AUTODESK UNIVERSITY

[BamCore Showcases its Carbon Impacts via Autodesk Ecosystem]

[Luc Wing]
[Microdesk Symetri]

[Hazem Kahla]
[BamCore]

Learning Objectives

- Learn about required data for energy and carbon performance calculation.
- Learn about the necessary metrics for product selection to achieve low carbon design.
- Learn how to create Revit families that can facilitate product-specific energy and carbon performance.
- Learn about evaluating product-specific energy performance using Revit and Insight workflow for early design feedback.

Description

Microdesk Co-Innovation Lab collaborated with BamCore through the Autodesk Foundation to show the value and benefits of their products to industry clients. Using the Autodesk-provided design analysis ecosystem, we showcase the energy and carbon advantages that BamCore's products can bring to the design. The developed custom workflow allows BamCore to rapidly obtain comparative energy and carbon impacts and present them to their clients without future support. We've also set up the groundwork and created a phased journey to navigate the Future of Work, aiming to include an interactive user interface dashboard for rapid ROI analysis. We compare BamCore technology versus typical constructions to ensure Microdesk and BamCore co-create meaningful and inspirational future impacts toward resilient and low-carbon buildings.

Speaker(s)

Luc is a Solutions Specialist at Microdesk, focusing on sustainable analysis platforms and workflows. Over the past five years since obtaining his Autodesk Building Performance Analysis (BPA) Certification, he has made it his mission to promote integration of sustainable mindsets and solutions as part of the BIM process and throughout the life cycle of a project. Luc has worked with a wide range of architectural, engineering, and construction management clients on Revit modeling, construction documentation, training, and energy analysis. He has provided support for firms participating in the Architecture 2030 initiative, has conducted whole building analysis including heat gain, cooling loads, daylighting, solar, and wind, and is a regular presenter at Autodesk University. As part of the Co-innovation Lab with a sustainability focus at Microdesk, Luc develops workflows and documentation for our team, while helping our clients make informed design decisions that lead to better building performance. Luc is skilled in a host of software including Revit, Navisworks, Insight, and Bluebeam, is a Revit Certified Professional and is a certified Building Performance Analyst.

Hazem Kahla
Having studied Architectural Engineering and with a love of automation and BIM, like a sponge... I readily and quickly absorb technology.
Resourceful and primarily working on my own Initiative, I am however able to integrate effectively with any management team.

Section Heading

Who is Bamcore

At BamCore we are using biogenic fibers and industrialized construction to deliver efficient decarbonization of the built environment. Each house we build helps the climate cleanup as for the building material, the construction system, time, and labor that's why we can say "it is the best way to build".

Today we have 3 messages to talk about
1- How we use the computer design to construct our projects in a very efficient way
2- The benefit of using sustainable materials in construction
3- The tool we developed with Microdesk to calculate the carbon impact at an early stage of the construction

At BamCore we are using bamboo as the main building material, our houses are built from bamboo. The panels are fabricated in our plant using specially developed computer driven machinery and cutting-edge CAD-CAM workflows and processes.
This brings the benefits of automation to the construction cycle, to reduce the need for hard-to-find skilled labor on the job site.
The panels have any needed instructions printed directly on the surfaces, including sequential numbering, color coded nail patterns and locations for MEP elements that will need to be installed in the wall cavities. The panels are then easily assembled on site into the prefabricated wall packages that were created to the specifications of our customer's design teams
The house will be quickly assembled as Lego, even the nails' locations are printed on the top of the panel surface. Our Job Site Application, built on the Autodesk Forge Platform, and with the help from the Microdesk support team, brings the benefits of BIM straight into the field. The app includes all the necessary data from the BIM model for the contractor, even a 3D step-by-step animation of the panel installation sequence.

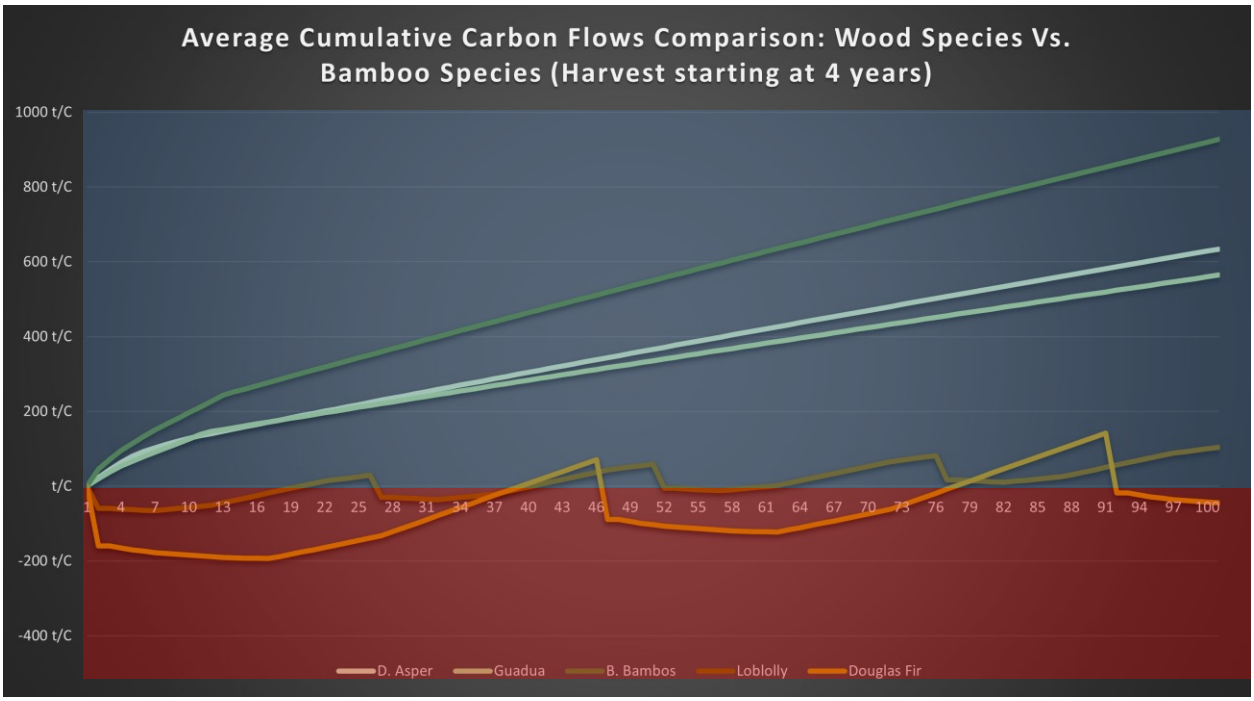
At BamCore, we are working on a sustainable solution that removes the Barriers to adoption

- A recent analysis with the town house customer showed they are saving around 5000$ per unit for construction, it's also way more than that for the long run when the operating cost get considered
- As for the time It's cut in half, or even more based on comparison on what's replaced in the conventional construction processes, we implemented the computer design to the fabrication stage, so everything is coordinated, and the building is easy to be assembled
- As for the labor, there is no special training required, no special equipment is required, labor requirements are significantly reduced, there is visual instructions printed on the panels that aids the installation for different trades

Why Bamboo

Bamboo is one the fastest growing plant on earth, it could grow more than 1 foot per day, it also could be harvested every year without killing the plant, not like the wood we get from trees. It's much stronger than traditional wall systems especially for resisting impacts. At BamCore we are eliminating 80 – 90 % of the framing, which also eliminates the thermal bridging that framing

creates in the wall, which means more continues space in the cavity for insulation and Our panels assembly have a better acoustic insulation compared to the conventional wood framing walls. Bamboo sequesters carbon and is much more sustainable than traditional wood harvesting practices.
We did a study of different wood and bamboo species to see the amount of carbon absorbed during the life cycle of the plant, we checked (Douglas Fir, loblolly, B. Bamboo, Guadua, and D. Asper), the results varied as the following graph



The graphs show the results of the study on one hector of the forest,
here we are showing the results of a forest of Douglas fir
We started presuming that we have a mature forest ready to be harvested, when the forest gets harvested the plant get killed and there is what we call a carbon emission event which is about 150 metric tons of carbon emitted in the air
Then we plant the forest again and wait about 45 years for the trees to become mature again and ready for getting harvested, during that time the trees will sequestrate about 200 metric tons of carbon, but most of that will get wasted when we harvest the forest again due to the carbon emission event

As a climate cleanup act we have sequestered less than 200 metric tons of carbon at any time during the life cycle of the forest. When bamboo get harvested it doesn't kill the plant so the plant will continue to grow and to sequestrate carbon. This is why we call bamboo the "carbon sequestration engine"!!

Obtaining Carbon Credits

Taking our point of time and looking ahead, the important thing is that we remove CO2 from the atmosphere, we have just shown with that study and that graphs that Bamboo is doing it way

faster and way more effectively than wood, so, any carbon credit comes from our use of bamboo in building materials should be valued higher than the carbon credit coming from the use of wood
When we say Carbon Credit we mean the reward we get from the carbon credit organizations, these organizations gets the fund from the companies who exceeds the limit of CO2 emissions, it's necessary for these companies to buy carbon credit for the extra amount of CO2 released from the companies who are pulling it out from the atmosphere. So, we are fighting to be recognized for additional credits to showcase the benefits of Bamboo. Currently Bamboo and traditional systems are credited the same, which we have shown not to be the case.

HELP NEEDED

- Needed Clear way to communicate the Value of Bamboo walls
- Needed way to quantify & visualize impacts of BamCore Systems vs traditional systems
    - For Energy Impact\ Operating Carbon
    - For Material Impact\ Embodied Carbon
- Engage with Clients in a digestible single platform

Microdesk to support

First, we conducted a Discovery workshop
During this time, we worked with Bamcore to review and decipher all their content libraries and templates to understand how they worked and delivered projects
Thankfully, we did because the OOTB workflow just would have cut it for a unique engagement like this. However, after this we were able to develop a simple process
A Set of simple workflows to achieve your end goal we felt this would enable BamCore to adopt these processes with a higher success rate limiting hiccups and knowledge loss
We developed strategies and support guides (or how to manuals if you will) for each of the steps you see here on how to repeat this process ensuring consistency and accuracy.
Eventually helping them help clients achieve net zero aspirations.
We decided to approach this implementation strategically and in bite sizes.

first task to tackle, Was energy modeling. When I first met with bam core via the Autodesk foundation, I was originally brought in to discuss Insight. Insight is a fantastic tool for energy modeling.
1 because its free and available to anyone with Revit
2nd because it fast and accurate

You don't need much input if any to have accurate results due to the algorithms running insight calculations. It runs through the same energy simulation engine of energy Plus and is compliant with DOE 2.2. For all these reasons. I quickly was able to see value with insight and how it could support bam core and showcasing to their clients the value for the operational carbon AKA energy savings by choosing bam core products. Through the Co innovation lab, we always start with an in-depth discovery session and in this session, we understood that it wouldn't be as easy to showcase this value with the way the tool currently was understood implemented and showcased

so, there was some key areas and issues we had to address in order to make this process robust enough to showcase the true impact.

the first hurdle was the model condition as you can see the model that BamCore typically receives are very early in the design process and typically leave a lot to the imagination or may not capture all that is needed to be captured for proper analysis. This cause BamCore a lot of time trying to re model and clean up make the energy model. Only to simplify to analytical surfaces anyway. We proposed a process and documented it in a workflow guideline so no matter what condition the model was received in BamCore had a fast and efficient way to get an accurate EUI

When using insight, we typically suggest your schematic overrides and select our values that correlate with the R values you intend to hit during construction
as you know the systems usually do not align to what you are proposing to build and that throws people off even if the value is the same

BamCore high performing walls confronted us with some very different challenges

Let look at what made this more complex than simply matching schematic R values (CA)

BamCore offers walls @:
- 5 ½”
- 7 ¼”
- 9 ¼ “
- 11 ¼ “widths

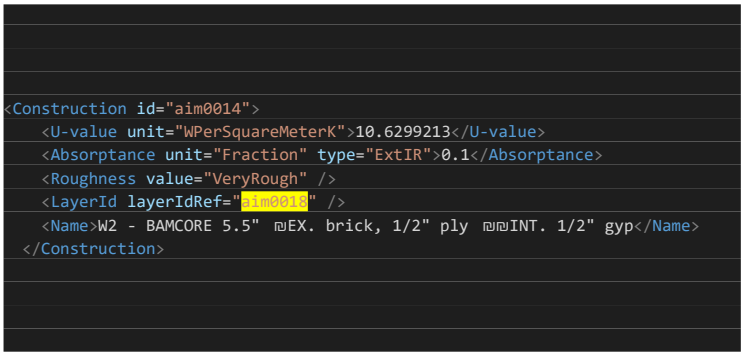
All can have 2 insulation types
fiberglass insulation or cellulose insulation (10)

They part that made this tricky was each of those came with 4 different options for framing factors.
- 9.78
- 6.65
- 5.16
- and an outstanding 3.28%

With the traditional Insight workflow this would have sunk our hope right here…

Going through the schematic type overrides would no long work considering the complexity of BamCore systems. Simply there isn’t an assembly like it.

Knowing That when you utilize detailed elements your constructions are converted to GBxml we could utilize this information if we could locate where the data was coming from that supports the energy settings database.



File Location: C:/Program Files/Autodesk/Revit Year/en-US

After adding our assemblies to the Constructions file, you are now able to select specific wall types with tested and validated data

Once we were able to get the custom assemblies into Insight, we needed to study all the iterations. Insight allowed us to make and study multiple iterations of our model
Helping us showcase the impacts of the different wall types into the energy modeling platform. Then we were able to set a scenario in insight to ensure we were comparing apples to apples for all the models. They only difference being the wall types.

This information is displayed in insight but as you know sending an insight link to a client may not be the best way to communicate it.

Some export all this data and images and make deliverable and explain the story which is the route I have usually taken with most owners

This is only because it's easier to lay out the facts and narrate the story of value and impact to the project.

However, BamCore wanted again needed to take it to another level and also showcase embodied carbon. So took the next step to begin to understand how we could now tackle Carbon. Again, the needs here were very similar. We needed a way to showcase embodied Carbon In a clear and digestible manor.

First, we Took all wall types BamCore offers and typically sees specified on projects like the IBC standard R-13 & California title 24 R-20 assembly
And we benchmarked the assemblies for Embodied Carbon @100 SQ ft
The Co-Innovation Lab has coined this process

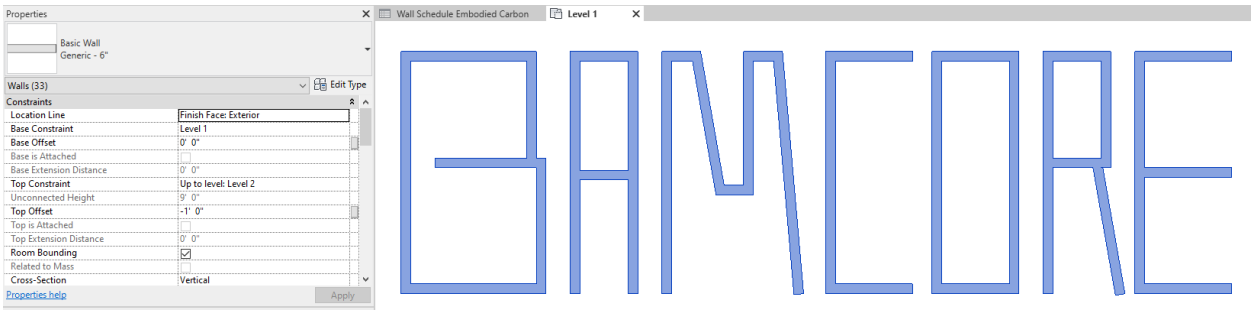
P A C I
Predicted Assembly Carbon Index

Wall Name	Embodied Carbon Value /100 SF in tC02
BC FG 5.5” -3.28%	.135 tC02
BC FG 7.25” -3.28%	.200 tC02
BC FG 9.25” -3.28%	.226 tC02
BC FG 11.25” -3.28%	.252 tC02
BC IBC R-13	.409 tC02
BC CA Title 24 R-20	.481 tC02

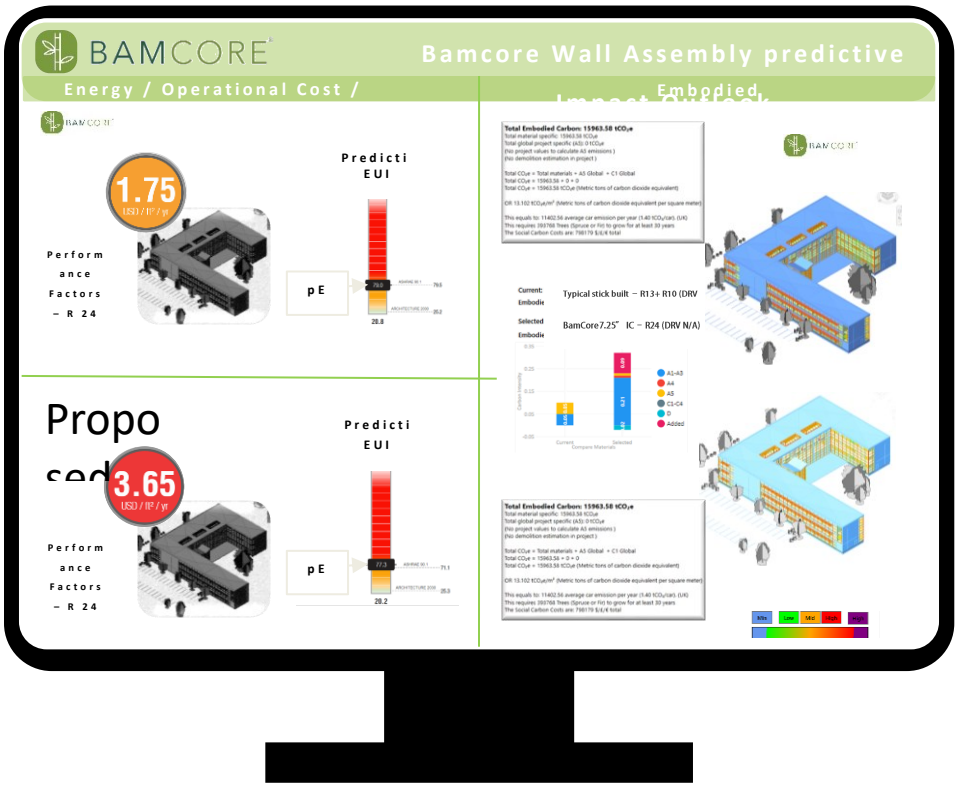
Using this index, we were able to write carbon calculations embedded these number into schedulable parameters. This allows BamCore to Rapidly understand carbon impacts for all assemblies live as you model. Using this simple formula from our pACI has enabled us to view the predicted carbon of a project even if using a generic wall type. So as one models, we can see what my embodied carbon would be if I were using any of the BamCore walls or the typical stick construction assemblies. As you model and develop the building you can check on the different impact of various wall systems

<Wall Schedule Embodied Carbon>

A	B	C	D	E	F	G	H
Family and Type	Area	BC FG 5.5 EC (tC02)	BC FG 7.25 EC (tC02)	BC FG 9.25 (tC02)	BC FG 11.25 (tC02)	BC IBC R13	BC CA T24 R20
Basic Wall: Generic - 6"							
Basic Wall: Generic - 6"	113 SF	0.151875	0.225	0.25425	0.2835	0.460125	0.541125
Basic Wall: Generic - 6"	113 SF	0.151875	0.225	0.25425	0.2835	0.460125	0.541125
Basic Wall: Generic - 6"	108 SF	0.1458	0.216	0.24408	0.27216	0.44172	0.51948
Basic Wall: Generic - 6"	113 SF	0.151875	0.225	0.25425	0.2835	0.460125	0.541125
Basic Wall: Generic - 6"	109 SF	0.146888	0.217612	0.245902	0.274192	0.445018	0.523358
Basic Wall: Generic - 6"	108 SF	0.1458	0.216	0.24408	0.27216	0.44172	0.51948
Basic Wall: Generic - 6"	108 SF	0.1458	0.216	0.24408	0.27216	0.44172	0.51948
Basic Wall: Generic - 6"	104 SF	0.139725	0.207	0.23391	0.26082	0.423315	0.497835
Basic Wall: Generic - 6"	113 SF	0.151875	0.225	0.25425	0.2835	0.460125	0.541125
Basic Wall: Generic - 6"	108 SF	0.1458	0.216	0.24408	0.27216	0.44172	0.51948
Grand total: 10	1094 SF	1.477313	2.188612	2.473132	2.757652	4.475713	5.263613



Now let's take a quick look on how we put this all together. When we were with BamCore to envision what this could look like this was the concept sketch. We wanted to show the benefits that insight analysis provided side by side with the carbon impacts of the project for BamCore proposed assemblies vs. the proposed traditional stick construction. This allows owner to visualize the project and the impacts these crucial decisions can make.



Impact Summary

- When we talk about sustainable housing, we find most of the research on how to power the building using green energy, but little will think about the building envelop and the building material.
- A recent study showed that the thermal difference between traditional framing house and BamCore panels house over the life cycle of 70 years of 2000sf house reduces more than 200 metric tons of carbon emissions, which is equivalent to the emissions of driving 500,000 miles, this is beside the savings on the operating cost and the benefit of better building envelop
- What we wanted by developing these tools with Microdesk is to show that our carbon benefit from bamboo is way better than wood and that should be taken into consideration when carbon credit is calculated

- Increasingly society are asking organizations to take responsibility for their social, environmental, and economic impacts but we can only bring this change when we work together.

- Which the 'Co' in our name is ingrained in our DNA. We collaborate externally, and this opportunity with Bamcore has been amazing. It has been encouraging to see the amount and degree of innovation in collaboration that has emerged in response to the challenge BamCore brought forward. This is just the beginning of our journey together to bring impact to their clients, but also collectively sharing our knowledge leaders now recognize the importance of not just connections, but deeper collaboration with others to drive progress on common objectives. So, it great to partner with Autodesk Foundation and Bamcore as we drive innovation for a positive change we look forward to the future impact as we challenge in the industry to make change!