BuildingGreen Top 10 Products

Reducing Our Carbon Impacts

Presented by Brent Ehrlich

What we are going to cover

- How products can help mitigate climate change
- Unveiling of BuildingGreen's Top 10 products for 2021
- For each product:

  Business as usual – why the Top 10 product is needed

  The smarter solution

BuildingGreen's Top 10 Green Building Products for 2021

Business as Usual: Ignoring inefficient, old residential buildings

- Retrofitting old buildings for energy efficiency is difficult and expensive
- Buildings in economically depressed areas are particularly challenging
- Wasted energy
- Uncomfortable tenants

Photo: BlocPower

Top 10 Product: BlocPower Lease Program

Photos: BlocPower

- Installs heat pumps and other energy-efficient equipment with no money down
- 15-year lease program
- Includes regular maintenance
- Proproprietary software analyzes entire process, including leasing, project management, and monitoring of urban clean-energy projects

Top 10 Product: BlocPower Lease Program

- Founded in 2012
- Almost 1,000 buildings
- Customers save 20%–40% on their energy bills annually
- Performance guarantee
- Lowers operating costs (can be passed on to residents)
- Tenants are more comfortable

NYC co-op retrofitted with heat pumps and PV
Photo: BlockPower

Top 10 Product: BlocPower Lease Program

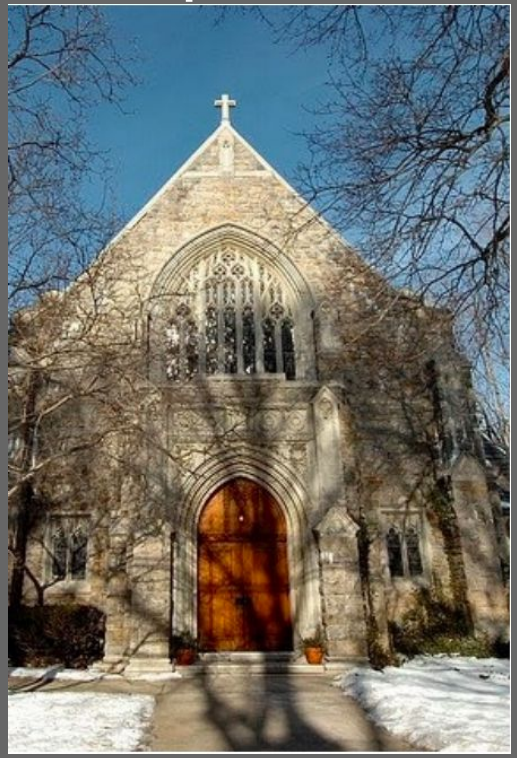


Photo: BlocPower

Replaced fossil fuel-based boiler system with variable refrigerant flow (VRF)

Used to require space heaters and portable heaters and had minimal AC

- Now has AC, adding revenue through weddings and other functions
- $8,500 annual savings
- Zero money down
- 55% utility bill savings
- 70% reduction of GHG emissions

Business as Usual: Lack of viable carbon storage

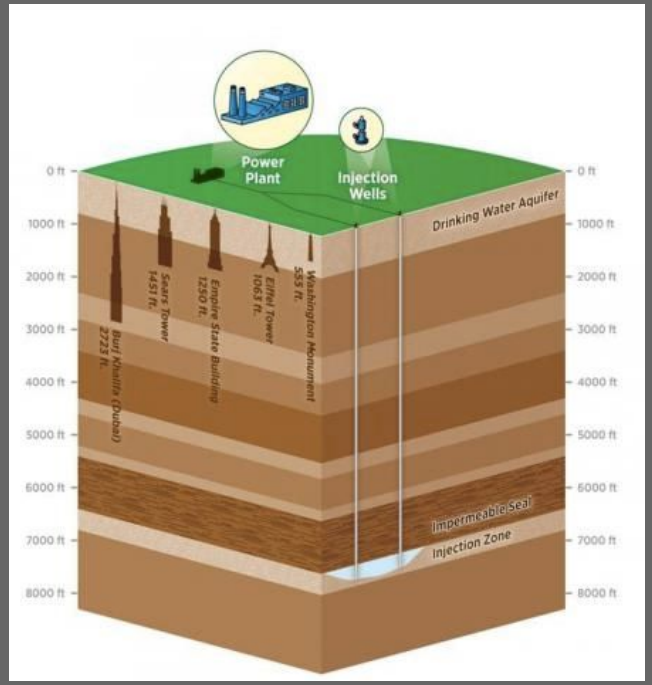


Image: EPA

- Little incentive to reduce carbon emissions at the source
- Geologic carbon capture and storage is expensive
- Currently no viable market for carbon
- Purifying CO_2 for reuse requires resources and equipment

Top 10 Product: Blue Planet Carbon Capture

- Economically viable carbon capture
- Creates synthetic limestone aggregate using CO_2 from flue gases
- Does not require purification of CO_2
- 44% CO_2 as part of final aggregate

Photo: Blue Planet

Top 10 Product: Blue Planet Carbon Capture

Photo: Blue Planet

- Cubic yard concrete
  - 600 lb Portland cement
  - 1400 lb sand
  - 1800 lb course aggregate
- @ 44% CO2 = about 1300 lbs of CO_2 sequestered
- Ton of concrete = ½ ton CO_2 sequestered
- Uses recycled concrete as raw material

Business as Usual: Standard PV panels

SunPower carports: a 2018 Top 10 winner.
Image: SunPower

Nothing wrong with current PV

- Excellent efficiencies >20%
- But panel size is limited by wafer size
- Smaller wafer = less power

Business as Usual: Standard PV panels

"If Solar Panels Are So Clean, Why Do They Produce So Much Toxic Waste?"
Forbes

"Solar Energy Isn't Always as Green as You Think"
IEEE Spectrum

"Use of photovoltaic technology is shown to result in creation of an energy sink."
Energy Policy, Ferroni and Hopkirk

Top 10 Product: Trina Vertex Large Format PV Panels

- Larger wafers = fewer cells per panel = higher watts per panel
- Fewer balance-of system costs (inverters, connections, mounting hardware)
- 550W per panel
- Efficiency 21+%

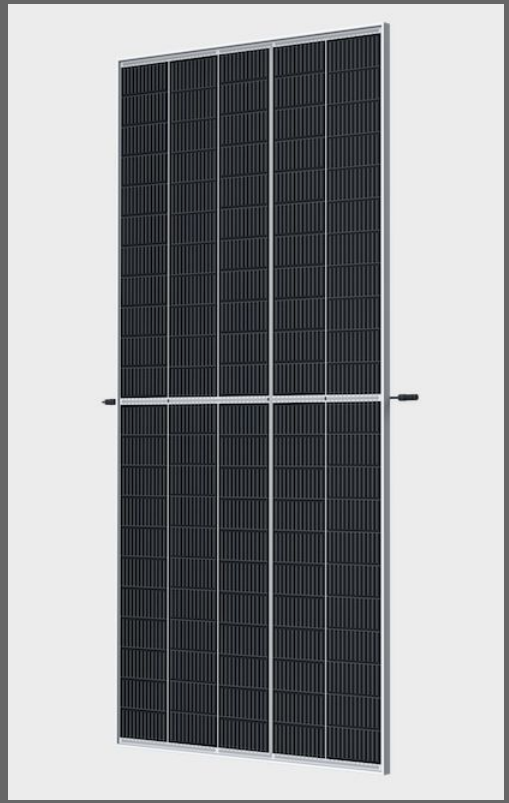
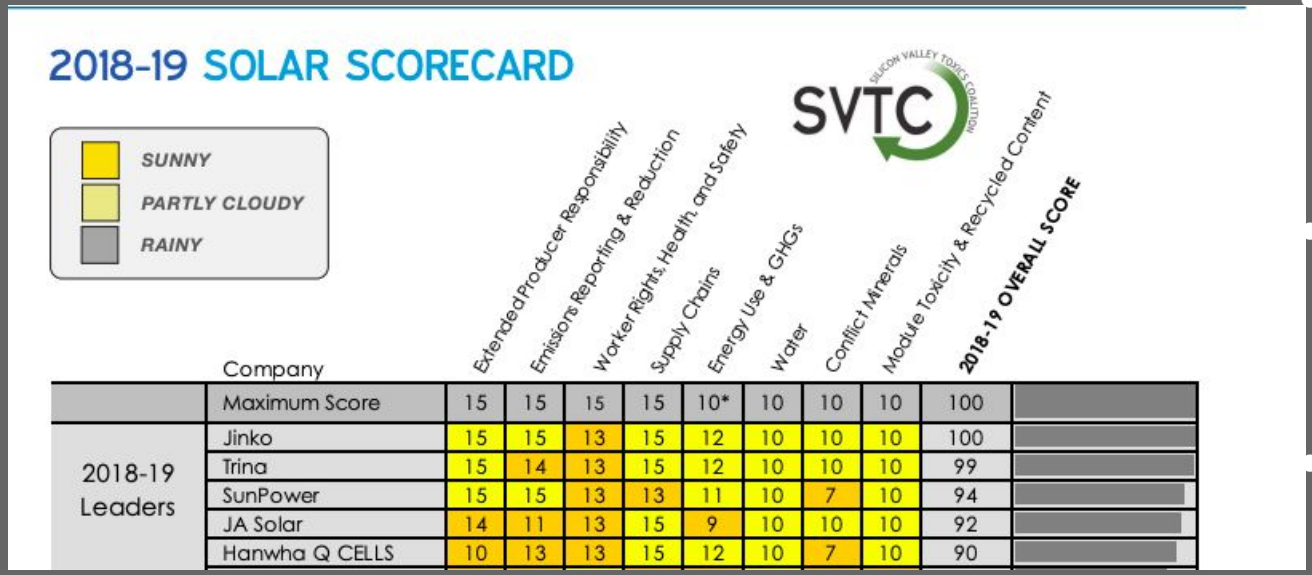


Photo: Trina Solar

Top 10 Product: Trina Vertex Large Format PV Panels



2018-19 SOLAR SCORECARD

SUNNY
PARTLY CLOUDY
RAINY

SVTC
SILICON VALLEY TOXICS COALITION

	Company	Extended Producer Responsibility	Emissions Reporting & Reduction	Worker Rights, Health, and Safety	Supply Chains	Energy Use & GHGs	Water	Conflict Minerals	Module Toxicity & Recycled Content	2018-19 OVERALL SCORE	
	Maximum Score	15	15	15	15	10*	10	10	10	100	
2018-19 Leaders	Jinko	15	15	13	15	12	10	10	10	100	
	Trina	15	14	13	15	12	10	10	10	99	
	SunPower	15	15	13	13	11	10	7	10	94	
	JA Solar	14	11	13	15	9	10	10	10	92	
	Hanwha Q CELLS	10	13	13	15	12	10	7	10	90	

- Trina Solar top ratings for sustainability #1 in 2017 and 2018
- 46%–47% energy and greenhouse gas reductions since 2015
- 32% less water since 2015

Business as Usual: Plug loads that waste energy

- Computers, monitors, printers, and other office equipment continue to consume energy even after the building closes

- Plug and process loads (PPL) can account for >30% of a commercial building's electricity consumption—and even more in high-efficiency buildings

Photo: By SurgeIntern - Own work, CC BY-SA 4.0

Business as Usual: Plug loads that waste energy

Common solutions:

- Employee engagement initiatives (such as plug load reduction contests) usually don't work
- Smart plugs with on/off controls provide limited functionality and energy-consumption data
- Complicated systems wired into building automation allow full granular control of loads, but they are expensive to install and can be difficult to operate and maintain

Top 10 Product: RAB Lighting's Lightcloud Outlet

- 2020 Lightfair Technical Innovation Award winner
- 20-amp (120V) outlet
- Top receptacle integrates into the Lightcloud cloud-based lighting and energy-monitoring control system
- Appliance can then be incorporated into lighting schemes or used to control a building's overall energy consumption, including demand response
- The bottom receptacle is always on and can be used as a standard outlet or for critical equipment that shouldn't be turned off

Photo: RAB Lighting

Top 10 Product: RAB Lighting's Lightcloud Outlet

Photo: RAB Lighting

- Sensors (occupancy, daylighting, etc.), dimmers, controllers, and Lightcloud-enabled fixtures
- Energy consumption for each fixture is monitored and tracked
- Connected to the company's servers through a secure, private 4G cellular connection
- Each device functions as a "repeater"
- Private, encrypted wireless system is separate from the building's other wifi networks and connects via a private connection

Business as Usual: Inefficient commercial kitchen ventilation

- Combustion gases
- HVAC running to vent appliances not in use
- Wastes fan energy
- Wastes energy required to heat/cool makeup air
- Extra heat in kitchen = extra energy for refrigeration/coolers

Photo: Richard Young, Frontier Energy

Business as Usual: Inefficient commercial kitchen ventilation

And it makes kitchens uncomfortable and noisy for employees

Photo: Richard Young, Frontier Energy

Top 10 Product: Halton M.A.R.V.E.L Demand-Controlled Kitchen Ventilation

Photo: Halton

- Detects status of cooking equipment
- Adjusts exhaust flow rate accordingly
- Exhaust hoods are controlled independently from one another
- Variable pressures and flow rates maximize efficiency and guarantee a balanced air flow in the kitchen
- Can be reprogrammed as cooking equipment changes

Top 10 Product: Halton M.A.R.V.E.L Demand-Controlled Kitchen Ventilation

- IR on cooking surface and temperature sensors in ducts and kitchen
- Damper and system controls
- Airflow/pressure sensors
- Variable frequency drive adjusts the exhaust fan speed

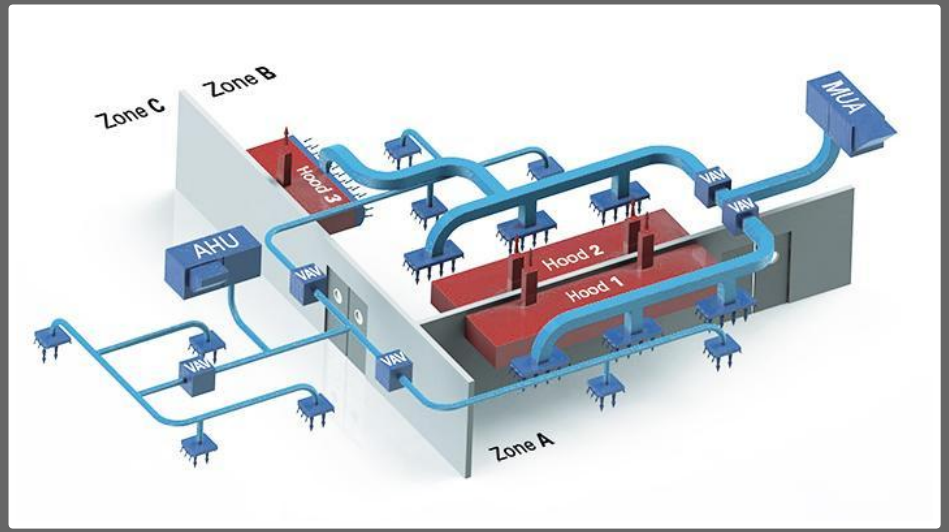


Photo: Halton

Business as Usual: Poor LED efficacy and light quality

- Many standard LEDs are still 80 CRI
- Blue light requires phosphors to create "warmer" color temperatures
- Phosphors limit LED efficacy

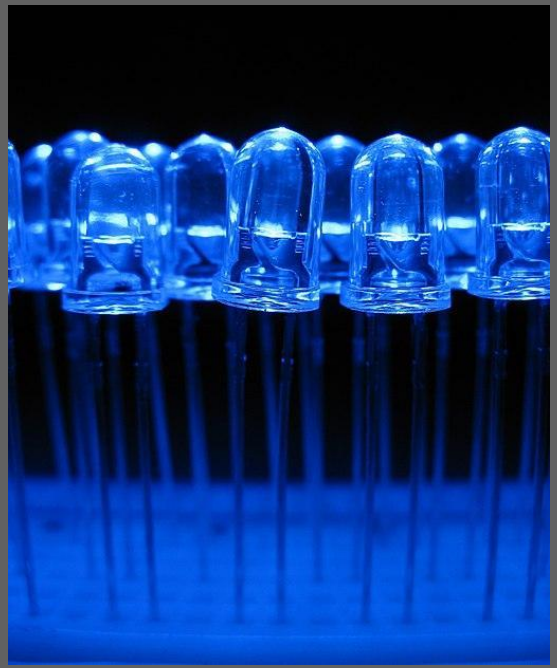


Photo: By Gussisaurio CC BY-SA 3.0, from Wikimedia Commons

Top 10 Product: Osram Quantum Dot LEDs

Photo: Osram

- OSCONIQ S 3030
- Excellent color quality of 90 at 173 lm/w and 3000k
- Does not rely on phosphors for colors
- Edison Award winner

Top 10 Product: Osram Quantum Dot LEDs

- QD nanoparticles emit light of a specific wavelength if blue LED pump light is applied to them
- Color depends on the size of the Quantum Dots
- 2 nm = blue light, 7 = red
- Area and downlight applications

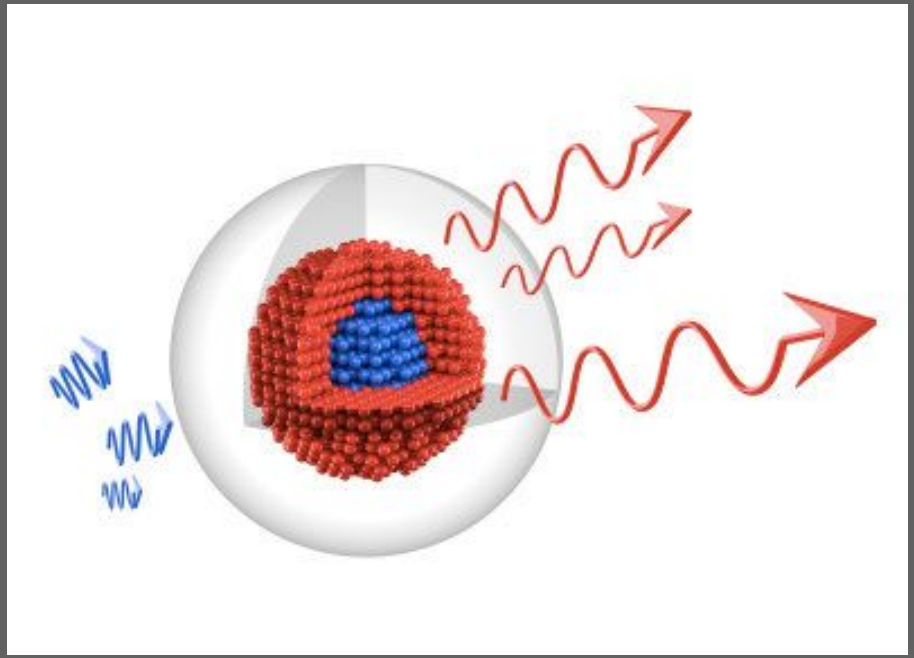


Photo: Osram

Business as Usual: Replacing aging furniture with new

Photo: Davies Office Inc.

- Functional, well made furniture gets dated and “ugly”
- Tenants refresh offices with new furniture at a significant carbon cost
- Over time furniture replacement can be responsible for more embodied carbon than the building structure

Top 10 Product: Davies Office Furniture

- Remanufactures old office furniture into “like new”—or better—condition
- Old product is stripped down to its core
- Remanufactured to needs of the end user

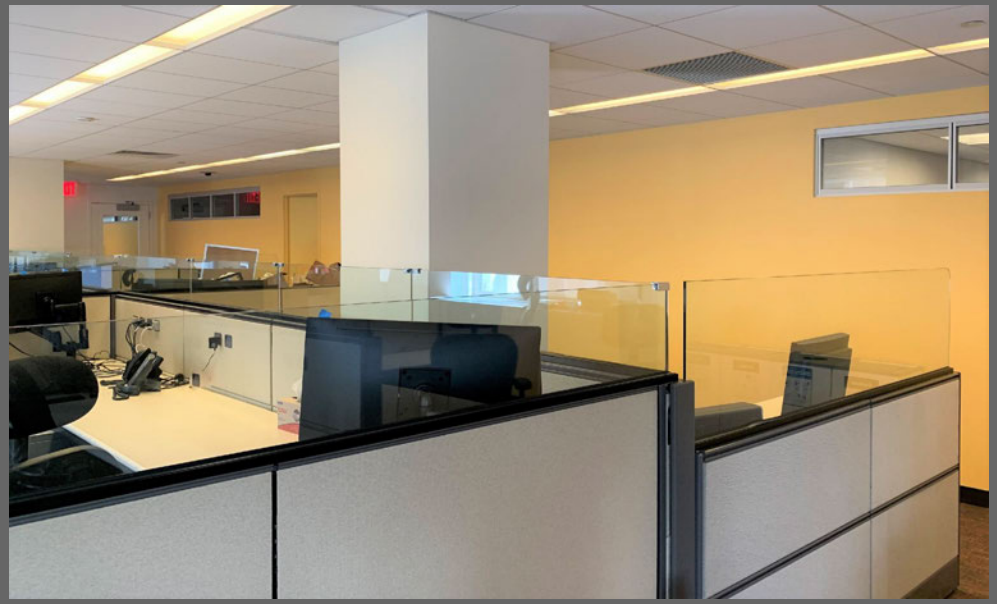
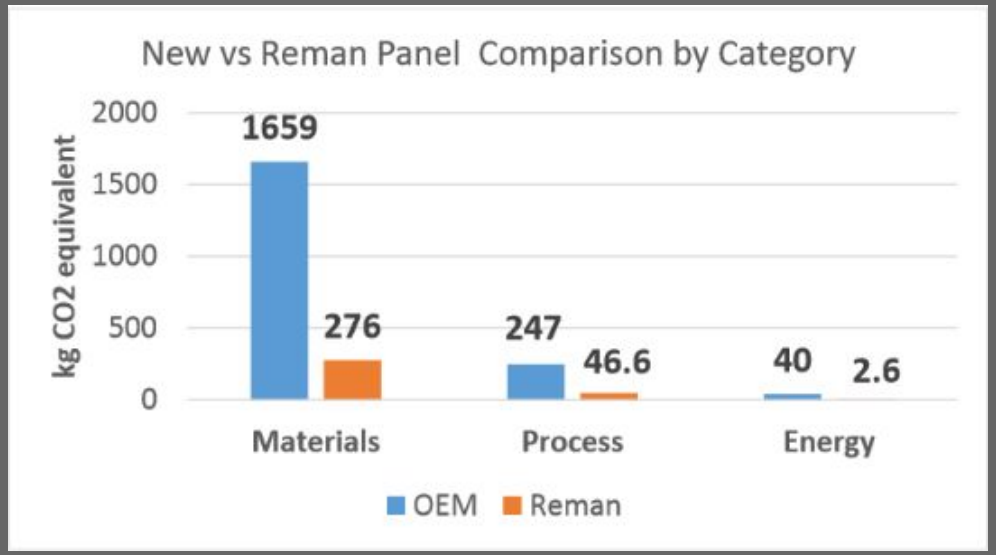


Photo: Davies Office Inc.

Top 10 Product: Davies Office Furniture



- $ savings of 40%–60% over new
- One year of office panel remanufacturing =

  8.5 million pounds fewer virgin materials

  Avoids the release of more than 6.9 million pounds of CO_2

Photo: Davies Office Inc.

Top 10 Product: Davies Office Furniture

- Products from
  - Herman Miller
  - Steelcase
  - Haworth
  - Knoll
- Cubicles, desks, chairs, other casework
- BIFMA level certified

Photo: Davies Office Inc.

Business as Usual: Carpet with large carbon footprint

- Commercial carpet is typically made from petrochemicals
- Their carbon footprints can be up to 21 kilograms of CO_2e per square meter
- Carpet is frequently replaced and rarely recycled, adding to the overall carbon footprint

Photo: CalRecycle

Top 10 Product: Interface Carpet Tiles with CQuestBio and CQuestBioX Backings

- The first carbon-negative carpets
- Use post-consumer-recycled face fibers
- Biobased, recycled, natural, and other carbon-mitigating materials in the backing
- Low-embodied-energy manufacturing processes
- Step toward making all its backings carbon negative

Photo: Interface

Top 10 Product: Interface Carpet Tiles with CQuestBio and CQuestBioX Backings

TRACI v2.1	A1-A3
GWP [kg CO2 eq]	-3.69E-01

→

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
EPD Type	X			X	X	MND	MND	MND	MND	MND	X	MND	X	MND	X	X	X

4.1. Life Cycle Impact Assessment Results

Table 7. North American Impact Assessment Results

TRACI v2.1	A1-A3	A4	A5	B2	C2	C4
GWP [kg CO2 eq]	-3.69E-01	1.23E-01	1.10E-01	3.91E-01	4.89E-03	3.17E-01
ODP [kg CFC-11 eq]	3.83E-07	3.07E-17	7.01E-09	1.25E-09	1.22E-18	-2.10E-08
AP [kg SO_2 eq]	2.52E-02	6.74E-04	7.27E-04	8.17E-04	2.68E-05	-5.38E-04
EP [kg N eq]	5.70E-03	5.02E-05	1.34E-04	2.78E-04	2.00E-06	2.54E-04
SFP [kg O_3 eq]	4.04E-01	1.50E-02	1.08E-02	1.35E-02	5.97E-04	1.83E-03
ADP_{fossil} [MJ, LHV]	1.20E+01	2.39E-01	6.59E-01	3.05E-01	9.54E-03	2.38E-01

Top 10 Product: Interface Carpet Tiles with CQuestBio and CQuestBioX Backings

- Carpet tile with 20 oz of yarn on standard recycled backing = 4.4 kg of CO_2 per square meter
- Carpet tile with 12 oz of yarn CQuestBioX backing –0.3 kg of CO_2 per square meter
- Competitively priced

Photo: Interface

Business as Usual: Lack of useful carbon data

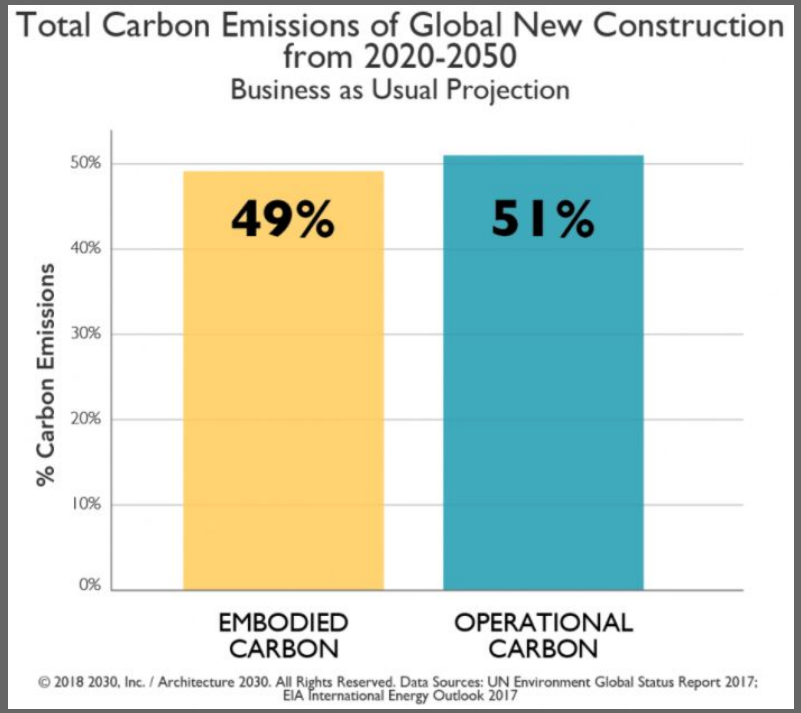


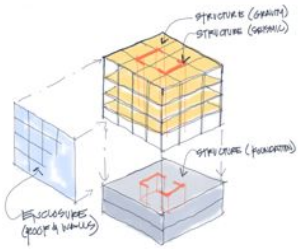
Image: Architecture 2030

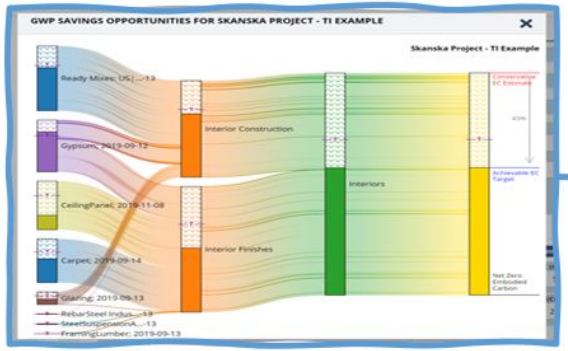
- Over time, the embodied carbon of products nearly equals operational energy
- How can we reduce the carbon footprint of our buildings if we don't know the carbon footprint of products?
- EPDs contain embodied carbon info but are not useful on their own

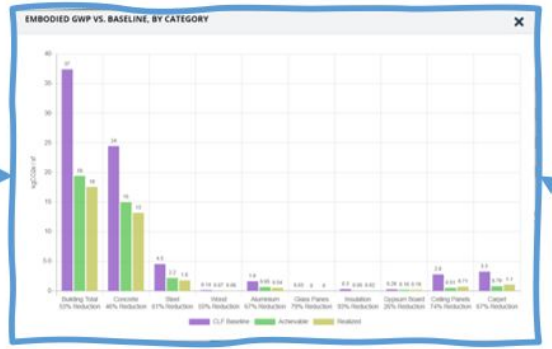
Top 10 Product: Embodied Carbon in Construction Calculator (EC3)

- Launched 2019
- Now run by the non-profit Building Transparency
- More than 40,000 (and growing) digital third-party EPDs
- Free, open-source platform
- Building professionals can directly measure, compare, and reduce their building's embodied carbon
- Concrete, steel, wood, glass, aluminum, insulation, gypsum, carpet, and ceiling tiles

Images: Building Transparency





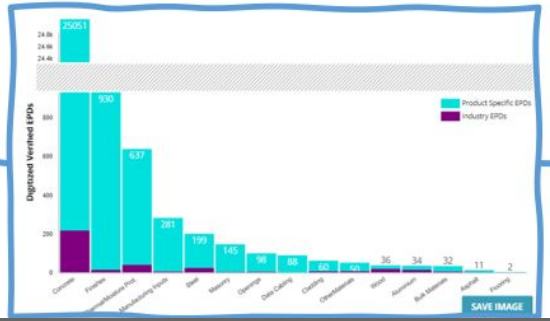


Material Quantities (from Construction Estimates/BIM 360/Tally

Stages A1-A3 Embodied Carbon Emissions data

Building Upfront Estimate and Realized Embodied Carbon

Digital EPD Database for Comparing Product Embodied Carbon



EC3

Image: Building Transparency

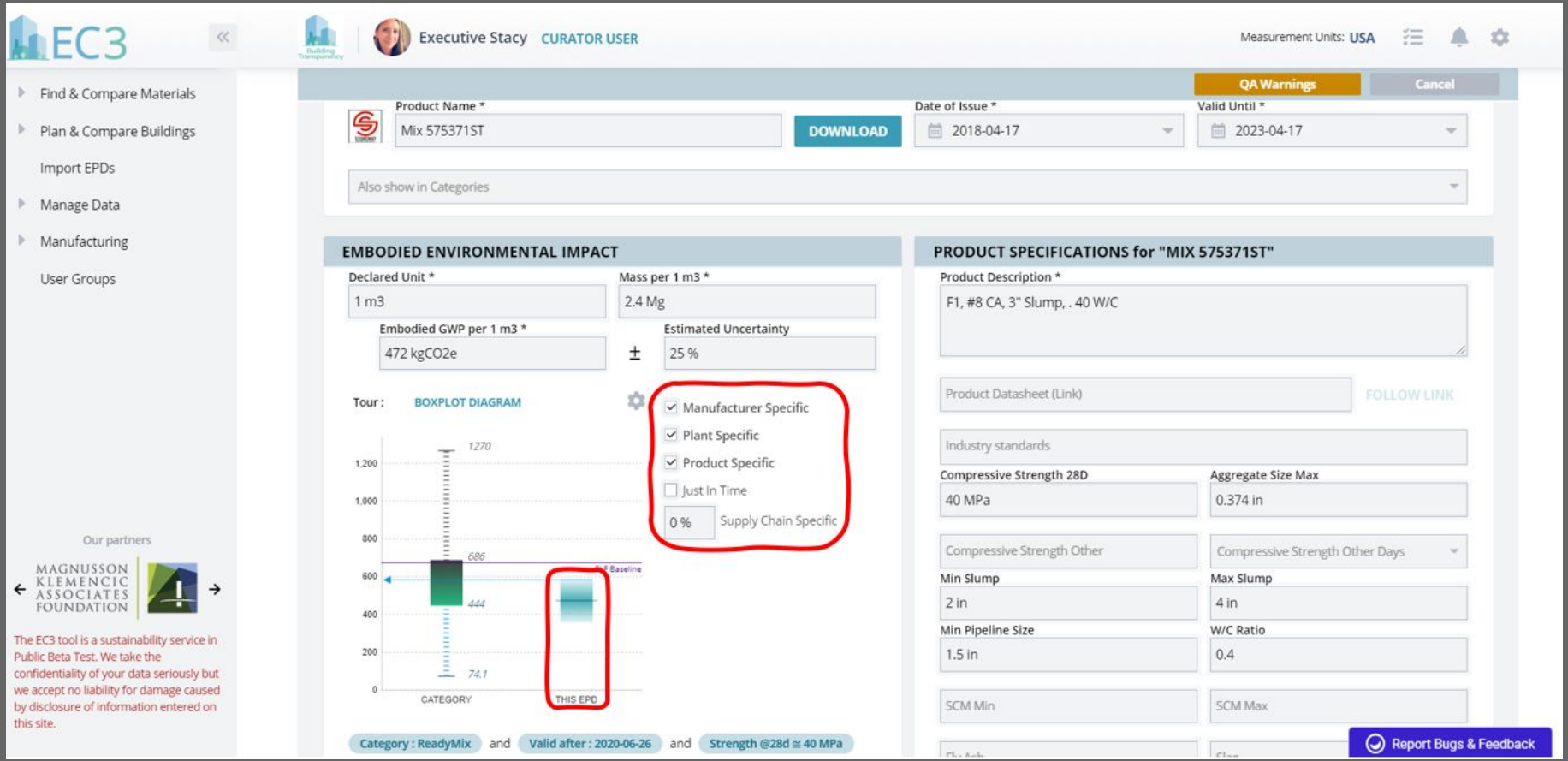
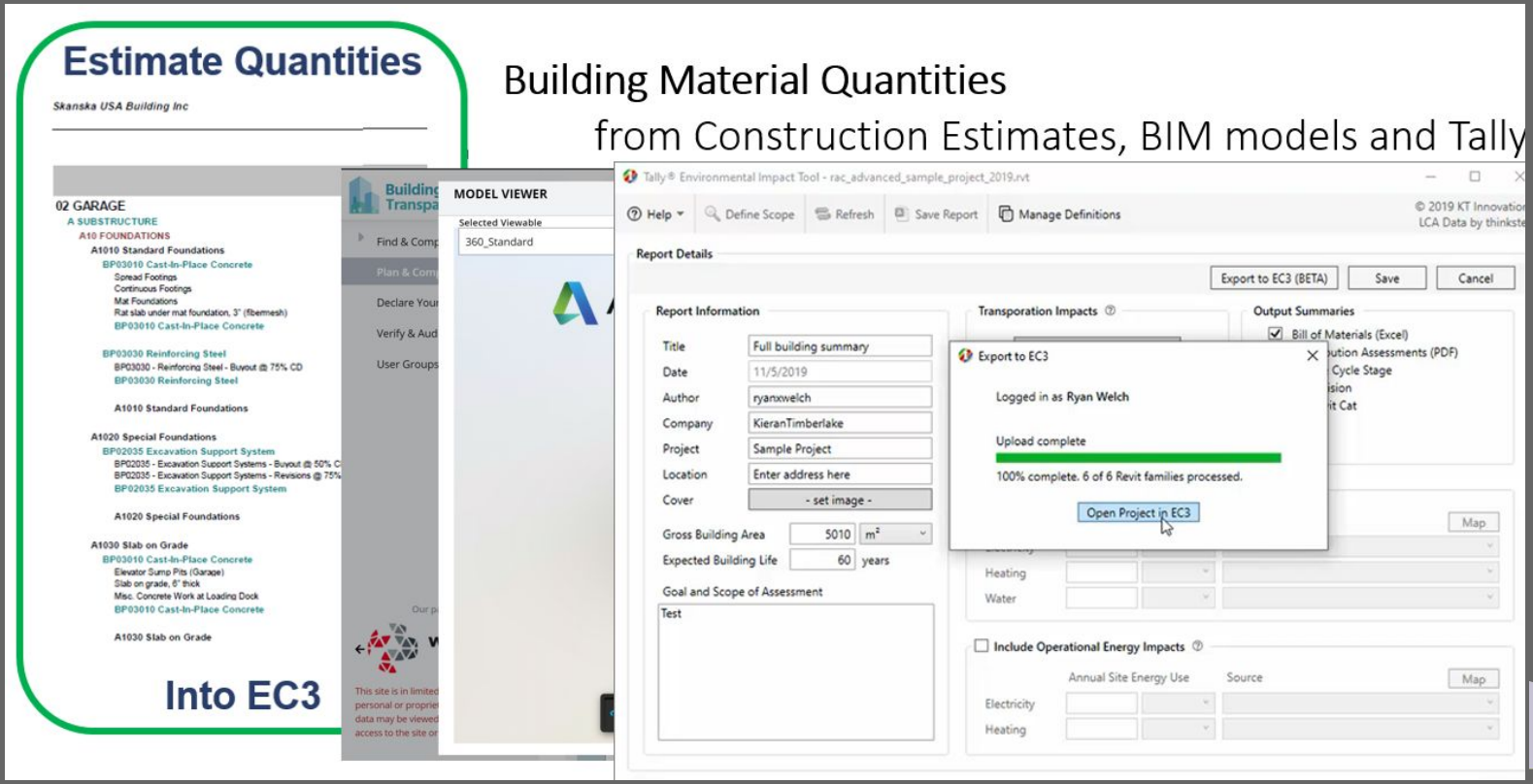


Image: Building Transparency

Top 10 Product: Embodied Carbon in Construction Calculator (EC3)



Building Material Quantities

from Construction Estimates, BIM models and Tally

Business as Usual: What do we do with old electric vehicle batteries?

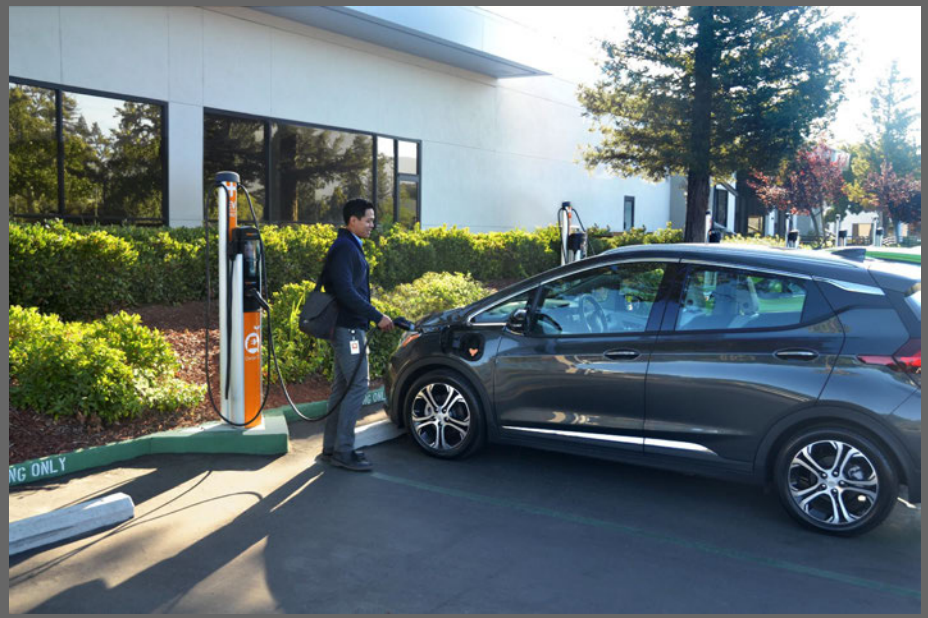


Photo: Chargepoint

- Disposal…no
- Recycling for minerals…not cost effective
- BUT still viable for energy storage post-EV
- >70% of battery capacity left

Reusing EV batteries is not easy

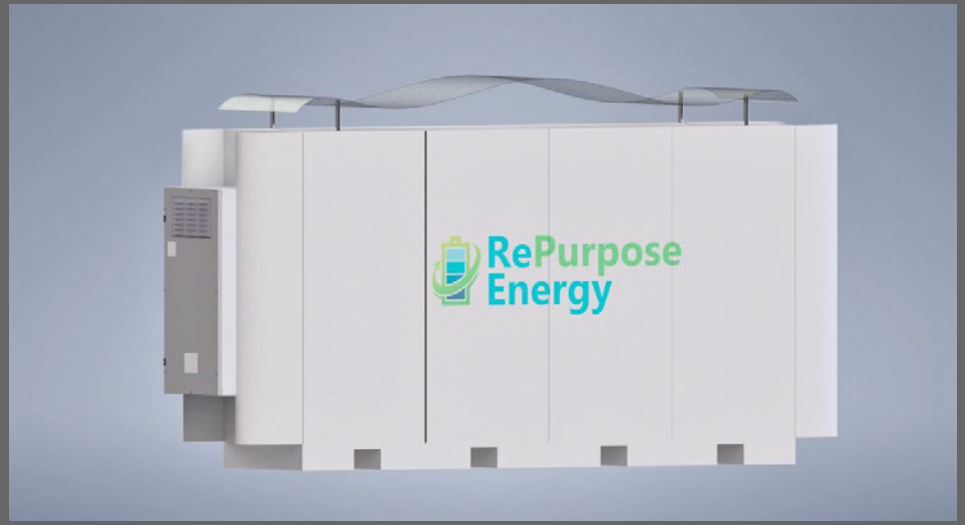
- Custom made for each manufacturer/EV
- Lack of standardization (size, chemistry, format)

Top 10 Product:
RePurpose Energy Battery PODs

- Modular battery storage for commercial and industrial applications
- EV battery packs with Battery Management System (BMS) are called SEEDs (Sustainably Engineered Energy Devices)
- POD (Power On Demand) houses SEEDs
- Each POD also includes inverter, HVAC, fire suppression, racking, etc.

Photo: RePurpose Energy

Top 10 Product:
RePurpose Energy Battery PODs



- Each SEED is ~10 kWh
- POD is ~150 kWh
- For applications >500 kWh, the PODs are housed in a larger container

RePurpose Energy

Top 10 Product:
RePurpose Energy Battery Packs

- Battery assessment, modeling, life span
- Battery management system to maximize performance. CANbus or RS485
- Energy management system: battery integration/optimization use with renewable-energy demand response

Photo: RePurpose Energy

Top 10 Product:
RePurpose Energy Battery Packs

RePurpose Battery System at
Robert Mondavi Institute
Photo: RePurpose Energy

BuildingGreen

- Founded in 1985
- In Brattleboro, Vermont
- Launched EBN in 1992
- 15 employees
- Supported by online memberships and consulting
- Not supported by product manufacturers

BuildingGreen offices in the old Estey Organ Factory, Brattleboro

Questions?