Stairs	new switch back stairs, wood framed, all levels, in existing SF, ~~include addition~~	200 SF on three levels = 600 SF	in existing ~~addition~~	$180,000	10%	$114,180
		Life Safety - Doors, Hardware	improvements to door hardware, exit devices, etc	five entry points	$3k/EA	$15,000	10%	$17,127
		Fire Alarm	Complete new fire alarm system	1	$/SF	$26,000	5%	$28,337
		Fire Protection system upgrades - distribution	*Changes and upgrades to sprinkler distribution piping and head replacement*	*15,000 SF at $9/SF. Need to include all coved spaces/attics etc*	$9/SF	$45,000	5%	$49,046
		Fire Protection system upgrades - storage tank	Re-line tank with polymer or fiberglass coating, replace fittings, repaint	1	LS	$15,000	50%	$23,355
		Fire Protection system upgrades - new compressor and associated controls	Replace compressor for dry system	1	LS	$30,000	25%	$38,925
		~~*Fire Protection system upgrades - storage tank (may need variance on this)*~~	~~*We likely to exempting on most of 20,000 gallons of storage currently and exceptional Pump, controls and pump. They believe the existing Tank is only adequate*~~	~~5~~	~~LS- $100,000~~	$0	0%	$0
		Mechanical system upgrades	Total Plant replacement, partial distribution replacement, add ventilation, hood M/U Air	13,000 SF at $30/SF	$30/SF	$400,000	10%	$456,720
		Structural Upgrades - Bar Area Foundation	Shoring, Full height or just frost wall?	102 LF Wall; 3,080 SF slab	LS	$100,000	10%	$114,180
		Structural Upgrades - General	Un-discovered Structural Upgrades		LS	$25,000	10%	$28,545
		~~*New roof and partial insulation on top of existing structure*~~		~~40000~~	~~$33/000~~		5%	$0
		Electrical system upgrades	*We believe the entire electrical system will need to be replaced, including fire alarm. Recommend budgeting $16-18 PSF*	*Whole building*	$34/SF	$184,800	5%	$201,414
		Grease trap sizing/relocation to suited unit			LS	$15,000	5%	$16,349
			MUST-DO ITEMS	**COST PER SF: $** **300**		**SUBTOTAL**		**$1,325,204**
		Renovate Lower Level toilet facilities	Renovation: New fixtures (except trough) and partitions in existing toilet rooms			$30,000	5%	$32,697
		Additional toilet facilities	Renovation: Develop new bathrooms for on Main and Upper Levels	tbd	$200/SF	$60,000	5%	$65,394
		Additional toilet facilities	Develop new staff toilet rooms: Two single use ADA	2 at 70 SF = 140 SF	10,000 each	$20,000	5%	$21,798
		Sitework related expense to increased fixture count	*Wastewater expansion and tankage*		~~$1-$50,000~~	$0	5%	$0
		Food & Beverage - Bar Access	Open East End of Bar		LS	$30,000	5%	$32,697
		Food & Beverage - Upgraded kitchen and storage	Mostly Renovation		LS	$200,000	5%	$217,980
		Food & Beverage - Upgraded servery	Minor upgrades		LS	$40,000	5%	$43,596
		Additional seating and cubby storage				$0	5%	$0
		Rework kids' ski school area				$30,000	5%	$32,697
		Replace Window Glazing	South Facing large glass	1,500 SF	$60/SF	$90,000	5%	$98,091
		General Expansion - Use is for what you want/seating/cubbies/repairs/etc.		200	$200/SF	$40,000	5%	$43,596
			ELECTIVE SCOPE	**COST PER SF: $** **85**		**SUBTOTAL:**		**$538,546**
			TOTAL BASEBOX	**COST PER SF: $** **185**		**TOTAL:**		**$ 1,913,750**
PATROL CONST. COST: $294,4			NOTE: Patrol pricing assumes project will construct simultaneous with basebox, under same general conditions					
		Foundation Repair Work to repoint, waterproof and drain existing full foundation		1	LS	$35,000	10%	$17,127
		New frost wall style foundation to uphill portion of building		40	CY	$17,000	10%	$19,413
		Sitework and Utilities related to this		1	sum	$25,000	10%	$28,545
		40'x40' Renovation and space reconfiguration	Mostly Renovation	1,600 SF	$150/SF	$240,000	10%	$274,032
		$150/SF would work if the exterior finish and interior finish "beyond a vanilla box" could be done via in-kind labor donations or volunteers						
			TOTAL PATROL	**COST PER SF:**	**173**	**TOTAL:**		**$ 339,115**
					Total Construction Cost			**$ 2,252,865**

STRATEGIES

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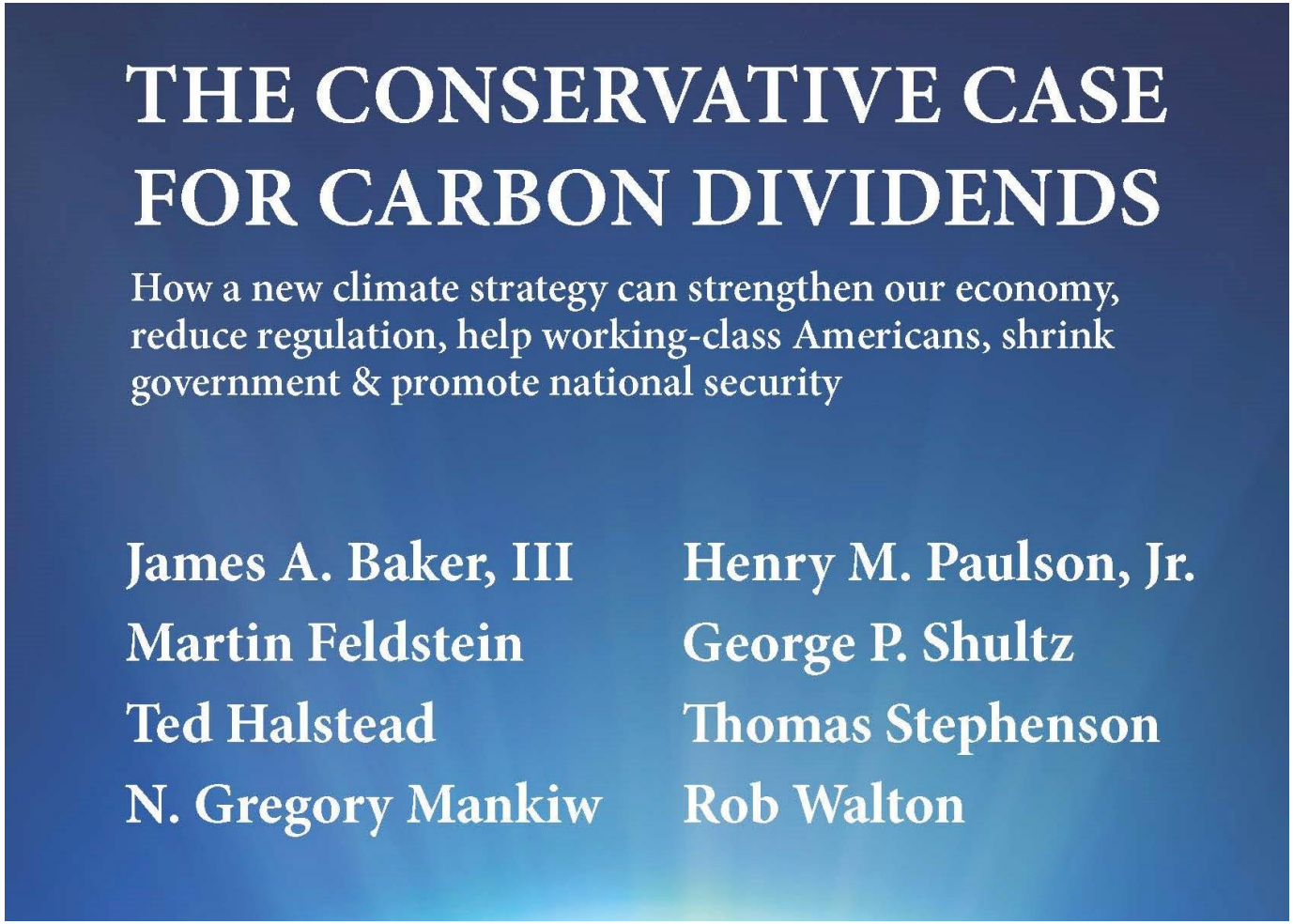
THE CONSERVATIVE CASE FOR CARBON DIVIDENDS
How a new climate strategy can strengthen our economy, reduce regulation, help working-class Americans, shrink government & promote national security
James A. Baker, III
Martin Feldstein
Ted Halstead
N. Gregory Mankiw
Henry M. Paulson, Jr.
George P. Shultz
Thomas Stephenson
Rob Walton

CONSTRUCTION

CONSTRUCTION

CONSTRUCTION

EVERYONE GETS ENGAGED/THINKS CRITICALLY

DENSE DEVELOPMENT

REDUCE BUILDING SIZE

WILL HAVE LEARNING CURVE

THE BUSINESS CASE

STRATEGIES

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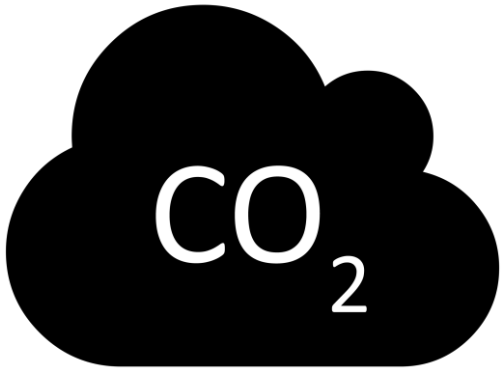
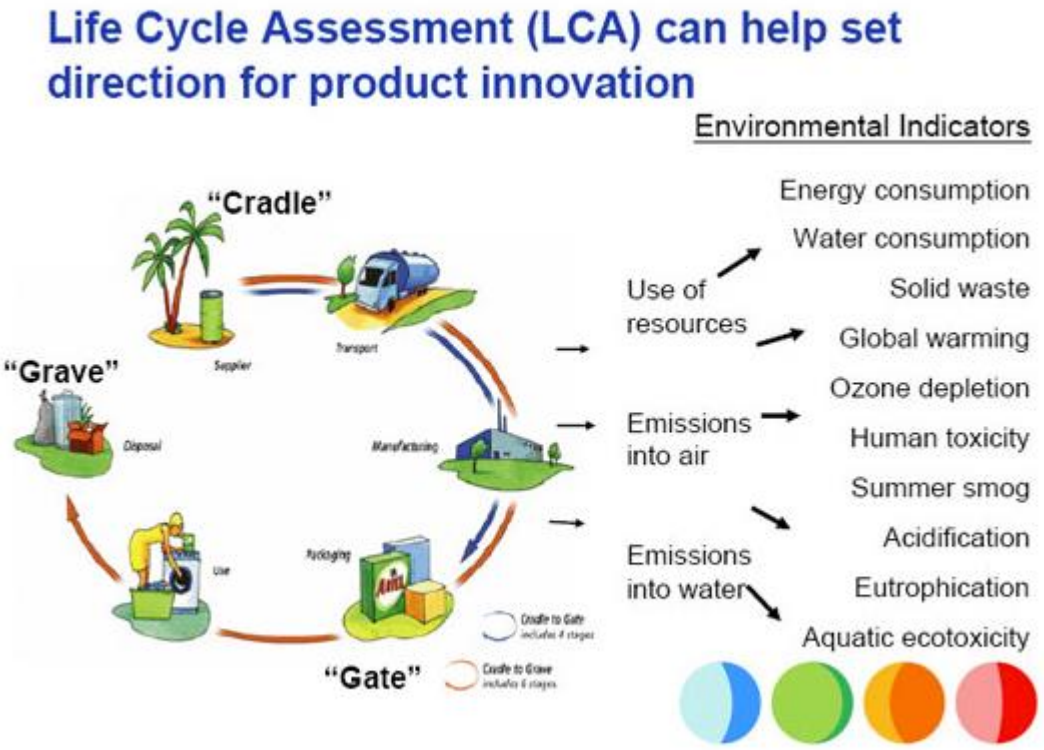
TERMS

1) **GREEN HOUSE GAS EMISSIONS (GHG)**
    1) Used interchangeably with carbon emissions and emissions to mean all ghg emissions, including carbon dioxide (co2) AND OTHER GHGs, sometimes expressed as …
2) **EMBODIED CARBON EMISSION EQUIVALENTS = eCO2e**
    1) Carbon/GHG emissions from materials and construction activities
3) **OPERATING CARBON EMISSION EQUIVALENTS= oCO2e**
    1) Carbon/GHG emissions from operating a building (i.e. heating/cooling, lighting, plug loads, etc.)



TERMS – LCA AND SUPPLY CHAIN

1) CRADLE TO GRAVE
   A) CRADLE TO CRADLE
2) CRADLE TO GATE
3) GATE TO GATE
4) WELL TO WHEEL



Source: SCDirect

TERMS

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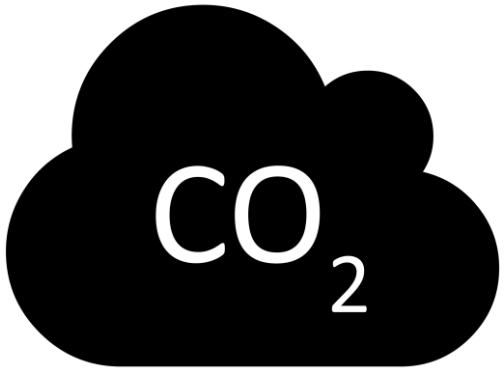
EUI



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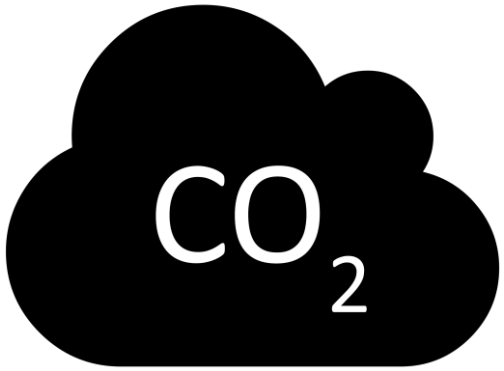
cEUI?

EUI



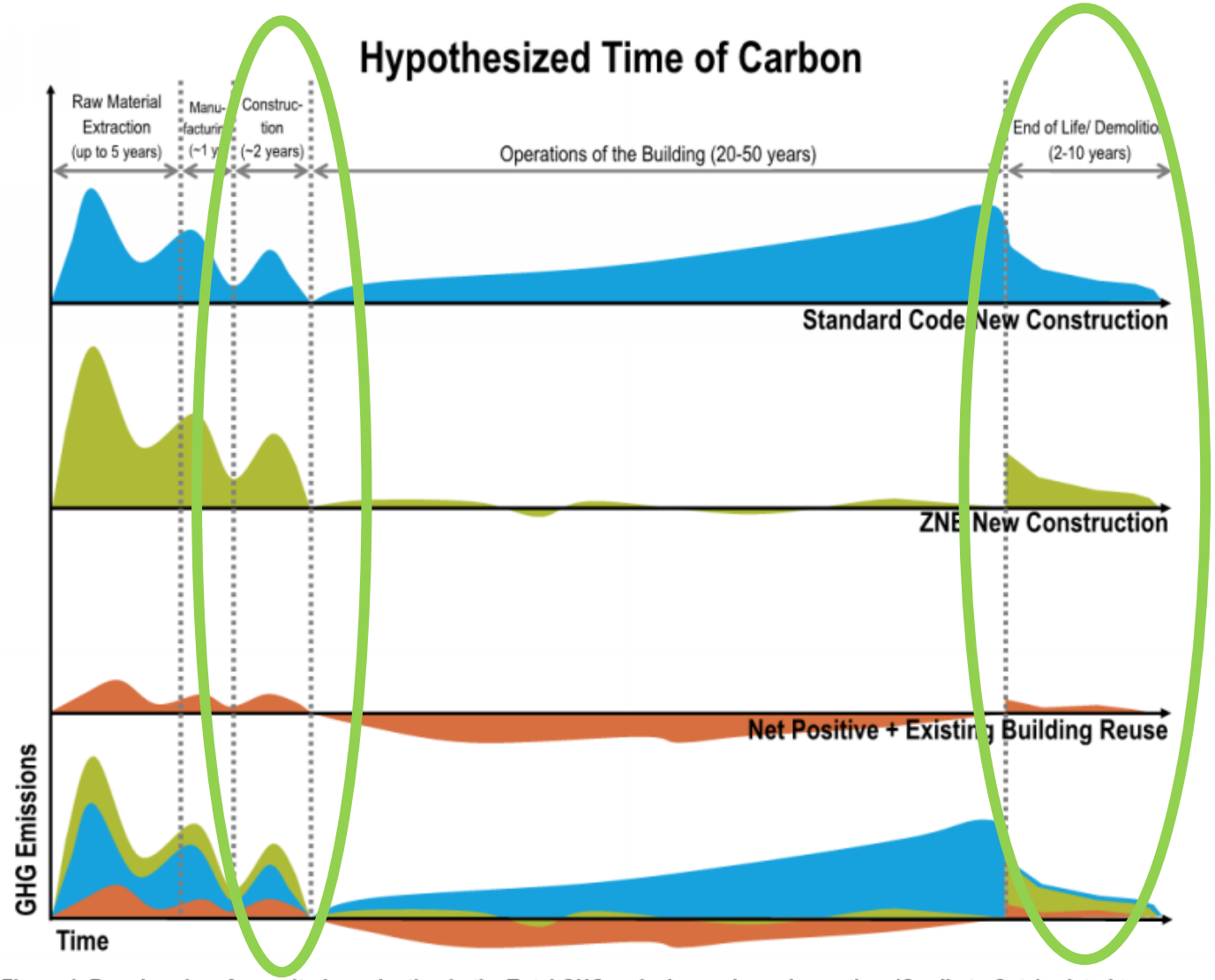
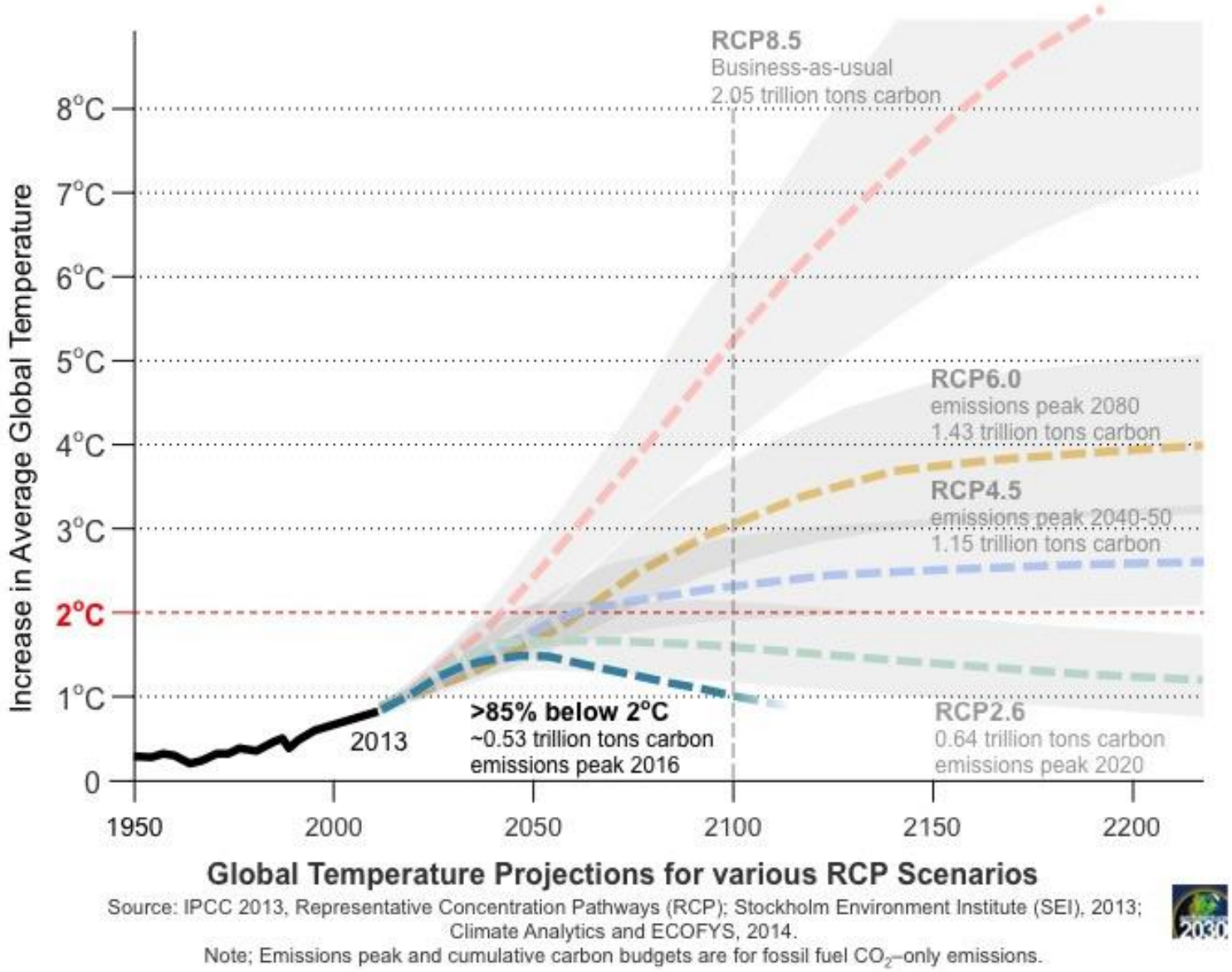


Figure 1. Rough order of magnitude evaluation in the Total GHG emissions released over time (Cradle to Gate) related to buildings - comparing Standard code-compliant new construction, Zero Net Energy (ZNE) new construction, vs. Net Positive existing building reuse.

Source: The Total Carbon Study, 11.13.15
Ecological Building Network
Integral Group
Siegel & Strain Architects



Global Temperature Projections for various RCP Scenarios

Source: IPCC 2013, Representative Concentration Pathways (RCP); Stockholm Environment Institute (SEI), 2013; Climate Analytics and ECOFYS, 2014.

Note; Emissions peak and cumulative carbon budgets are for fossil fuel CO_2–only emissions.

AT 1º, WHAT ARE OUR OPTIONS?

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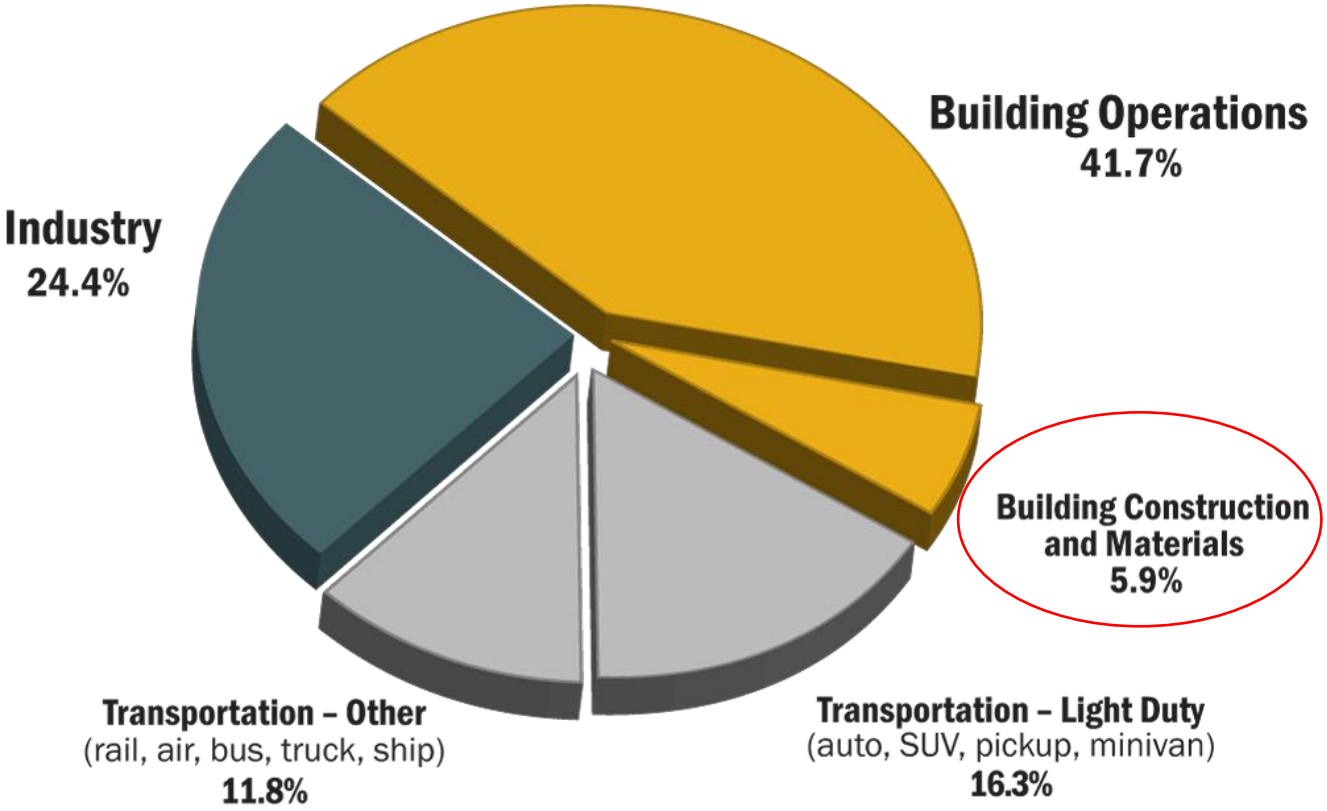
SCALE OF ANNUAL NEW CONSTRUCTION IN U.S.

SCALE OF ANNUAL NEW CONSTRUCTION VS. EXISTING BUILDING STOCK IN U.S.

2013 TOTAL US EMISSIONS = 6.3 B TONS
5.9% OF 6.3B = 370 MILLION METRIC TONS



U.S. Energy Consumption by Sector

Data Source: U.S. Energy Information Administration (2012).

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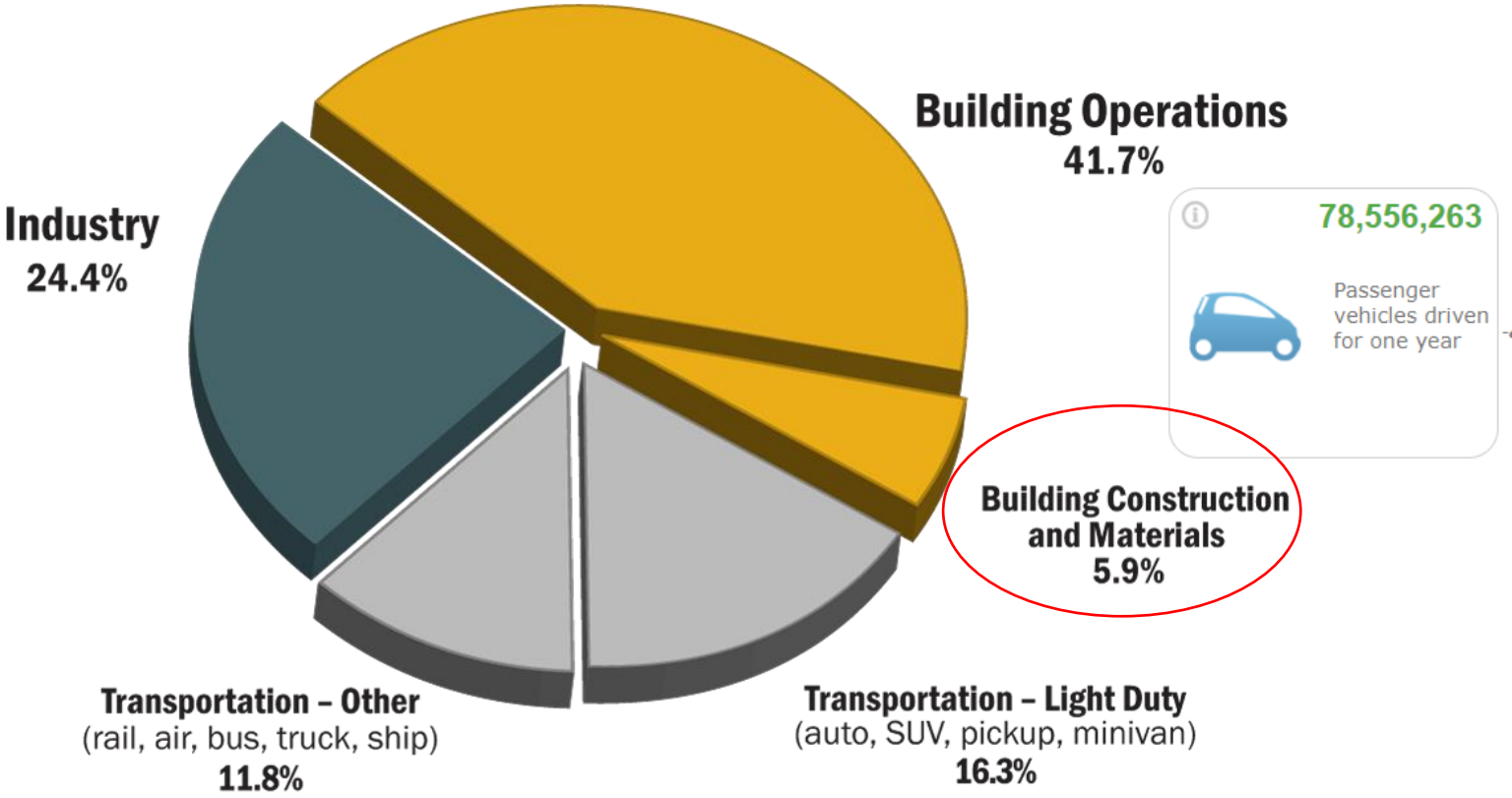

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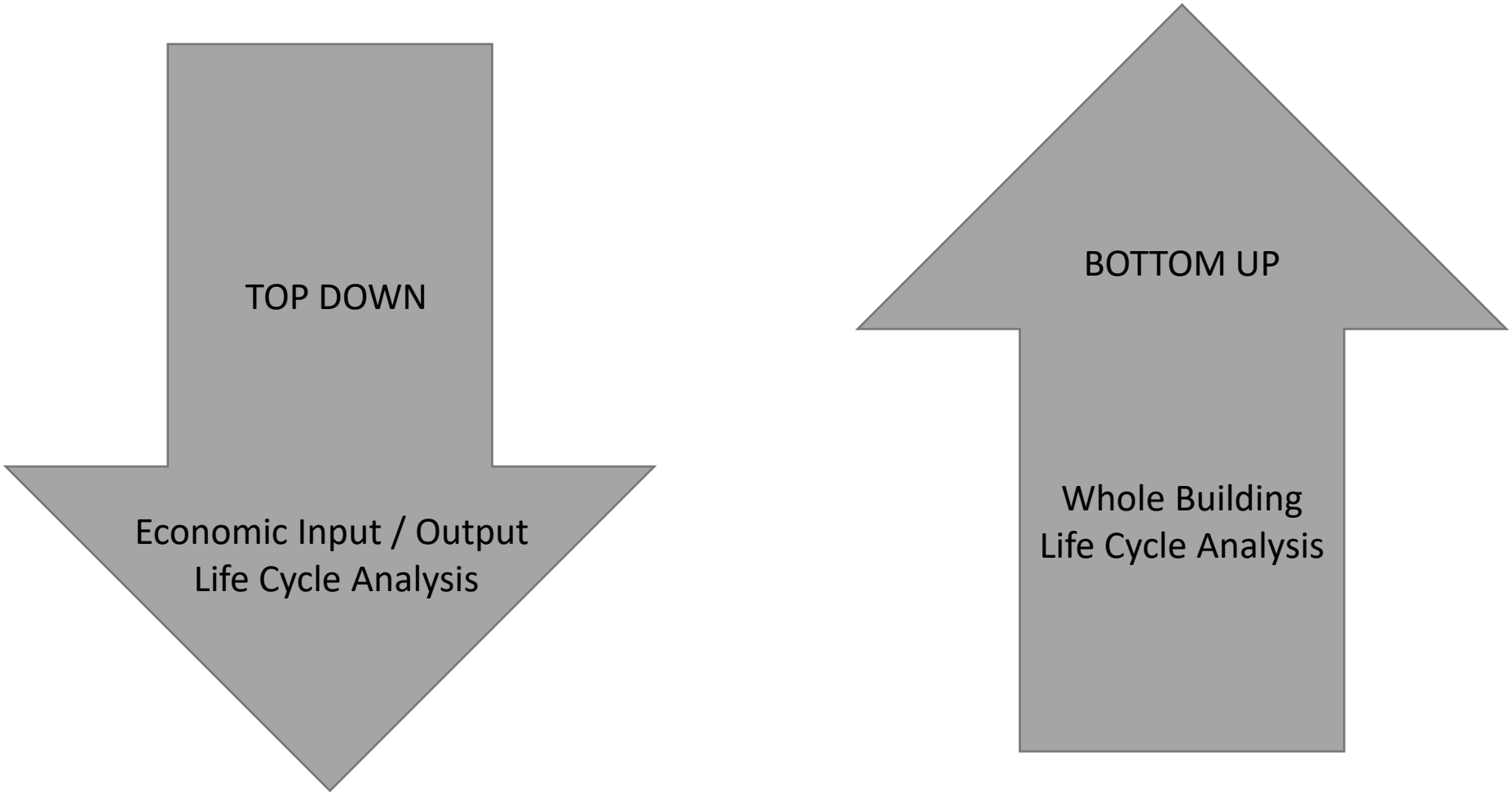
ESTIMATING EMISSIONS FROM MATERIALS AND CONSTRUCTION
TWO METHODS



WHOLE BUILDING LIFE CYCLE ANALYSIS

BOTTOM UP TOOLS

Athena Sustainable Materials Institute

tally

EC3

Sustainable Minds Transparency Catalog

PRODUCT EPDS

Samples: 34 | Achievable: 0.29 kgCO2e | Average: 0.587 kgCO2e ± 59.7% | Conservative: 1.04 kgCO2e | Declared Unit: 1 ft2

Subcategory: Board	Manufacturer (Compare)	Plant (Compare)	Product	Description	≤ EC3 / 1 ft2	Details
Board	Owens Corning	Wabash, IN	Thermafiber Mineral Wool Insul...	Thermafiber® Mineral Wool Ins...	0.632 kgCO2e	Details View
Board	Owens Corning	Wabash, IN	Thermafiber Mineral Wool Insul...	Thermafiber® Mineral Wool Ins...	1.23 kgCO2e	Details View
Board	Owens Corning	Wabash, IN	Thermafiber Mineral Wool Insul...	Thermafiber® Mineral Wool Ins...	0.574 kgCO2e	Details View
Board	Owens Corning	Wabash, IN	Thermafiber Mineral Wool Insul...	Thermafiber® Mineral Wool Ins...	1.17 kgCO2e	Details View
Board	Owens Corning	Wabash, IN	Thermafiber Mineral Wool Insul...	Thermafiber® mineral wool ins...	0.264 kgCO2e	Details View
Board	Owens Corning	Wabash, IN	Thermafiber Mineral Wool Insul...	Thermafiber® mineral wool ins...	0.672 kgCO2e	Details View
Board	Knauf Insulation	Shelbyville, IN	Earthwool Insulation Board - un...	Knauf Insulation Earthwool Ins...	1.04 kgCO2e	Details View
Board	Knauf Insulation	Shelbyville, IN	Earthwool Insulation Board - FS...	Knauf Insulation Earthwool Ins...	1.09 kgCO2e	Details View
Board	Knauf Insulation	Shelbyville, IN	Earthwool Insulation Board - AS...	Knauf Insulation Earthwool Ins...	1.11 kgCO2e	Details View
Board	Carlisle SynTec Systems	Puyallup, WA	Polyiso Roof Insulation Board	Polyiso insulation produced by ...	0.29 kgCO2e	Details View
Board	Carlisle SynTec Systems	Smithfield, PA	Polyiso Roof Insulation Board	Polyiso insulation produced by ...	0.29 kgCO2e	Details View
Board	Carlisle SynTec Systems	Tooele, UT	Polyiso Roof Insulation Board	Polyiso insulation produced by ...	0.29 kgCO2e	Details View
Board	Carlisle SynTec Systems	Terrell, TX	Polyiso Roof Insulation Board	Polyiso insulation produced by ...	0.29 kgCO2e	Details View

Report Bugs & Feedba

Source: https://buildingtransparency.org/

WHOLE BUILDING LIFE CYCLE ANALYSIS

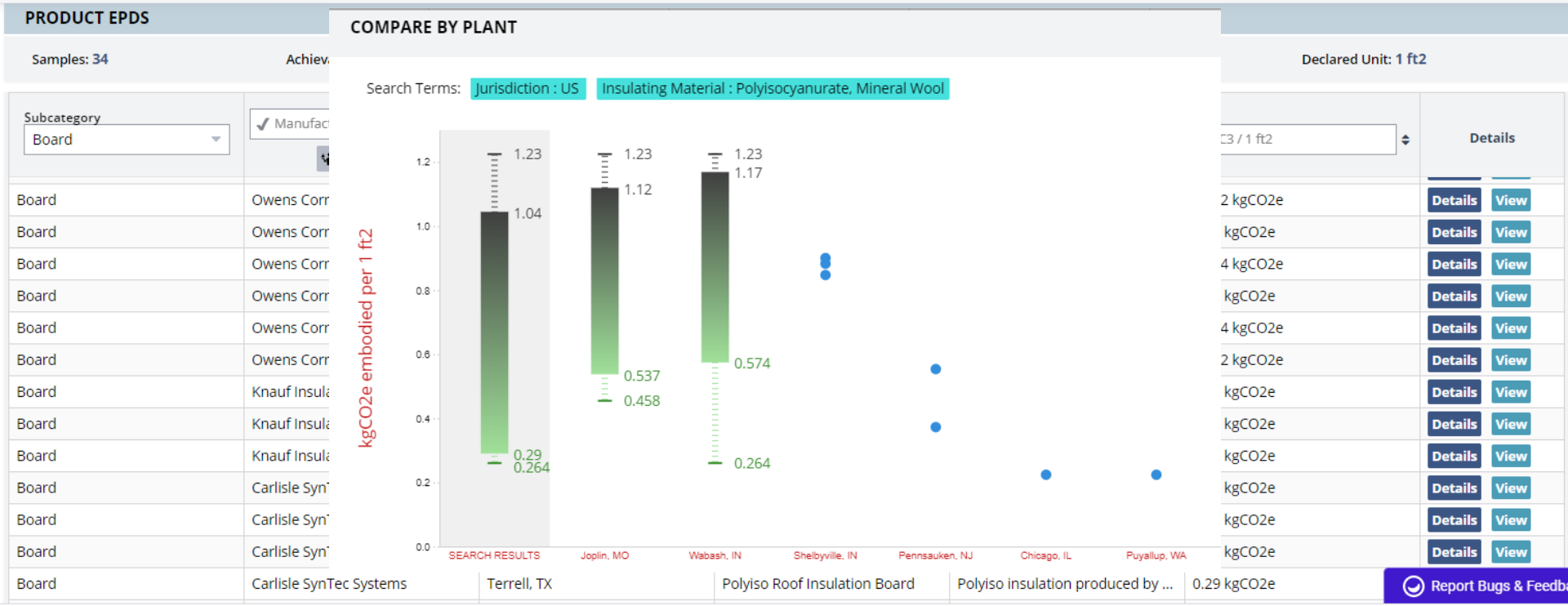
BOTTOM UP TOOLS

Athena Sustainable Materials Institute

tally

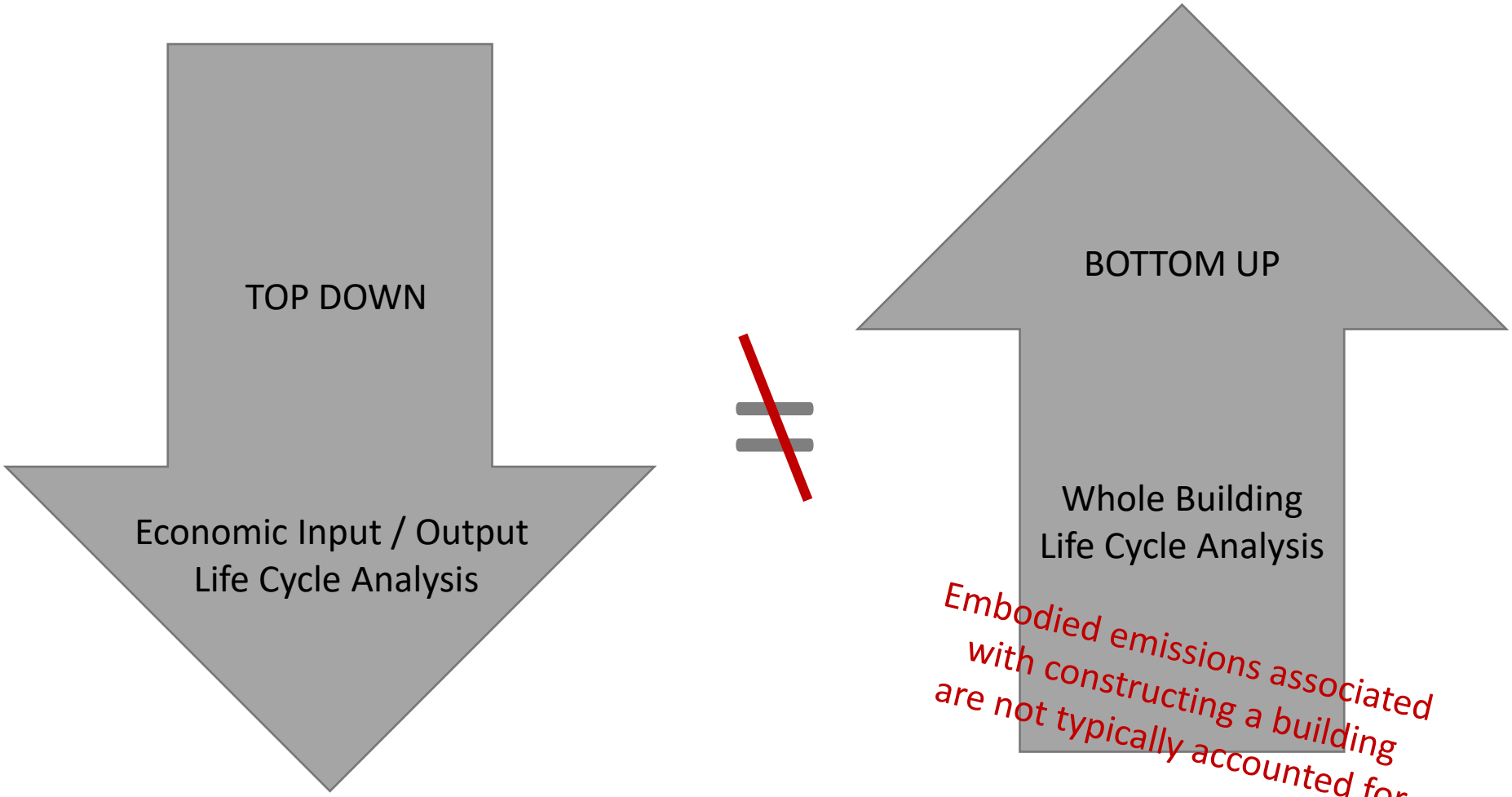
EC3

Sustainable Minds Transparency Catalog



Source: https://buildingtransparency.org/

ESTIMATING EMISSIONS FROM MATERIALS AND CONSTRUCTION
TWO METHODS



Carbon Leadership Forum's Embodied Carbon Benchmark Project

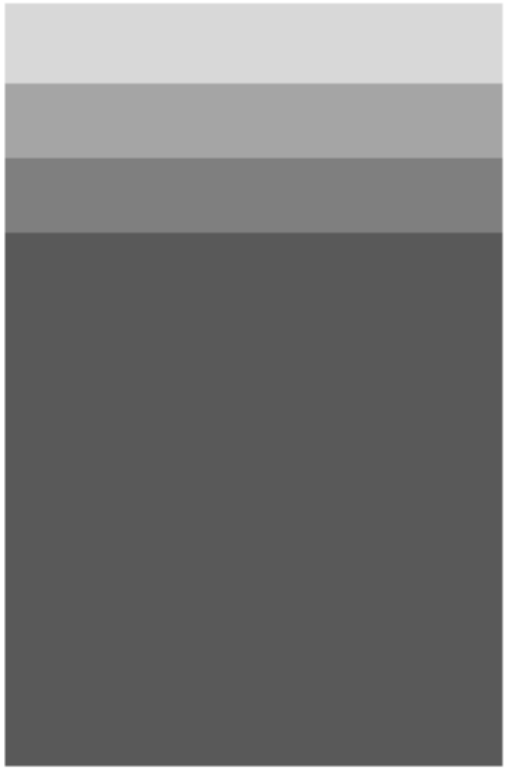


Figure 4. Where's the Carbon?
Source: Embodied Carbon Benchmark Project, and review of multiple embodied energy and carbon studies

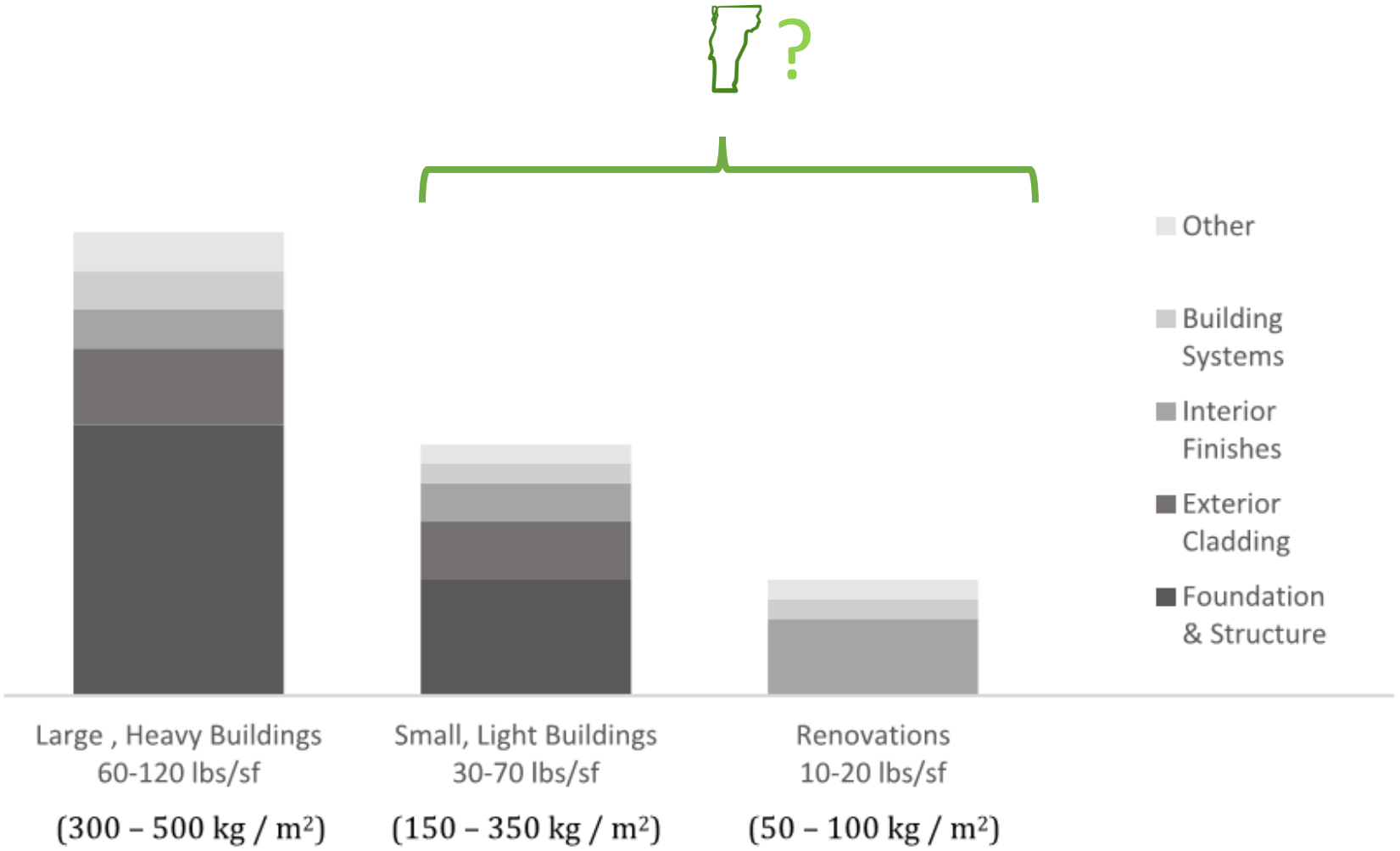
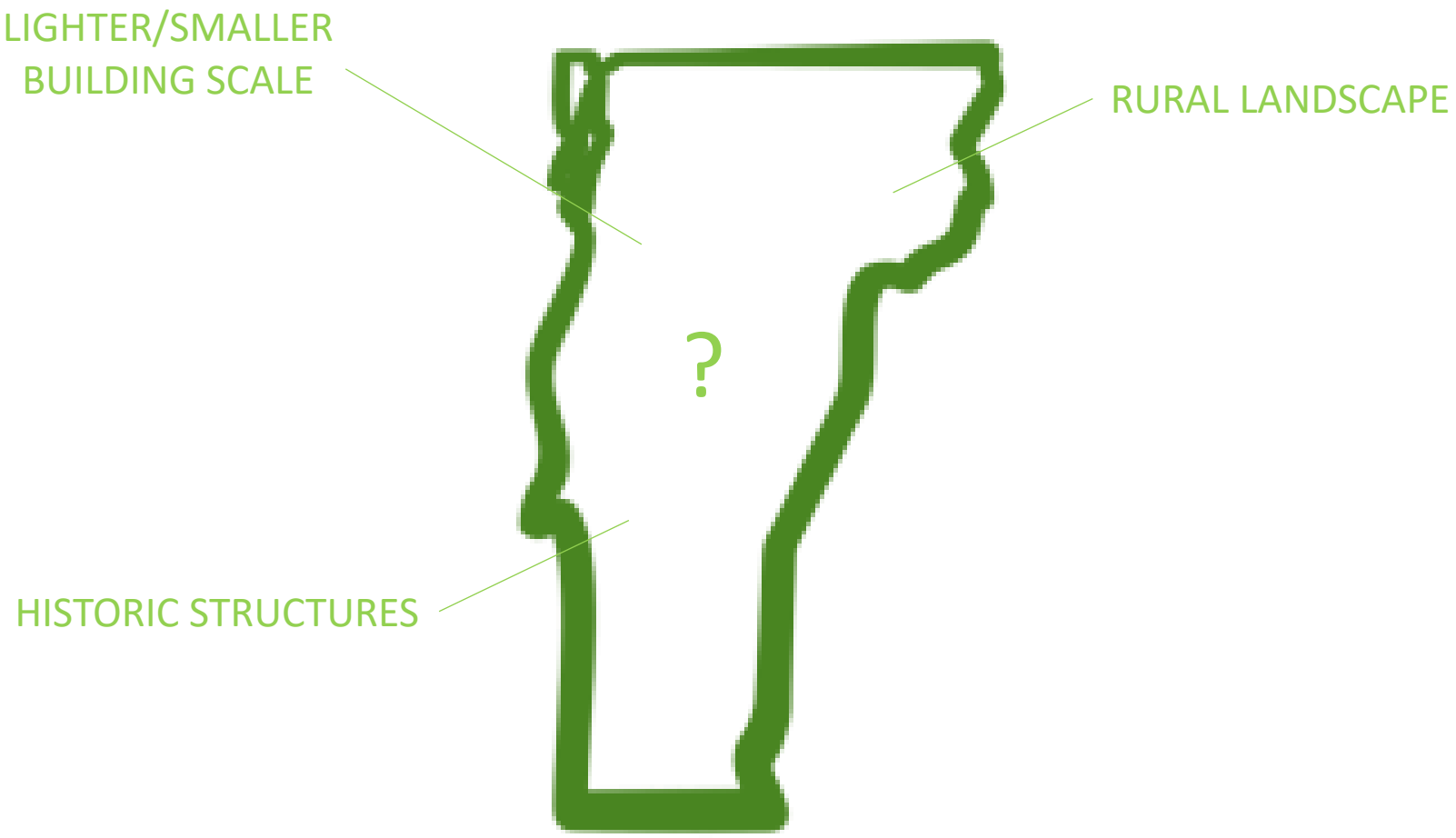


Figure 5. Carbon Emissions by Building Type and Building Element
Source: Embodied Carbon Benchmark Project, Carbon Leadership Forum, and review of multiple embodied energy and carbon studies



KEYS FOR VERMONT

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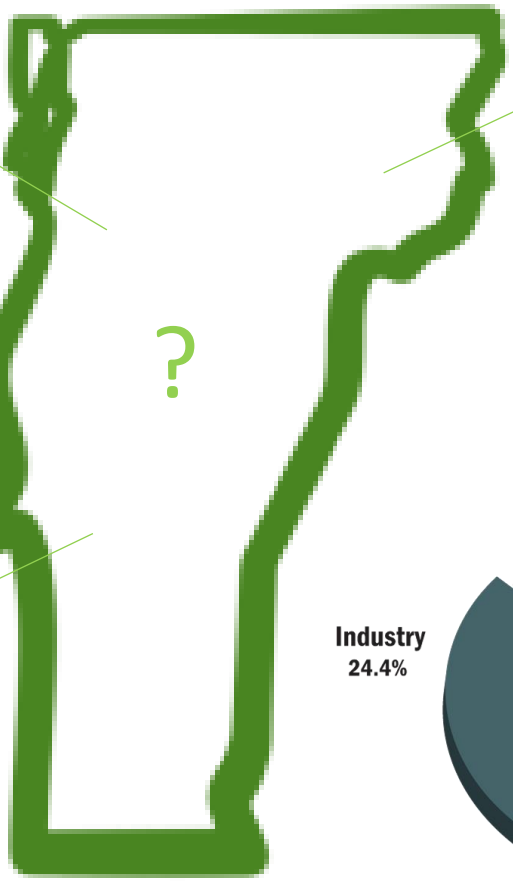
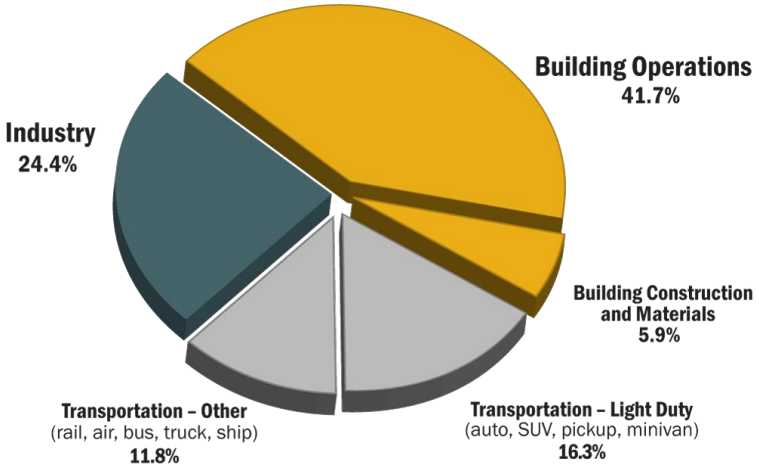
LIGHTER/SMALLER BUILDING SCALE

RURAL LANDSCAPE



HISTORIC STRUCTURES



KEYS FOR VERMONT

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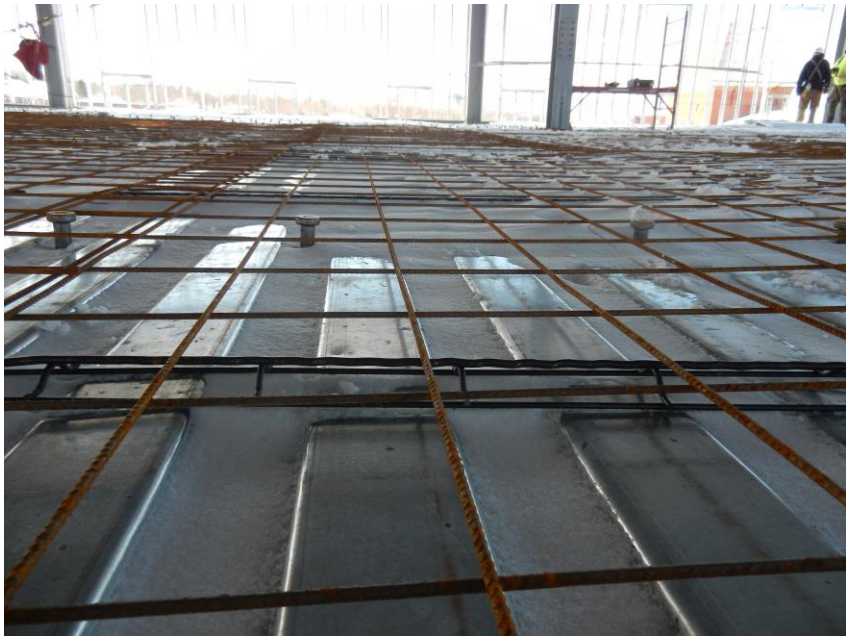
CONSTRUCTION: FACTORS TO CONSIDER

WINTER CONDITIONS:



WINTER HEATING AND TENTING:

GROUND HEATING:

APPROACH/METHODOLOGY:

1
CHARRETTE

Review Schedule & Plan
Identify System & Strategy Options

2
COUNT

Use metrics and tools available to quantify

3
CONSIDER

Evaluate $$, Time, and Carbon




APPROACH/METHODOLOGY:

1
CHARRETTE

Review Schedule & Plan
Identify System & Strategy Options

RINSE AND REPEAT

2
COUNT

Use metrics and tools available to quantify

3
CONSIDER

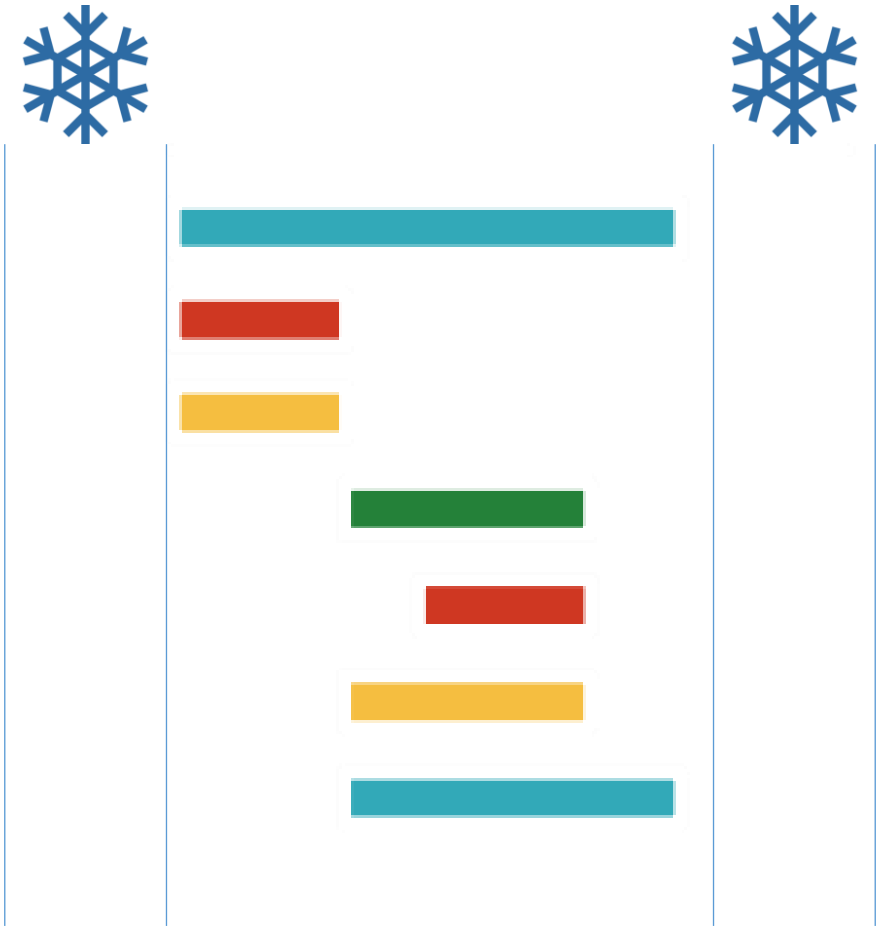
Evaluate $$, Time, and Carbon

AREAS TO CONSIDER

Better Buildings by Design Conference
February 5, 2020

1. CHARRETTE

PLANNING AND SCHEDULING



WINTER HAPPENS

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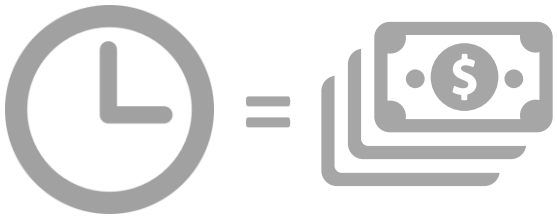
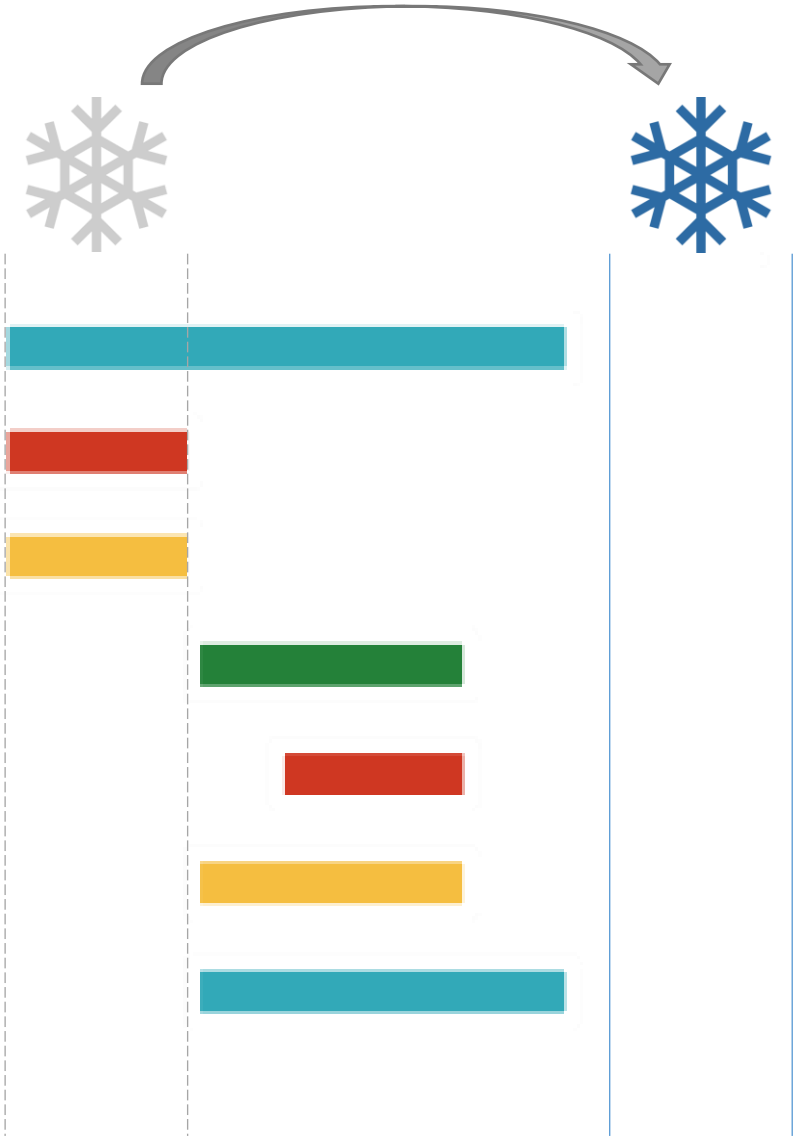
February 7, 2018

1. CHARRETTE

PLANNING AND SCHEDULING



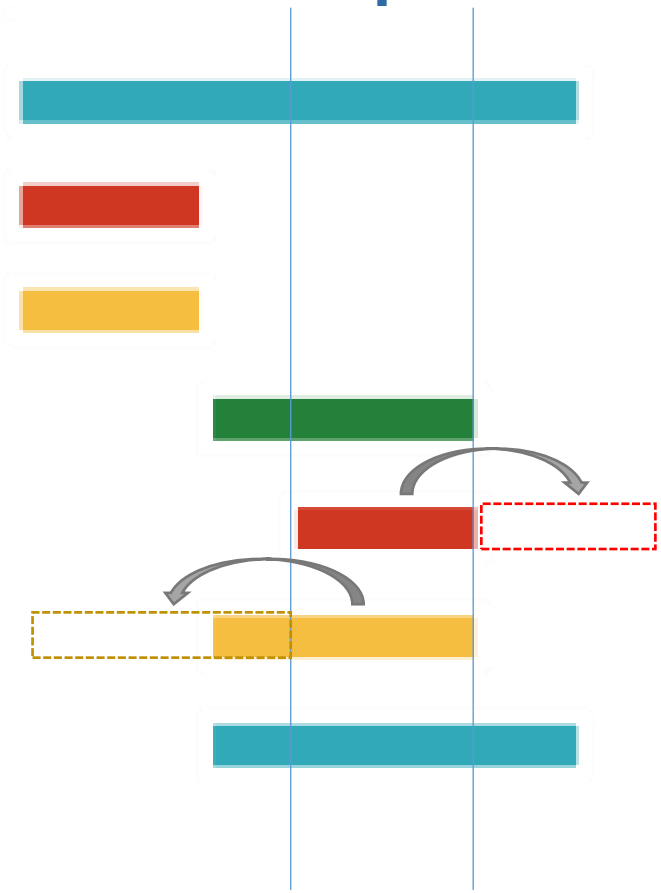
- COST OF MONEY
- LOST REVENUE
- COST OF ENERGY / CARBON ROI



1. CHARRETTE

PLANNING AND SCHEDULING

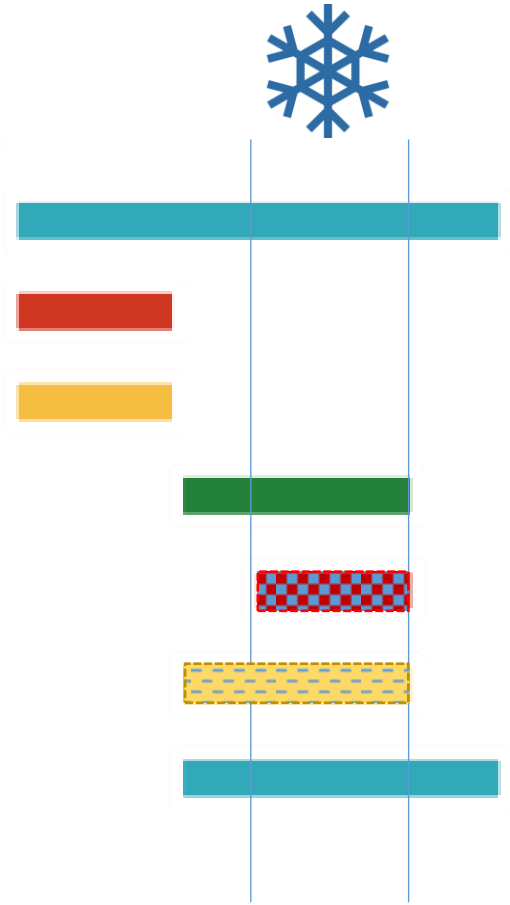
– SHIFTED SEQUENCING OPPORTUNITIES



1. CHARRETTE

PLANNING AND SCHEDULING

– ALTERNATIVE STRATEGIES TO MINIMIZE EMISSIONS



2. COUNTING

USE METRICS AND AVAILABLE TOOLS TO QUANTIFY

Athena Sustainable Materials Institute

tally

EC3

Sustainable Minds Transparency Catalog

	Type	Unit	Emissions	Cost			Conversion Factor
			kg CO2e/unit	USD			to kBtus
Operational Fuel information	Diesel	gal	10.16	$3.00	/	gal	138.87
	Propane	gal	5.76	$2.00	/	gal	91.65
	Kerosene	gal	9.75	$8.00	/	gal	135.00
	Electricity	kWh	0.31	$0.17	/	kWh	3.41
	#2 Fuel Oil	gal	10.16	$2.68	/	gal	138.69
	Natural Gas	ccf	53.12	$1.00	/	ccf	102.90
	Cord Wood	cords		$300.00	/	cords	22,000.00
	Gasoline	gal	8.89	$2.39		gal	124.88

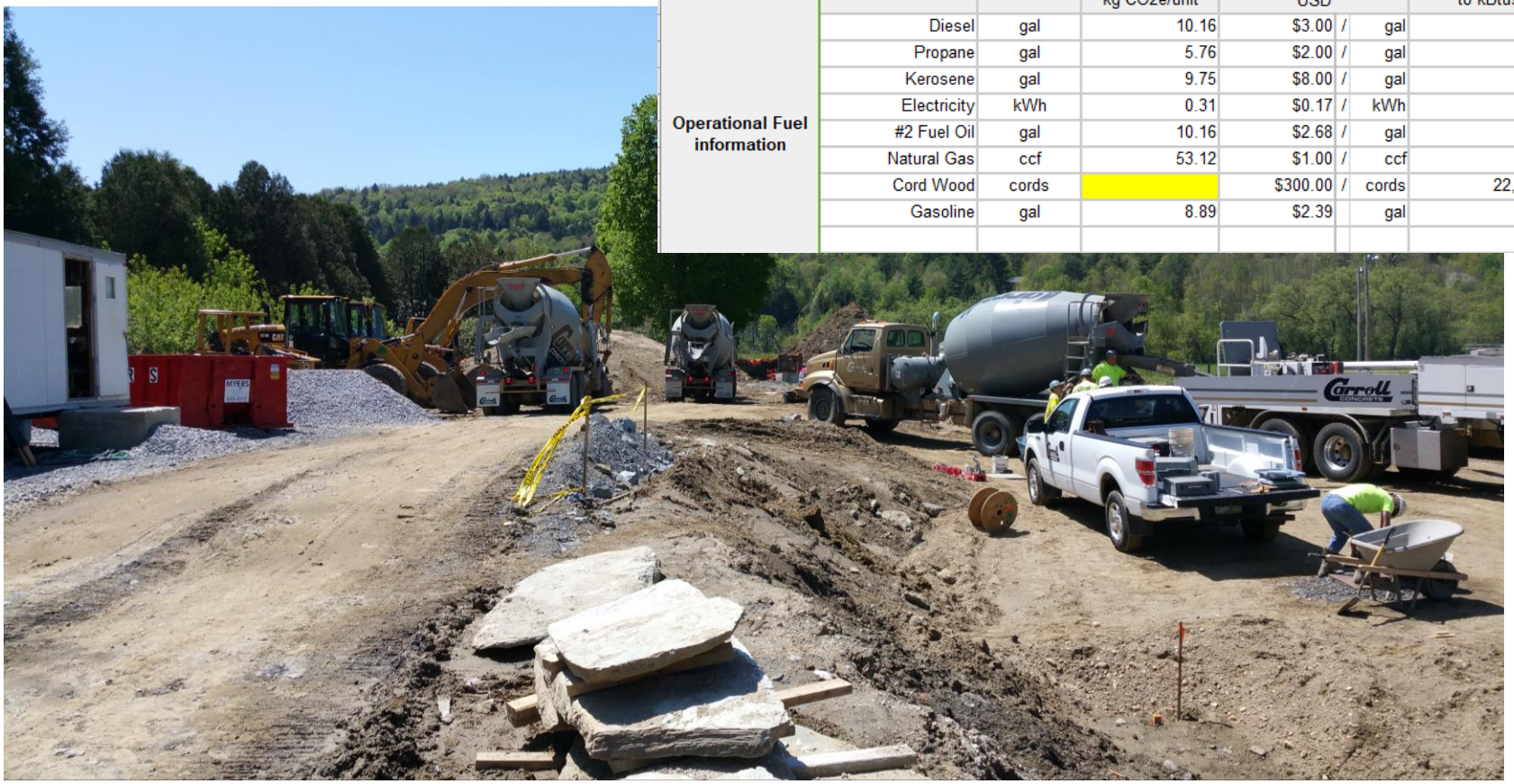
2. COUNTING

USE METRICS AND AVAILABLE TOOLS TO QUANTIFY

LOGIC?

-SITE WORK, LOCAL/REGFIONAL SOURCING, & HEAVY EQUIPMENT:

	Type	Unit	Emissions	Cost		Conversion Factor
			kg CO2e/unit	USD		to kBtus
Operational Fuel information	Diesel	gal	10.16	$3.00 /	gal	138.87
	Propane	gal	5.76	$2.00 /	gal	91.65
	Kerosene	gal	9.75	$8.00 /	gal	135.00
	Electricity	kWh	0.31	$0.17 /	kWh	3.41
	#2 Fuel Oil	gal	10.16	$2.68 /	gal	138.69
	Natural Gas	ccf	53.12	$1.00 /	ccf	102.90
	Cord Wood	cords		$300.00 /	cords	22,000.00
	Gasoline	gal	8.89	$2.39	gal	124.88



2. COUNTING

USE METRICS AND AVAILABLE TOOLS TO QUANTIFY

-MATERIAL TRANSPORTATION

	Type	Unit	Emissions	Cost		Conversion Factor
			kg CO2e/unit	USD		to kBtus
Operational Fuel information	Diesel	gal	10.16	$3.00 /	gal	138.87
	Propane	gal	5.76	$2.00 /	gal	91.65
	Kerosene	gal	9.75	$8.00 /	gal	135.00
	Electricity	kWh	0.31	$0.17 /	kWh	3.41
	#2 Fuel Oil	gal	10.16	$2.68 /	gal	138.69
	Natural Gas	ccf	53.12	$1.00 /	ccf	102.90
	Cord Wood	cords		$300.00 /	cords	22,000.00
	Gasoline	gal	8.89	$2.39	gal	124.88

2. COUNTING

USE METRICS AND AVAILABLE TOOLS TO QUANTIFY

-WASTE GENERATION AND MATERIAL REUSE

NEW CONSTRUCTION GENERATES APPROX. 3-5#/SF OF WASTE/SF

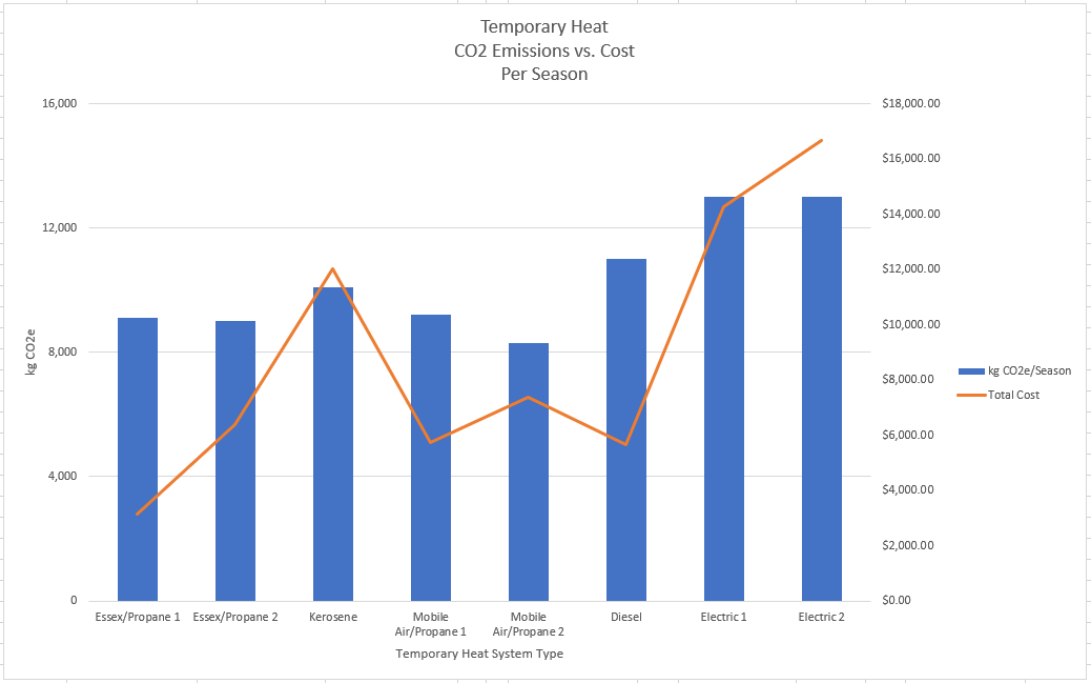
RENOVATION IS OFTEN 20-30X THAT AMOUNT

2. CONSIDER

EVALUATE $$, TIME, AND CARBON

New Frameworks

Rental Company	System	System size (btu)	Operational Hours	Make/Model	Fuel Usage/hr		Fuel Used/Season		kg CO2e/Season	Fuel Cost		Operational Cost	Rental Cost/season	Total Cost
Essex Equipment	Propane 1	170,000	847	CP170	1.86	Gal	1580	Gal	**9100**	$2.00	/gal	$3,160.00		**$3,160.00**
	Propane 2	400,000	360	CP400	4.36	Gal	1570	Gal	**9000**	$2.00	/gal	$3,140.00	$3,231.80	**$6,371.80**
	Kerosene	205,000	702	HVF210	1.48	Gal	1040	Gal	**10100**	$8.00	/gal	$8,320.00	$3,717.00	**$12,037.00**
Mobile Air	Propane 1	450,000	320	OHV 500 LN/NG	5	Gal	1600	Gal	**9200**	$2.00	/gal	$3,200.00	$2,550.00	**$5,750.00**
	Propane 2	500,000	288	Tioga AH-5	5	Gal	1440	Gal	**8300**	$2.00	/gal	$2,880.00	$4,500.00	**$7,380.00**
	Diesel	500,000	288	Foreman 500 OIL	3.6	Gal	1040	Gal	**11000**	$3.00	/gal	$3,120.00	$2,550.00	**$5,670.00**
	Electric 1	408000	353	Heat Wagon P4000	118	kW	41650	kWh	**13000**	$0.17	/kWh	$7,080.50	$7,200.00	**$14,280.50**
	Electric 2	390000	369	Heat Wagon P1800	118	kW	43540	kWh	**13000**	$0.17	/kWh	$7,401.80	$9,270.00	**$16,671.80**



KEY TAKE-AWAYS

1) START EARLY

2) USE AN INTEGRATED PROCESS TO:

   CHARRETTE,

   COUNT, AND

   CONSIDER

   WAYS TO OPTIMIZE CONSTRUCTION PHASE CARBON EMISSIONS IN ADDITION TO OPERATIONAL AND EMBODIED CARBON EMISIONS

3) SELECT OPTIMIZED SOLUTIONS

4) SHARE YOUR FINDINGS AND YOUR DATA!

CALL TO ACTION

1) ARCHITECTS

2) CONSTRUCTORS

3) OWNERS

4) PRODUCT MANUFACTURERS

CALL TO ACTION

1) ARCHITECTS
2) CONSTRUCTORS
3) OWNERS
4) PRODUCT MANUFACTURERS

POLICY

POLICY APPROACHES

Better Buildings by Design Conference

February 7, 2018

Reducing embodied carbon in the built environment: Can Montpelier Help?

AMY SHELDON

Chair, Natural Resources, Fish and Wildlife Committee Vermont General Assembly
Middlebury/Addison 1 District

POLICY APPROACHES

Better Buildings by Design Conference
February 7, 2018

CURRENT POLICIES

Incentives (Carrots) / Regulation (Sticks)

- **Support for weatherization**

- **require RBES and CBES + stretch code for energy efficiency (need enforcement)**

- **do not consider life cycle analysis or total carbon footprint of construction**

ACT 250 CRITERIA

1. Undue water or air pollution
2. Sufficient water available
3. Unreasonable burden on water supply
4. Soil erosion/capacity of land to hold water
5. Unreasonable Traffic
6. Educational services
7. Municipal services
8. Scenic or natural beauty of the area, aesthetics, historic sites or rare and irreplaceable natural areas.
9. Conformance with capability and development plan
10. Conformance with local or regional plan or capital program

Changes to Capability and Development Plan to Address Climate Change

Create a new finding:
(20) GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE
Climate change poses serious risks to human health and safety, functioning ecosystems that support a diversity of species and economic growth, and Vermont's tourist, forestry, and agricultural industries. The primary driver of climate change in Vermont and elsewhere is the increase of atmospheric carbon dioxide from the burning of fossil fuels, which has a warming effect that is amplified because atmospheric water vapor, another greenhouse gas, increases as temperature rises. Vermont should minimize its emission of greenhouse gases and, because the climate is changing, ensure that the design and materials used in development enable projects to withstand an increase in extreme weather events and adapt to other changes in the weather and environment.

Other Changes to Criteria to Address Climate Change

Transportation: bicycle, pedestrian, and other transit infrastructure added

River corridors: Permit program for high priority river corridors

Updates floodways language to current practice

Adds avoid, minimize, mitigate for forest blocks and habitat connectors

New Criteria 9(M)

(9) (M) Climate adaptation. The development or subdivision will employ building orientation, site and landscape design, and building design that are sufficient to enable the improvements to be sited and constructed, including buildings, roads, and other infrastructure, to withstand and adapt to the effects of climate change, including extreme temperature events, wind, and precipitation reasonably projected at the time of application.

Changes to address Greenhouse Gas Emissions

Change Criteria 1 to focus on air only and read:

(1) Air pollution. Will not result in undue air pollution. In making this determination, the District Commission shall at least consider: the air contaminants, greenhouse gas emissions, and noise to be emitted by the development or subdivision, if any; the proximity of the emission source to residences, population centers, and other sensitive receptors; and emission dispersion characteristics at or near the source.

Changes to address GHG Emissions

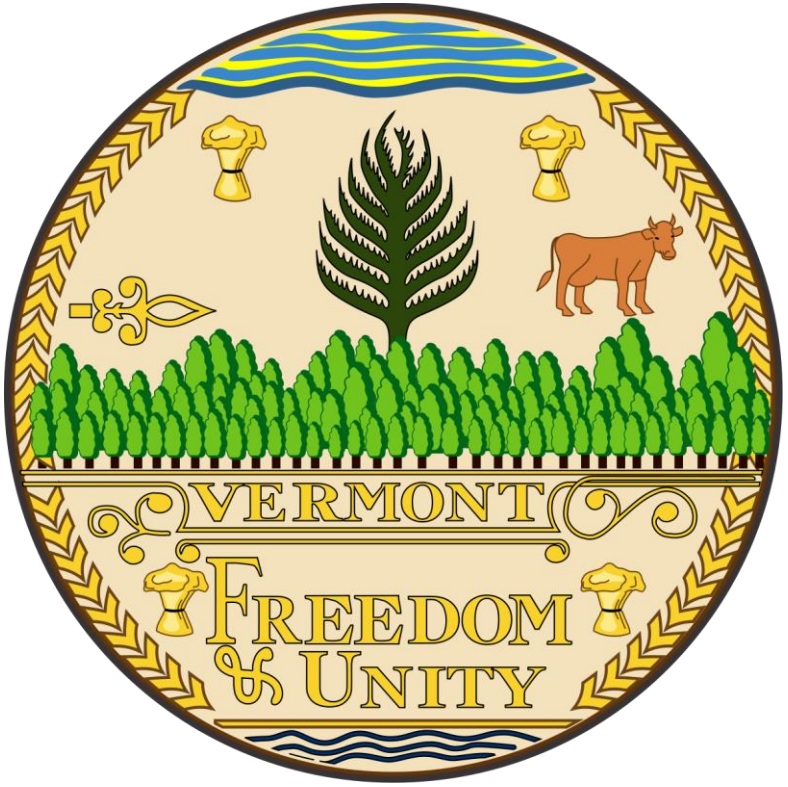
Tried to include: an avoid, minimize mitigate standard for “The construction, use, operation, and maintenance of the development or subdivision.

But came up short on if this was possible…

Are there policy changes to incentivize or regulate that would be effective in reducing total carbon emissions from construction?

- **Is the carbon tax, where it exists, helping reduce embodied carbon?**
- **Extended Producer Responsibility model expanding in other sectors – could it help in construction?**
- **Act 250 – adding climate change to criterion 1 – could we include embodied carbon?**
- **Ideas for incremental steps**

QUESTIONS??



QUESTIONS: