Building a future school

A strategy on how to create a learning environment for children based on Doughnut Economics

Introduction

How do we build shelter and space in a world where a planetary metacrisis hoovers over every single decision we take? Report after report on the construction industry is clearly stating how we, the human race, have lived off finite planetary resources in a way that has now created such imbalances that it threatens not only our own lives, but all other living organisms. For more than 50 years this has been common knowledge among politicians and government officials, yet we've still not managed to steer our methods and solutions towards a new way of being and living within our planetary boundaries.

We strongly argue we have a broken relationship to nature and life. This is clearly visible in many societal structures, e.g how we buy food, how we look at natural resources, how we value other living things, how we value other humans, how we collaborate and how we build cities. In Scandinavia the way we live in cities is often extremely disconnected from nature and a modern person today might never set foot in a forest. If we are to try to survive our metacrisis, we need to better understand how this broken relationship can be rebuilt. And the best way to do this might be to dive straight into what was one of the main reasons for us all ending up here, the troubling economic system we have created for ourselves.

In 2015, economist Kate Raworth did exactly that. By looking at planetary boundaries and work done by Stockholm Resilience Centre, she developed an economic model that is enormously simple but with a brutally honest message. Compared to previous models, the Doughnut Economics model gives the reader an instant visual idea of how we need to behave and live together if we want the planet and all living things to thrive.

The model can be seen as a compass to guide us and consists of two concentric rings, one showing a social foundation of human wellbeing and the other one being our ecological ceiling of planetary boundaries. In between these two rings is the safe and just space where humanity and life can thrive. This means to change society's goal from profit and monetary growth to trans-forming economic systems to be centred around wellbeing.

What the Doughnut model also clearly demonstrates is how different countries in the world have different economic challenges. Sweden has a massive overshoot of our planetary boundaries whereas other countries such as Bangladesh live under circumstances where they need to "use" more of our shared resources to secure safe living standards for their citizens.
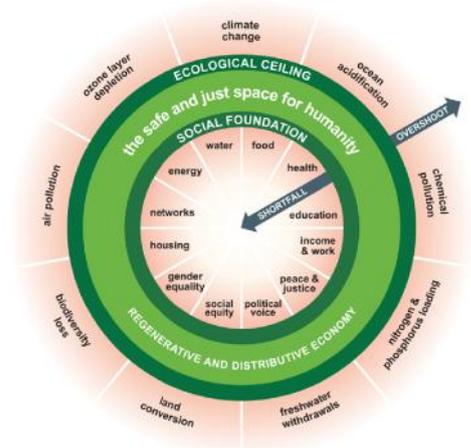

Figure 02 The Doughnut of social and planetary boundaries. (Source: Raworth, 2022)

Since the model was shared by Raworth it has gained massive attention and has been tested on various systems, products, companies and organisations. To work with the Doughnut Economics for the built environment can clearly be an interesting method where local perspectives in relation to planetary boundaries are taken into account. But it's similarly a tool to use on social possibilities by strengthening communities through non-material processes, methods and mindsets.

The main focus of this report has been to create a strategy to support the small municipality of Tomelilla in Southern Sweden in planning the development of a new school and its surrounding area. Despite their small size and scale, Tomelilla has become famous for being brave, honest and interested in leading innovation for a better future. The procurement included the project management of a needs inventory and a proposal for

a master plan, which must have a clear focus on a holistic sustainability perspective, to be based on the principles of Doughnut Economics. The masterplan should answer such questions as:

- How can the new school and its surrounding area contribute to Tomelilla becoming a thriving place for thriving people, while simultaneously respecting the well-being of the whole planet and of people elsewhere?

- What does it mean to design a school fit for a 21st-century curriculum--one which is designed, constructed, and operated within planetary boundaries, and which delivers positive social benefits for all?

- How can we "imagine and build together a sustainable and inclusive future that is beautiful for our eyes, minds, and souls"?

- What does it mean to create an educational and recreational environment in a beautiful area–a school that sets a precedent in Sweden and internationally around the question of what it means to work towards a safe and just world for future generations?

What we realised when we worked with this report is how enormously entangled the world truly is. We knew that working with the economy, built futures and school environments would send us off in new unknown directions, but we never fully realised the extreme complexity of what this would entail. Over the course of a few months of research, deep dives into data on carbon emissions, architectural futures and our metacrisis, we ended up with more questions than answers.

What does human learning within the limits of the planetary boundaries look like? Are current educational curriculums in correct relation to the survival of our planet? What skills for the future do children need to develop? How does a school affect the surrounding society? Is a school a learning place for all ages? How important is the future in relation to today? Are schools important for fostering democratic values? How do we build a school of only recycled materials, when there are no material banks to deliver these materials?

We've tried to follow ongoing discussions on our built futures and to make sense of them all in a larger perspective. By gathering information from the International Union of Architects , resources from the European Parliament, Boverket, existing knowledge on the Doughnut Economics, philosophy on foresight and research on the vast amount of (and continuously growing) carbon emission measurement tools, we created a mapping of themes that seemed relevant for further explorations.

The research, methods and conclusion that you are now reading is our attempt in trying to merge and communicate some of our collective understanding of an enormously complex field. We feel the need to communicate that this is not a solution, just a spark of imagination towards something different. We believe that there are no simple answers on how to build when we can't or shouldn't, on how to look at geographical areas and climate from different perspectives, and how we might need more time for the general public within construction to emotionally understand where we are heading. But most importantly of all, we see our work on a new way to relate to the built environment as a collaborative and transparent process and would love for this brief text to merge with other reports, research and work to collectively deepen our understanding and knowledge.

Chapters

An attempt to understanding existing knowledge on the built environment and Doughnut Economics

The built environment is responsible for about 40% of annual global CO2 emissions. To accommodate the largest wave of building and infrastructure growth in human history, from 2020 to 2060, the world is expected to double its building stock and add about 230 billion m2 of new floor area. That is the equivalent of adding an entire New York City to the world, every month, for 40 years. Additionally, three-quarters of the infrastructure that will exist in 2050 has yet to be built. All of this needs to happen while there is a goal of net zero emissions by 2050, the numbers are undoubtedly aggressive and the stakes are high. Will lower carbon emissions per square meters change our overall carbon footprint if there is an expected vast increase in new built housing? Will the overall carbon emissions still be higher than what we see today?

In Sweden, Boverket proposes that limit values for climate emissions from buildings should be introduced in 2027 for the construction industry and then be lowered in two phases, until 2035 and 2043.

Similarly, according to Byggutsläppslistan, an initiative by Architects Climate Action Network Sweden, what we need to do to fully reduce carbon emissions within the building sector is to;
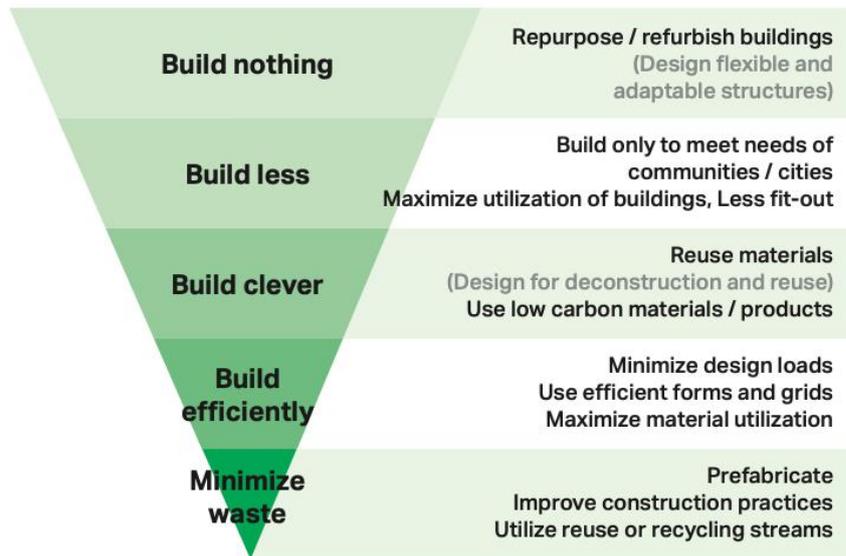
1. Build less, only what we really need.
2. Use both new and existing buildings as efficiently as possible.
3. Make construction processes more low-emission, with circular flows and the right material in the right place.
4. Stop demolishing the buildings that already exist. This saves both emissions and resources in the form of building materials.
5. Make buildings energy efficient and use fossil-free energy for heating and cooling.
6. Make sure that the new houses we build are of high quality so that they can be maintained, used for a long time, and meet the challenges and needs of the future.

Some argue we need better ways to understand the whole life carbon cycles (life cycles assessment) and their impact on each building we decide to construct. However, to understand, locate and compare different measurements and calculation tools (GHG Protocol, Environmental Product Declarations, Product Environmental Footprint (PEF) and Organization Environmental Footprint (OEF) etc) is a tremendous challenge. It's hard to make sure of all the details on production of a material in other countries and how they for example might have an impact on a social setting with a spillover effect on carbon emissions (an employee working long hours for a sustainable material company and therefore can't take care of their ageing mum who needs to buy a car to drive herself to hospital). With those complex systems thinking perspectives, are we sure that by only measuring more, we will be able to reduce carbon emissions? The lack of data and numbers is an important gap to fill, but to see them as the final solution is slightly misleading.
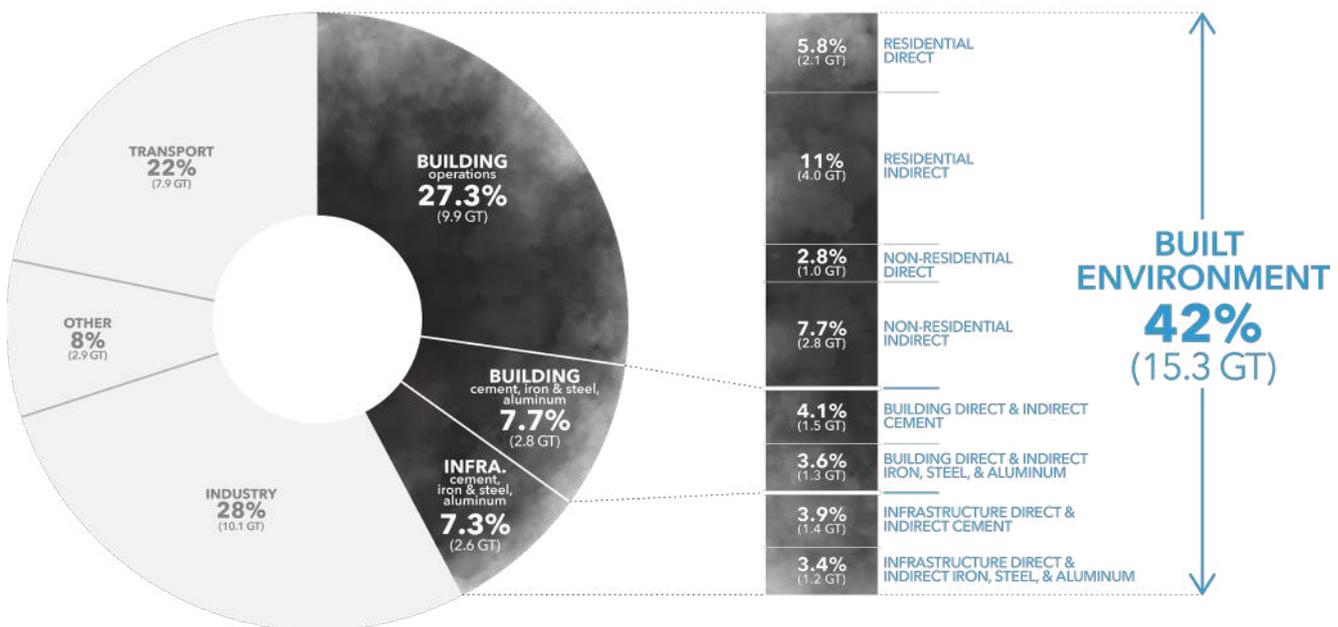
Analysis & Aggregataion by Architecture 2030
Total annual global CO2 emissions, direct and indirect energy and process emissions.

Figure 9: Embodied carbon reduction strategy

Build nothing	Repurpose / refurbish buildings (Design flexible and adaptable structures)
Build less	Build only to meet needs of communities / cities Maximize utilization of buildings, Less fit-out
Build clever	Reuse materials (Design for deconstruction and reuse) Use low carbon materials / products
Build efficiently	Minimize design loads Use efficient forms and grids Maximize material utilization
Minimize waste	Prefabricate Improve construction practices Utilize reuse or recycling streams

https://www.wbcsd.org/Programs/Cities-and-Mobility/Sustainable-Cities/Transforming-the-Built-Environment/Decarbonization/Resources/Net-zero-buildings-Where-do-we-stand

Many forecasting systems thinkers are now starting to wonder and question the construction industry as a whole, can we keep building at all? By looking at the already built environment and urban landscape with an updated lens we might be able to relocate, reuse, share and transform cities in a much larger scale than first anticipated. Rather than focusing on materials and measuring carbon emissions, we might need to focus on how to map empty space and efficient use of space in cities.

The Doughnut Economics might be a tool to further explore this question since it goes beyond the rational data and incorporates a broader view of human prosperity. Over the last few years there has been testbeds and research on how the Doughnut Economics might be implemented into the built environment to better understand if there are tools and solutions that could arise to further improve the industry's work towards net zero emissions.

Doughnut Economics Action Lab (DEAL) was created by Kate Raworth to establish a platform with learnings and adaptation of the model. It has become part of the emerging global movement of new economic thinking and they work across three levels of transformational change; reframing economic narratives, influencing strategic policy and innovating with the DEAL Community. Over the years they have covered a few projects on the model and the construction industry. We will showcase a few of them, but also some other projects touching on the same topic.

Natural Building Lab Constructive Design & Climate Adaptive Architecture located in Berlin, operates as part of a transdisciplinary network focused on projects that generate knowledge and physical prototypes for a post-fossil fuel society. Emphasising the urgent need to address planetary boundaries, they advocate for climate- and resource-responsive architecture aligned with circular prin-

ciples. Bridging academic and non-academic spheres, the lab creates practical solutions in real-world settings to catalyse change in building practices. Their approach is rooted in holistic objectives centred on the collective good, employing a transdisciplinary methodology that engages diverse disciplines, trades, and civil society. Their projects, situated at the intersection of education, research, and application, are driven by these principles. https://www.nbl.berlin/

The Doughnut Economic Approach in Architecture is a tool designed by graduating students at the faculty of Architecture and the Built Environment at Delft University of Technology to guide and design interventions, and support the architectural practices towards a design and implementation approach related to Doughnut Economics.

The text outlines a plan to extend and refine a framework aimed at guiding architectural practices in adopting Doughnut Economics principles. This extension involves qualitative and quantitative testing across various stages of real projects, as well as interdisciplinary research and education efforts. The ultimate goal is to increase the number of architectural firms successfully integrating Doughnut Economics into the built environment nationally.

Home Earth is a Danish real estate company founded in 2021 and committed to doing things differently. They believe we can develop cities in balance with the interest of people, planet and profit. Together with an international team of cross-disciplinary experts from Aalborg University - BUILD, Danish Technical University, Doughnut Economics Action Lab, Green Building Council - Denmark, EFFEKT, SLA, Sweco, Stockholm Resilience Centre and Vandkunsten they have written the book "Doughnut for Urban Development: A Manual". The book aims to support the application of Dough-

AREA ANALYSIS FRAMEWORK

CULTURAL & ECONOMIC VALUE
- Supporting a localized economy
- Encouraging diverse economy
- Supporting long term societal wealth
- Contributing to local culture
- Responding to local preferences

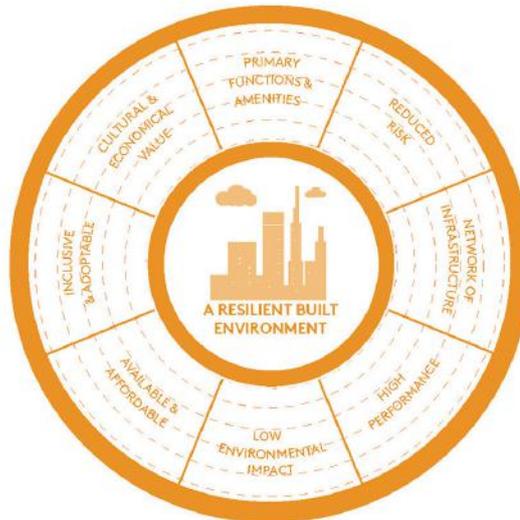**PRIMARY FUNCTIONS AND AMENITIES**
- Providing adequate shelter
- Having access to energy supply
- Having access to safe drinking water
- Having access to food supply
- Provide safeguards for human health

REDUCED RISK
- Promoting risk awareness
- Promoting risk preparedness
- Providing secure structures
- Adhering to safe planning
- Enabling immediate recovery

NETWORK OF INFRASTRUCTURE
- Encouraging strong community cohesion
- Providing resilient network of institutions
- Having a resilient supply of resources
- Providing distributed network of communications
- Having a resilient energy network

(Central diagram: A RESILIENT BUILT ENVIRONMENT — segments: PRIMARY FUNCTIONS & AMENITIES, REDUCED RISK, NETWORK OF INFRASTRUCTURE, HIGH PERFORMANCE, LOW ENVIRONMENTAL IMPACT, AVAILABLE & AFFORDABLE, INCLUSIVE & ADOPTABLE, CULTURAL & ECONOMICAL VALUE)

INCLUSIVE AND ADOPTABLE
- Integrating with local norms
- Allowing for flexibility
- Setting an example
- Ensuring understanding
- Enabling equal opportunities

AVAILABLE AND AFFORDABLE
- Utilising localised resources
- Utilising localised labour
- Utilise localised knowledge
- Being economically affordable to a widespread public
- Ensuring sustained supply & affordability

LOW ENVIRONMENTAL IMPACT
- Using renewable resources
- Optimising circular life-cycle of resources
- Producing minimal emissions and waste
- Optimising durability
- Using renewable energy sources

HIGH PERFORMANCE
- Minimising energy demand
- Encouraging awareness of energy usage
- Applying passive design principles
- Applying responsive design principles
- Optimising energy source to use

The AREA Framework has been designed by graduating students Charlotte Uiterwaal, Isabella van der Griend, Ryan McGaffney and Karolina Bäckman (Faculty of Architecture and the Built Environment, TU Delft), under the supervision of Henri van Bennekom.

nut principles in urban development and covers topics such as exploring the social foundation, discussing the Ecological Ceiling for Urban Development and offering guidance on setting measurable, evidence-based targets for scaling urban development within planetary boundaries to achieve regenerative outcomes.

Bioconnections framework for ecological and social boundaries under a regenerative and circular approach for the built environment is a research article by Henrique Sala Benites and Paul Osmond (2021) which argue that many of the current approaches to making cities greener or more sustainable are still linear and insufficient to deal with our growing global challenges.

They believe that learning from nature may be the most important step to-wards improving cities in the context of environmental and climate issues. In such a context, embracing regenerative and circular perspectives for the built environment might encourage a more comprehensive approach to development, focusing on what is beneficial rather than merely mitigating what is harmful.

In this article, they propose that biconnectivity or bioconnections—a nature-focused approach based on biophilic design, biomimetic, and ecosystem services—may be an important enabler for the regeneration of the ecological and social boundaries of the planetary boundaries and doughnut economics models. In addition, the authors presented a framework summarising relevant bioconnections for each social and ecological boundary (Figure 1) in their article.

Urban development in Grønlikaia, Oslo is a novel 200,000m2 fjord district in Oslo that has explored Doughnut Economics with a diverse array of experts including biologists, sociologists, environmental psychologists, architects, oceanographers, artists, energy scientists, and residents.
Employing the four lenses of the Doughnut, they have meticulously analysed opportunities, gaps and solutions for the future neighbourhood. Through this process, they have crafted a 'recipe' for incorporating the Doughnut framework into urban development, which they are now disseminating further.

In 2015, governments agreed through the Paris agreement to the goal of limiting global heating to 1.5°C above pre-industrial levels, but current pledges to reduce emissions fall far

short of what is needed. To stay within this guardrail, every person on Earth would need to emit an average of just 2.3 tonnes of CO2 per year by 2030. The average carbon footprint per person and year in Sweden is 10 tonnes, which is significantly higher than the global average. The severity and scale of change that humans need to take is so profound that we're still not moving towards reducing Co2 emissions and instead keep seeing a global increase.

To keep the heating below 1.5°C as decided in 2015 is unfortunately not a possibility anymore, we're starting to touch on those temperatures already. To use models such as the Doughnut Economics is a great tool since it visualises words. What it says is that we need to stay within a circle, that you can see, and that is connected to the calculated data on carbon emissions in relation to planetary boundaries. However, the data keeps changing as the planet gets warmer. Some countries that are below the planetary boundary limits need to possibly emit a little

bit more carbon than for example Sweden, how do we measure those transfers? And finally, how do we measure unmeasurable social needs that are deeply entangled with wellbeing and our metacrisis?

We chose to be deeply inspired by previous work on the Doughnut Economics model and the built environment, however, we still felt they were better tools of inspiration rather than something we could actually apply on our specific site and community. Some of them had a theoretical and global perspective, some were very specific for the built environment but missed emotions, global democracy and social life, others were brave but lacked a way to add measurable data. The best way for us was to choose parts from all of them but also to create our own method of how to work with Doughnut Economics for this new school in Tomelilla. This is where four outlining themes became a way for us to map a systemic approach and try to get closer to both the possible, and the unattainable, solutions.
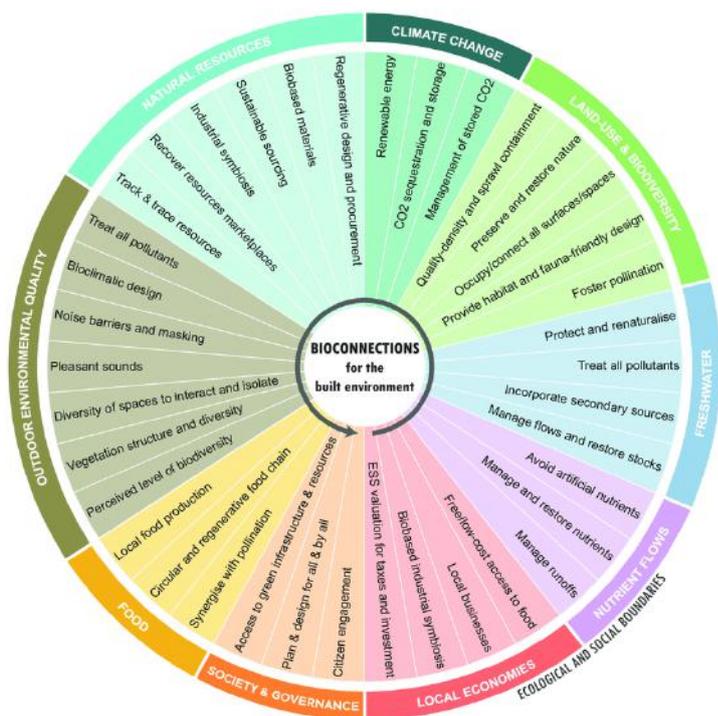
Bioconnections as Enablers of Regenerative Circularity for the Built Environment. Sala Benites, Henrique & Osmond, Paul. (2021).
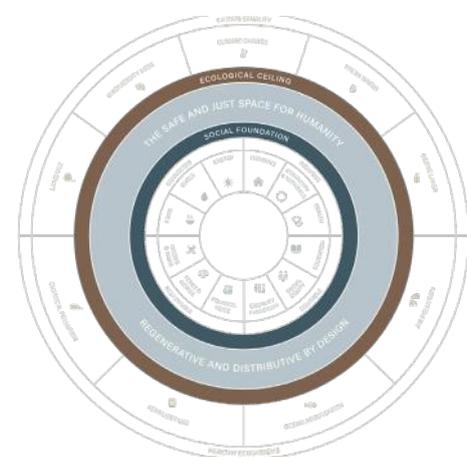
Home Earth Doughnut Tool

Doughnut Economics proposes an economic mindset that's fit for our times. It's not a set of policies and institutions, but rather a way of thinking to bring about the regenerative and distributive dynamics that this century calls for. Drawing on insights from diverse schools of economic thought - including ecological, feminist, institutional, behavioural and complexity economics - it sets out seven ways to think like a 21st century economist in order to transform economies, local to global.

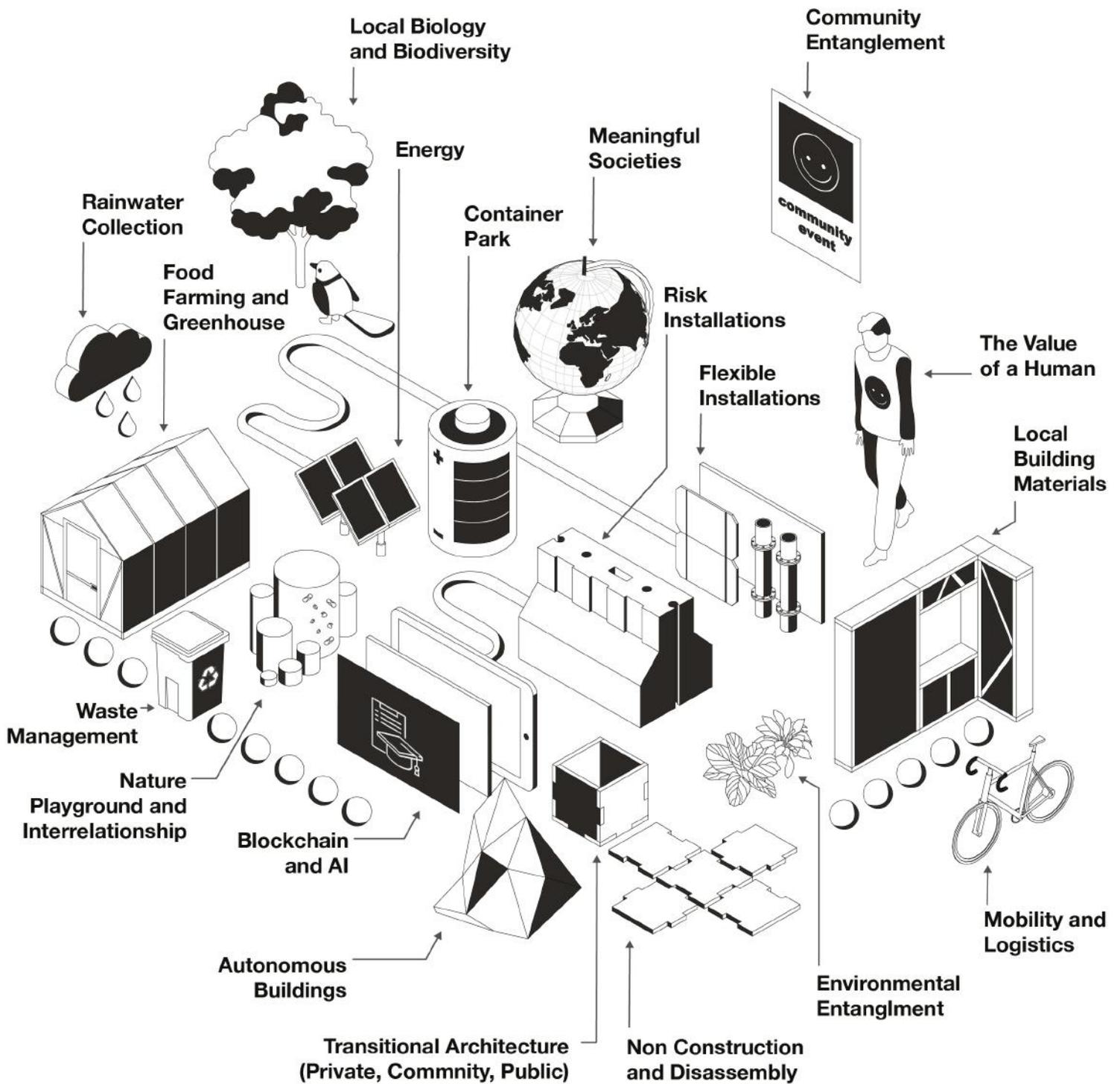# dough nut

The approach of four outlining pillars

1. Environmental regeneration
2. Architectural design
3. Technical innovation
4. Community care

Through research, workshops and meetings with experts in different fields we ended up building the strategy for the school in Tomelilla based on four different pillars; **Environmental regeneration, Architectural Design, Technical Innovation and Community Care.** For each pillar we've defined underlying themes and together they encompass all that we view as important when rethinking how to make a school building or learning environment fit for a different future. Throughout all of these themes, we have perpetually worked with 8 strategic principles. They were important for our work when interweaving regenerative architecture and economic thinking that goes beyond current monetary-focused systems.

For each theme we have added a brief description and a few points that we felt were important to add to the program for the school. But there are also a few extra questions that we couldn't answer within this first phase of the project and that we carefully send towards someone who can explore topics more in detail further down the line.

Strategic principles when designing:

1. Disrupt global incentives of monetary profit.

2. Use no new finite natural resources.

3. Expand our thinking from profit to generosity by philosophy, existentialism, emotional knowledge, morals and ethics.

4. Acknowledge that Scandinavian countries have a lot to learn from other parts of the world where "low-tek" is commonly used.

5. Decentralise economic systems and create local richness with active collaborative communities.

6. See stewardship as common knowledge of ownership.

7. Explore what it means to be human in a new era.

8. Understand that housing and shelter is a human right, but that offices or other spaces might not be. How do we make sense of space?

Local Biology
and Biodiversity

Community
Entanglement

Energy

Meaningful
Societies

Rainwater
Collection

Container
Park

Food
Farming and
Greenhouse

Risk
Installations

The Value
of a Human

Flexible
Installations

Local
Building
Materials

Waste
Management

Nature
Playground and
Interrelationship

Blockchain
and AI

Autonomous
Buildings

Mobility and
Logistics

Environmental
Entanglment

Transitional Architecture
(Private, Commnity, Public)

Non Construction
and Disassembly

Regeneration is the action of restoring the planet beyond just minimising its damage. This implies proposing solutions and changes in our relationship with the environment, for which we seek to assist in the recovery of degraded, damaged or destroyed ecosystems.

environmental regeneration

Environmental regeneration

Local Biodiversity

Every single proposal from humans to add something to a natural ecosystem should first take into consideration which systems existing biodiversity is living by and how any type of added human objects will interfere and possibly disturb this balance. For the construction industry this might have considerable consequences depending on the scale, type of construction and long term perspectives. In standard ways of planning and building we don't spend much attention at all to fully understand these ecosystems, how they impact our lives and what the outcomes might be for future generations if we remove or destroy them. To create built environments that fits within Doughnut Economics it's massively important to take the time necessary to understand these implications and add a considerable amount of planning and research within this theme to make sure we create safe environments for all living creatures.

Program:

- Spend enough time with experts to fully understand the existing ecosystem
- Expand on the existing biosphere system and help it grow and thrive
- Let the local climate and biosphere inspire both the education and the architecture

Questions for further development:

- How do we map micro ecosystems? (mycelium, insects, young trees etc).
- Do we connect surrounding systems and if yes, how far away?

Notes:

Environmental regeneration

Food farming & greenhouses

Cities all over the world are currently exploring how to become self-sufficient in food production. The Covid pandemic and closure of borders was a wake up call for many countries to realise that supply chains we take for granted are actually vulnerable. With ongoing disturbances in important logistic geographical areas such as the Panama canal and the Suez canal it's become even more clear that we need new local systems of safer food supply.

Schools could be micro versions of self-sufficient environments and testbeds for how to make systems that are local, regenerative and healthy. This would require to look into land use and space, which type of food fits local settings, what types of new expertise and labour might be needed and how to involve the surrounding communities. It would also require attention to regulation and existing laws to oversee the ability to keep animals, to serve own grown food and processes of farm-to-table.

Program:

- Greenhouse(s) - either fully recycled greenhouses from other local places or by assembling recycled materials
- Large vegetable garden
- Food forest - food park
- Edible plants, fruits and vegetables all over the site
- Full-time garden pedagogs
- How to deepen collaboration with local food systems such as Mylla and develop logistics with minimal traffic
- Engage with qualified, local, expert ecologists to conduct standardised
- and reputable biodiversity impact assessments on-site

Questions for further development:

- How much food can the school produce on-site? (This would include more exact research into the sizing of greenhouses but also food forests, fruit trees and incorporated growth of food in the school area)
- Are there other local food producers to cover all the rest of the needs for the school?
- What regulations might stop the school from producing food themselves?
- How many staff members would be needed to work on food production only?
- Can the school work collaboratively with local supermarkets and use food with a short shelf life? (e.g. in similar ways as Rscued who makes juice out of damaged fruit).

Notes:

Environmental regeneration

Nature Playgrounds

Playgrounds are a natural part of schools and surrounding areas, yet many plan them in accustomed ways and buy ready-made wood and/or plastic objects made in standardised designs. To be able to meet the requirements of the Doughnut model, playgrounds are easy to work with and a great starting point for understanding how to use natural and local materials that might already exist on site. There are a few landscape artists, designers and specialised consultants nowadays working with so-called "nature playgrounds".

These often consist of products from nature such as large wood logs, ropes and plants, but similarity they emphasise the importance of studying how children play, what they enjoy and what excites them to make play into a learning environment.

Program:

- Design and create a playground without any new virgin materials and heavy costs
- Deep collaboration with experts and users
- Give space to other living things on site and create possibilities for co-living/co-playing among children, plants and animals.
- Create outdoor learning spaces that will be used every day

Questions for further development:

- Are there safety regulations to understand?
- Can playgrounds be constantly transformed and adjusted together with the children and the pedagogies depending on needs and dreams?
- Can the outside playgrounds be incorporated into teaching and learning? (handcraft, biology, arts, languages etc)
- Can the forest or an outdoor greenhouse be a classroom?
- Mapping of local materials (existing or renewable) to use for playground structures.

Notes:

We collectively need to bring our hearts and bravery into everything we do to empower change.

Environmental regeneration

Environmental Entanglement

There is a clear divide between modern humans and nature which can only be repaired by constantly reminding ourselves of how all life is deeply entangled and sharing this old knowledge to new generations. Children need to learn this through education and by embodying this knowledge to fully feel what it means and how important it is for the planetary systems to function properly. It doesn't fully make sense to just read about how we're part of nature, we need to immerse ourselves into real true nature and learn from all that will arise from it.

Learning environments for not only children but adults as well, might need to move away from indoor classrooms and take space in nature. Schools could use outdoor classrooms and new types of architectural spaces in nature that can support teachers and students with minimum yet effective shelter.

Program:

- A large variety of outdoor classrooms with different programs
- Understand the importance of finding the right teachers that enjoy working outdoors
- Create opportunities for children to be in, and connect with, nature every single day

Questions for further development:

- How do we restore and rebuild our broken relationships to nature?
- What is important for children to learn to regain an understanding of our entanglement to nature?

Notes:

After the conference World Congress of Architects in Copenhagen 2023, 10 new principles - lessons, were created. The Copenhagen Lessons consist of 10 principles for rapid and radical change in the built environment to reach the UN's 17 Sustainable Development Goals (the SDGs). The congress demonstrated that the architectural solutions are already here, contributing to sustainable communities and quality of life. However, the built environment is also an active part of the current challenges: a major consumer of energy and natural resources, and a producer of waste – and it can have a huge impact on both inequality and public health. The construction industry alone accounts for 40% of global CO2 emissions and 35% of total waste, which calls for urgent action.

architectural design

01: Dignity and agency for all people are fundamental in architecture, there is no beauty in exclusion.

02: People at risk of being left behind must be accommodated first when we construct, plan, and develop the built environment.

03: Existing built structures must always be reused first.

04: No new development must erase green fields.

05: Natural ecosystems and food production must be sustained regardless of the built context.

06: No virgin mineral material must be used in construction when reuse is possible.

07: No waste must be produced or left behind in construction.

08: When sourcing materials for construction, local renewable materials come first.

09: In everything we build, carbon capture must exceed carbon footprint.

10: When developing, planning, and constructing the built environment, every activity must have a positive impact on water ecosystems and clean water supply.

Architectural Design

Local building materials

The market for reused building materials in Sweden is currently dysfunctional due to both a lack of organisation, logistics and regulations. Within the construction industry, there are strict regulations regarding the performance of products and materials. Current reuses of building material therefore mostly occur within the same company or organisation, taking from one building to another with the same owner. By doing this, the problem of being able to secure the guarantee for a reused material is different than if it would have been sold in an open market. There is the option of testing the performance of a material case by case, however that solution is not economically feasible.

For material not regulated by code there is a limited market. If the developer is willing, they can take the risk of disregarding the warranty of purchased reused material. This will make the process easier, but it is a risk. One solution is for developers to test all recycled materials individually, or find an organisation that certifies recycled and reused materials.

According to the Copenhagen Lessons, as few virgin materials as possible should be used when doing new constructions, however in the case where materials are needed, local renewable materials should be used. In Tomelilla and the Skåne region, there is an old heritage of clay construction, a material that has gained a lot of attention over the last few years. Large scale architecture made in different forms of clay and clay based materials have been tested and studied. Another interesting material for Tomelilla to explore is hemp which grows fast and requires little resources and maintenance and makes it an interesting material for construction. Most projects have worked with hempcrete which is referred to as a CO_2 negative material and together with clay, recycled materials such as bricks, windows, doors, wood and other durable materials, a full building could most likely end up with lower carbon budgets than standardised projects.

Program:

- Use 100% reused material for the full construction of the building
- If reused materials can't be found, carbon negative materials should be chosen (hempcrete, hemp isolation etc)
- Materials should be applied so that they can be removed separately and be used somewhere else or easily recycled when needed

Questions for further development:

- There is a lack of material libraries and systems in Southern Sweden, Scandinavia and Northern Europe. Where do we find all necessary materials?
- Which local material producers exist around Tomelilla and in the nearby region?
- Is it possible for developers to take the risk of reusing recycled materials and create new laws and regulations for this specific project?
- How can residents participate in providing materials or contribute to the building? What are the risks?

Architectural Design

Non construction approach & disassembly

With the extreme carbon emissions from the construction industry in mind, the idea of not building more and only working with existing built infrastructure is a topic currently being raised by a broad range of thinkers worldwide. Yet, what does it mean? If we are to work more closely with existing buildings we need better mappings of what we already have, which materials are used and time frames of plans and activities. To not construct new buildings could still mean we carefully use what we have, recycle, transform and reuse. This is often hard due to how we've constructed existing buildings where different types of materials are mixed and merged into pieces that we can't separate. For every single new building we make we have to make sure they can be demounted and all materials organised so that they separately can be used somewhere else.

Program:

- Build less and in unexpected ways
- Structures that can be disassembled using reversible connections
- Use building elements made of single materials
- Create a school that functions with an under-dimensioned building size.

Questions for further development:

- How do you channel the multiplicity of current research on carbon neutral architecture and the idea of building less?
- How do we meet local building needs by using already existing housing and spaces?
- How does a school function without a school building? How does a school function with an under-dimensioned school building?

Notes:

Architectural Design

Transitional architecture

By studying spatial architecture, heating and temperature needs we can start to implement new ways of structuring rooms within buildings for reduced needs of energy. By creating heated cores, surrounded by limited heated areas and finally adding unheated rooms at the edges of buildings we make transitional architecture. For a school this might be to make classrooms at the core, shared school - community space in the middle and public open spaces at the fringes. These different areas would in a Swedish setting

also be used in different ways due to seasons and outdoor temperatures.
Architecture that is transitional can also easily be transformed, reshaped and morphed into different uses over time.

Program:

- Create rooms that are heated differently and used in various ways throughout seasons
- Use the placement of space and rooms to ensure lower energy usage
- Plan shared public spaces in relation to private core spaces so that they function well for children and teachers

Questions for further development:

- How do transitional spaces still work with fire regulations etc.?
- How do you prepare end users for a colder indoor environment?

Notes:

Architectural Design

Water & rainwater harvesting

Lack of water is esteemed to be the next large-scale crisis that will lead to political instability and global wars. It's important for everyone to incorporate local small scale harvesting and purification systems into planning of any building, urban area or municipal work. These can be outdoor collection, dams, reuse of greywater, mobile purification systems, distributed systems or community connected systems.
Yet, to conserve natural water resources by designing for the treatment and reuse of greywater on-site for purposes such as irrigation, toilet

flushing, cooling systems, and watering nonedible plants is going to be heavily important moving forward.
There needs to be a vision that no water should leave a project area and that supporting natural water cycles is crucial. By catching and cleaning water with permeable surfaces, natural cleansing systems such as reed beds and bioswales and then redistributing clean water to the local water reserves, you can also create a full landscape into a water collecting machine.

Program:

*   Different types of rainwater harvesting for gardening and food production
*   Rainwater harvesting for toilets
*   Water filtration system for greywater to be reused
*   Explore a local water purification system within a container structure
*   Map surrounding existing systems (e.g. VA Österlen is testing a system of pools).

Questions for further development:

*   Which local water purification system is most appropriate?
*   The amount of different types of water systems and purification methods are extensive, how do you choose the most appropriate for the local setting that will be viable for long term use?

Notes:

Architectural Design

Mobility & logistics

Transportation is one of the elements for working with less carbon emissions that many of us have a relationship with. Transportation touches on both private and public sectors, local and global needs and emotional relationships to what we see as human rights.

For the construction sector we need to study both global impacts and local needs. If we aim at building with local reused materials, or not build at all, we can reduce the global impact. Yet, there is a local need from the municipality and citizens to still use some form of transportation and logistic solutions.

To create a collaborative supply chain for local settings is one way to try to reduce emissions. This requires a holistic approach and deep collaboration between municipalities and the private sector.

Program:

- Can children from surrounding areas share rides through digital apps or stronger networking via parents?
- Is there safe and enough infrastructure for children to bike to school?
- How can all teachers happily bike to school themselves?
- Car free area

Questions for further development:

- Can local distribution centres remove the need for constant deliveries of products?
- How do we make cargo bikes a more inviting alternative for deliveries?
- How do we create flexible mobility infrastructures that can adapt from current needs to future systems?

Notes:

Over the last few decades there has been a massive increase in technical innovation for the construction industry. New digital tools for smart energy systems, lights, heating and cooling, carbon dioxide measurements, supply chain management and logistics, are constantly entering the market. However, with the direct Co2 emissions from data storage centres and the expected increase in digital technologies, it's important to carefully consider which ones might improve an overall process and where it might be better to stay with old technologies.

technical innovation

Technical Innovation

Energy

Over the last few years we've seen and lived within an energy crisis due to an increased need, growing population, unequal distribution of wealth, political instability and wars, to just name a few factors. The instability of energy will continue with peak oil estimated to happen somewhere between 2025-2040 (an expression that refers to a hypothetical point at which global crude oil production will hit its maximum rate, after which production will start to decline).

We need to work with a broad range of solutions where solar and wind are a growing possibility for energy production. Even though they can't be the sole source of energy in Scandinavian settings, it is one of the more sustainable solutions we have today. Yet, all new sources of energy require materials, production and shipping, which again leads to solutions of lowering energy use rather than finding solutions to keep living and using energy in the same way as we do today.

There is a growing movement of creating local decentralised energy solutions with economic profits as well as sustainable gains. This also generates security in case of future risks where larger power grids might be cut off or unstable.

Program:

- Create an independent local small scale energy system
- Large space for a solar panel field
- Are there other nearby sites and land to be incorporated into a solar field? Who owns them and could the municipality rent extra land?
- Make the school into a decentralised energy company
- Create a flexible energy system that can easily be updated, changed and modified depending on future innovations and newer systems.
- Add energy storage solutions such as containers with batteries
- The swimming pool already has solar panels on the roof, how does that system work and can/should it be integrated in a larger system?

Questions for further development:

- How do you create a building that produces more energy than it consumes?
- What are current regulations that might make solar parks near the built environment hard to realise?
- How can an energy community work together with a school? Who owns and who operates?
- How much space for a solar field is needed to cover a full school's yearly energy?
- How can solar energy be used with parallel systems such as small wind turbines? What regulations restrict the use of small wind turbines near schools at the moment?
- How can a building use energy differently during a 24h period?
- The construction and installation of solar panels emit large amounts of carbon dioxide, are they better than other sources of energy?

Technical Innovation

Container park

As previously explained for both water and energy systems, many solutions today come in the size of containers for easy transport, flexibility and updates. A container park is a good solution to house not only batteries but possibly also other innovative systems and solutions that we might not know that we need at this current time. This might include water purification systems, food production or something else. Carefully selecting an appropriate area and keeping that clear for containers and with correct distances to build- ings is crucial. By using containers many of the installations and solutions will remain flexible and easy to upgrade in the future.

Program:

- Space for a container park of at least 2 (but preferably 4) 40 foot containers which needs to be placed at least 50 metres from buildings
- Mapping of existing technological solutions within containers

Questions for further development:

- Which systems beyond water and batteries might be interesting to explore further?
- Are these systems more sustainable than standardised systems?

Notes:

Technical Innovation

Flexible installations/HVAC

All future buildings that we decide to add to our existing stock need to be flexible. To create a building with long term opportunities that can be modified and updated with new technologies when needed is important to design correctly from the beginning. All technical installations need to be accessible from the outside and not hidden or placed inside the architectural construction to ensure never having to demolish parts of the building to be able to update systems.

There are many beautiful adaptations where technical installations have become part of the architectural design and the facades, the most famous example is possibly Centre George Pompidou in Paris.

Program:

- Flexible technical installations that give room for future improvements and updates.
- Distribution and technical centres need to be available from the outside of the building.
- All technical installations placed at ground level
- AI och sensors that automatically control heating, ventilation and light in classrooms
- Can a passive house construction merge with technical facade installations?
- Make technical installations into an architectural element

Questions for further development:

- Does a Scandinavian climate work for adding technical installations on facades instead of inside walls and buildings?

Notes:

Technical Innovation

Waste

Waste should be minimised in future built environments and locally dealt with as far as possible. Buildings and areas have an opportunity to create a revenue stream by creating collection points for waste such as plastics which would be rewarded with plastic credits. There are existing initiatives that already incentivize collection of waste materials or products by creating a deposit scheme. They provide some form of incentive, or reward, which is deployed to a smart contract. The smart contract contains the rules for the deposit scheme, and the reward is distributed according to these rules.

This model can also be applied to any other waste-material, however would require further development of local needs. As an additional benefit, by establishing a collaboration with existing local waste management, communities have an opportunity to create transparent material flows (highly educational for children in the context of environmental awareness). There is a great opportunity to establish educational modules around consumer society, producer responsibility and material economy.

Program:

- Explore solutions such as EmpowerChain and their work on waste management to add a local reward opportunity
- Add a local food waste/compost system to be used in the gardens
- Create a space and/or storage for materials to be used or re-used on the site
- Establish clear routines for the school to buy products without packaging

Questions for further development:

- How can we radically reduce waste by looking at deeper collaboration and demands with suppliers?
- How can waste become a resource?
- How can a school radically reduce its waste?

Notes:

Technical Innovation

Future risks

We live in times of emerging unknown risks and to create well functioning built environments we need to take possible future events into account. With climate change and increased natural disasters it's hard to predict how and when societies might be hit and it's therefore important to be flexible and agile when needed. Even though it might feel complex, we need to use perspectives of up to 100 years to try to forecast what we need to create and implement today.

Program:

• Water tank on site for future risks and needs
• Shelter for the community
• Emergency storage for dry food at a temperature of 14-16 degrees
• Reserve power plant
• Flat surface areas for fast flexible use in case of emergencies
• Create possibilities to make food for a larger group of people

Questions for further development:

• Which local and global risks do we need to consider when designing a new building?
• Which time frames do we need to study and explore?
• How do we prevent risks while also preparing for acute necessities?

Notes:

Throughout history, humanity has always struggled in various ways to stay alive and thrive, it's a notion that comes with the contract of life. However, never before have we been so aware of the global scale of our actions while at the same time over-use planetary resources. These two tendencies sit at the core of our metac-risis and to carefully overcome them we need to generously collaborate in new ways. We need to see all living things as creatures that only want to live a beautiful life. For humans this means to shift what we value most. Is it our profit leading economies or something else? We need to talk about, and share these thoughts and conver-sations more regularly at every scale and in every community to unravel new ways of being together.

community care

Community Care

Meaningful societies

We all want to live in places where we feel a sense of freedom and agency to live well, follow dreams and thrive. To build spaces where this can happen forces us to create long term visions where health, social and gender equalities, income and meaningful work, political agency, trust, shared spaces, belonging and joy are given more careful focus during planning processes. There is similarly an interplay between local aspirations and global responsibilities that we need to recognise and better understand. How is for example, the expected increase of climate refugees going to impact local communities around the world? We need strong, caring and generous international collaborations and they all build from strong, caring and generous local communities.

Doughnut Economics recognises that growth may be a healthy phase of life, but nothing grows forever: things that succeed do so by growing until it is time to grow up and thrive instead. How is this mindset reflected in the built environment at the moment?

Program:

- Create a learning environment where all children thrive
- Create a learning environment where everyone in Tomelilla can thrive
- Strengthen a sense of belonging to both the community but also to nature
- Explore ideas on how to create "friendship" communities (schools, municipalities) in other parts of the world

Questions for further development:

- How can local developments respect the well-being of humans and all living things in other parts of the world?
- How do we keep philosophical large scale dialogues within small scale communities?

Notes:

Community Care

Community entanglement

To face the unknown yet expected increase of the climate crisis and catastrophes, community networks need to strengthen their wellbeing, synergies and work with a spirit of high trust. They need to build strong solidarity that crosses borders and create opportunities through every-day life to connect, share and work together. This will need to be linked to local history and the context of each community to create unique frameworks and social platforms.
These platforms can be bridging generations, cultures, viewpoints, interests and hopes. Many senior citizens in Sweden live lonely lives and

by inviting them to be part of teaching children through shared moments together, society could gain massively on wellbeing and health.

By creating inviting and beautiful environments open to all, but also actively creating events, courses and moments to meet, a small commu-nity can use what used to be a school and rather make it into a connecting point for everyone to learn.

Program:

- Move beyond the idea of an elementary school only and create a learning environment for the full community
- Make sure to create spaces within the school area where citizens of all different generations can meet
- Open up school buildings for everyone in the community to use, rent and spend time with each other after school hours
- Invite all different cultures, ages and backgrounds
- Create a yearly harvest festival for the school area - co-created with a larger community, to join all citizens through emotions, joy and hope.
- Create reading groups for all ages
- Café at the school area which is open for elders as well within the community
- Establish a sold collaboration with Save the Children who are already working in Tomelilla

Questions for further development:

- How can a space deepen our understanding of entanglement?
- Which current regulations prevent a mix of generations within learning environments during daytime, evenings and weekends?
- How can stronger communities create trust in shared spaces?

Notes:

Community Care

Autonomous buildings

We might need to shift our perception of the built environment and single buildings as objects we own and are ours to rule over, fully decide on their fate and keep any monetary profit they're making straight into private pockets. A future might rather hold ideas of buildings being autonomous. If a building, just like we've recently seen with rivers and mountains, receives the status of a creature, a personhood, then how do we relate to that building? If the planet owns itself, then nature and materials own itself, and consequently, a building should be able to own itself.

These rather philosophical ways of looking at economic systems and ownership might seem far-out, but in reality they are easy to test and could very likely lead to interesting results. How can a community collectively own a space whose goal is to share knowledge to everyone? One might call this philosophical economy, but what it explores is value beyond money and how this value can mostly benefit a municipality.

If a building then creates more energy than it needs (as written about earlier in the energy section), we also have an autonomous building with its own fund. This opens up for enormously interesting questions on how a community can collaborate with the building and see it as an equal creature, what that relationship creates for the community and how humans therefore relate to material and each other.

Program:

- Create a local fund for the school governed by the community in Tomelilla
- Invite the community to collaboratively explore how a building can require 'personhood'
- Work with children to create the "school creature" and give it a name
- Connect an autonomous school to self organising technology

Questions for further development:

- How does making a building into a personhood change our perception of materiality and belonging to Earth?
- How is governance with a building set up?
- If a building is autonomous with its own fund, how is credits (money) distributed, used and which type of decision making systems is steering this?
- Can autonomous buildings be connected to each other to share care (needs to exchange materials, activities, resources etc)?

Notes:

Community Care

Blockchain & AI

Buildings can benefit from implementing a blockchain that would incentivize and facilitate collaboration between citizens and stakeholders in the community. The technology could be utilised to create governance systems and smart-contracts that would function as the backbone of the schools' digital twin. This would provide the project with a transparent and immutable dataset around the use of resources and in extension the aim of our project, to remain within planetary boundaries.

Examples could be:
1. Tracking: Proof of existence – Ensuring the traceability of materials used throughout the project through the use of blockchain's immu-

tability and cryptographic techniques called "hashing."
2. Community waste collection incentive schemes. Establishing bespoke deposit systems for the school to collect and recycle waste materials or products.
3. Create smart systems with AI for heating, control, air flows and renovation needs.
4. Support the idea of an autonomous building with personhood and create transparent interactions between buildings, citizens, natural resources and other living organisms.

Program:

- Use blockchain to secure transparency and democracy
- Test blockchain as a traceable fund system with credits to share where its needed, locally or globally
- Test AI for technological systems of self adapting heat, water, air systems

Questions for further development:

- How can blockchain explore possibilities for buildings to be supporting solutions to our planetary metacrises?
- In which micro scales can blockchain be easily implemented and tried out?
- With the expected massive growth of carbon emissions from AI, is it even worth adding to future projects at all?
- Is low-tech more appropriate than high-tech?

Notes:

Community Care

The value of a human

In times of extreme technological focus we sometimes forget the beautiful capacity that sits within humans. For a building to sit within planetary boundaries and within the safe space of the Doughnut Economics, we think it's absolutely crucial to develop new roles for humans. The care, the attention and the slowness that we need in communities in order to transform how we live is a philosophical trait that no machine can accomplish.

These new roles might be to support a building in being autonomous, to connect a building to communities or to be the voice of a building in transformation. By creating stronger connections between materials, nature and humans we can get a more comprehensive understanding of both current times and the future. Even though crisis after crisis seem to be lining up, the capacity of balance, joy and human experience is worth acknowledging and fully being explored.

Program:

• Add new professions that still don't exist to the school organisation (a school guide, school mother, a caring school captain and similar types of new roles that might be needed)
• Focus on hiring the right type of teachers
• Make sure to have brave and unusual competencies from the start, such as garden pedagogs, outdoor pedagogs, farming pedagogs, art teachers, philosophers, chefs, animal keepers, sustainability experts etc
• Make sure to find a head principle ready to tackle radical challenge, joyful learning, foresight and sustainability and deep global and local care.

Questions for further development:

• What is the value of a present human being for a community?
• Explore which types of roles a guiding person of a building might need to fill

Notes:
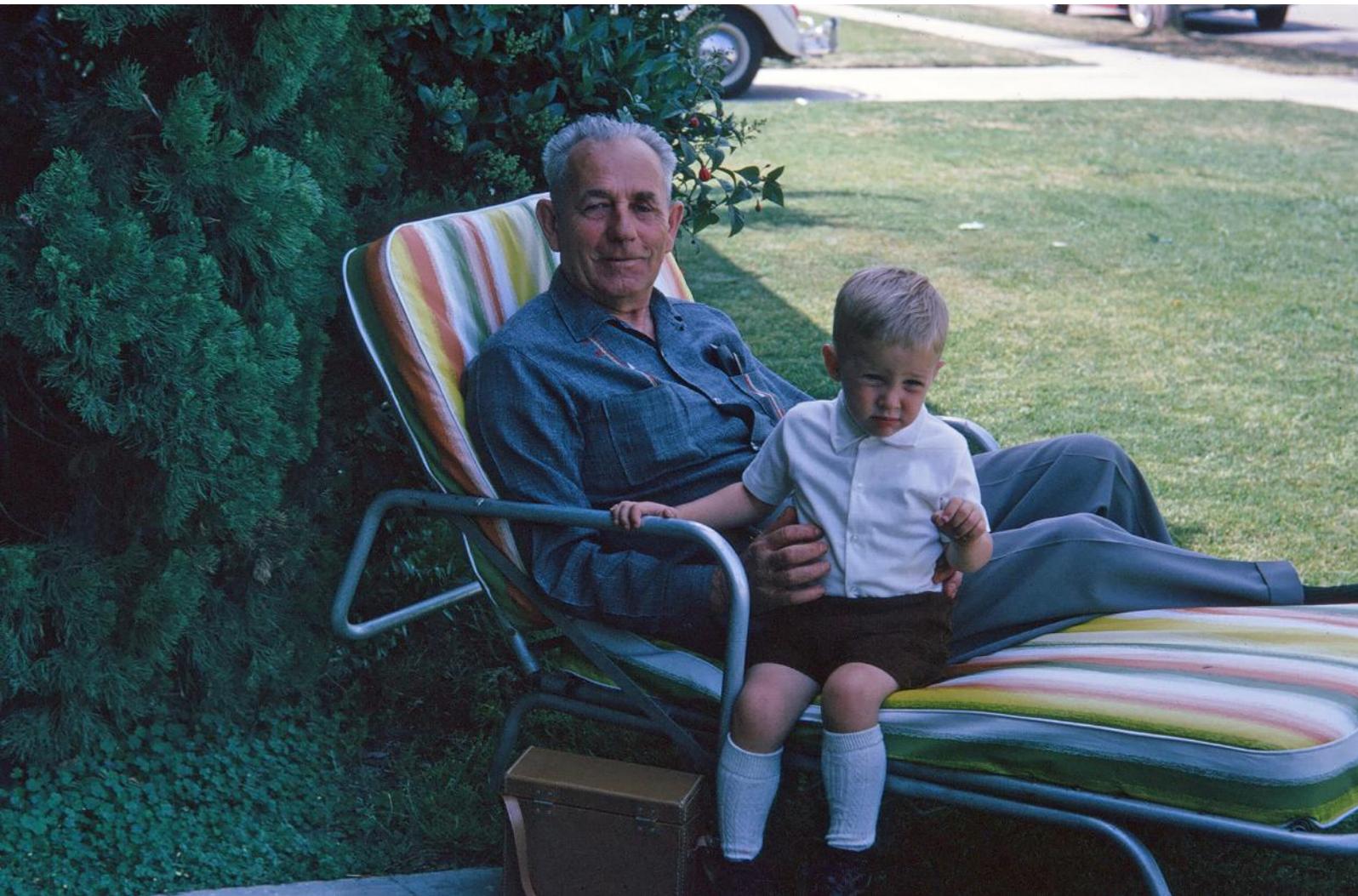
Closing thoughts

End of new construction as we know it

The necessary decrease of 80-96% (by 2050 the mentioned number is 100%) of carbon emissions within the building sector in relation to the increased building needs of 2060, are showing the complexity and impossibility of the construction industry. Our shared goals of 0 or even negative Co2 in relation to drastic demand for more space will not only require research and innovation, but is similarly frightening for many within the industry. The end of construction as we know it is here. And every single day that we continue on this same path is giving us more work to do in the future. Or rather, giving more work to our children to handle instead of us taking responsibility today.

While merging these foresight ideas with the Doughnut Economics, there are clear difficulties when working with the built environment in Sweden and staying inside the safe space of the model. The changes we need to do are so desperately dire that as a society we're most likely not ready yet to fully grasp the scale of transformation that is required. We would therefore like to be honest and say that the Doughnut model is a steering vision rather than a fully realistic method that the industry is ready to apply. If we were to state that we proposed a building within the model it would be greenwashing this project.

We don't know when we will be truly hit by climate change in Sweden and more harsh realities will most likely change the way we behave. Until then, all work on change is done by duty, personal will or caring interest of future generations. At some point in the future, we might be more ready, or forced to be more ready, to build inside the Doughnut model.

We need new economic systems where profit is no longer leading but wellbeing and thriving life for all a lead-ing star. To build a school will certainly not be the same in the future and we need to collectively dare to explore new ways of creating learning environments together. For us, there is a (with today's views, radical) solution to creating a school within the Doughnut model based on decentralised spaces, outdoor classrooms, a completely self sufficient system of energy, food, water and air. However, society is not ready to understand, buy and use this proposal and therefore we've adapted the idea slightly to better fit Scandinavian minds as of 2024.

Adaptable future ideas on space, schools and architecture

As stated throughout this report, the best option for the construction industry to stay within planetary boundaries is to stop building. For a new school, such as this project in Tomelilla, this will have a direct impact on planning, designing and holistically working with future learning spaces. We might need to accept the idea of smaller spaces, work with regulations on school environments and rethink what efficient learning spaces might look like. Schools might have to be placed inside already existing housing stocks, in urban store spaces or offices.

A future school will need to be architecturally flexible, adaptable and open for constant change. It will need to be flexible in relation to needs, citizens, climate change, innovation, political instability and future unknown events. Small-scale architecture might be of important value here, they might be more easily adaptable and reused and move us towards an idea of decentralisation.

Decentralised spaces and rooms might be a solution to exploring regenerative architecture and schools. A school might grow space by space over a long period of time, rather than being constructed as one single building all at once. This decentralisation of learning spaces and environments can lead to easy adaptation, innovative use, agile use of recycled materials and slow innovation. By testing and experimenting with small-scale solutions that are easily implemented, a school can become ready for climate change, crisis and unknown future events.
Less is more.

Collective care

What we have come to believe during this work is that schools need to become connecting places - meeting places for a larger community to learn. They can turn into testbeds for a new type of life together where we continuously develop skills and knowledge. Schools can explore ideas of who is a teacher and become spaces with interaction over age groups, gender and backgrounds. If we also imagine schools as an organism with personhood we can shift perspectives on ownership and relationships to objects and materials.

Municipalities are preparing themselves for harder times to come. There is a need to be both caring, radical and realistic all at once. This tremendous task can only be achieved through deep collaboration. To build a school should therefore no longer only be a responsibility for the community to handle alone but instead be a warm invitation to every single citizen who wants to participate and be part of a larger project. Through a survey we did with children in Tomelilla we know that many of them would love to help create a new school by painting, building, drawing, making cakes or singing for the builders, plant flowers or come with their parents who according to the children had amazing skill sets. To look at a building project in this way could create a massive feeling of agency, joy and belonging.

1. Rethink what to build - Less is more
Based on knowledge on carbon emission from the construction industry we can't build as we're used to. Every single added object to this world needs to be carefully selected through slow processes. A future school is outside in nature, learning happens in outdoor classrooms or in already existing building structures.

2. Self sufficient
A future school is self sufficient on food, energy and water. Farming happens locally, energy is produced on site and rainwater is collected and purified in a variety of ways.

3. Economic infrastructure
Energy and waste can bring in new types of economic agency for a school and a community. A school can earn money and become independent. Different types of digital coins can support a democratic governance that links local life to global needs.

4. Community learning
A future school is not merely an environment for children, it is a learning hub for a larger community where everyone is invited to share, inspire and evolve. Space and schools need to be used effectively over a longer period of time and be seen as opportunities for connection and joy.

5. Autonomous space
A school can own itself and thereby create a new understanding of what ownership means, how materials are planetary and that we share soil, objects and life. An autonomous school not only decides how to exist, but also creates a deepened understanding of relationships and regenerative futures.

Program for a future school

Environmental Regeneration

- Spend enough time with experts to fully understand the existing ecosystem
- Expand on the existing biosphere system and help it grow and thrive
- Let the local climate and biosphere inspire both the education and the architecture

- Greenhouse(s) - either fully recycled greenhouses from other local places or by assembling recycled materials
- Large vegetable garden
- Food forest - food park
- Edible plants, fruits and vegetables all over the site
- Full-time garden pedagogs
- How to deepen collaboration with local food systems such as Mylla and develop logistics with minimal traffic
- Engage with qualified, local, expert ecologists to conduct standardised
- and reputable biodiversity impact assessments on-site

- Design and create a playground without any new virgin materials and heavy costs
- Deep collaboration with experts and users
- Give space to other living things on site and create possibilities for co-living/co-playing among children, plants and animals.
- Create outdoor learning spaces that will be used every day

- A large variety of outdoor classrooms with different programs
- Understand the importance of finding the right teachers that enjoy working outdoors
- Create opportunities for children to be in, and connect with, nature every single day

Architectural Design

- Use 100% reused material for the full construction of the building
- If reused materials can't be found, carbon negative materials should be chosen (hempcrete, hemp isolation etc)
- Materials should be applied so that they can be removed separately and be used somewhere else or easily recycled when needed

- Build less, or even better, not at all
- Structures that can be disassembled using reversible connections
- Use building elements made of single materials
- Create a school that functions with an under-dimensioned building size.

- Create rooms that are heated differently and used in various ways throughout seasons
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- Shelter for the community
- Emergency storage for dry food at a temperature of 14-16 degrees

- Reserve power plant
- Flat surface areas for fast flexible use in case of emergencies
- Create possibilities to make food for a larger group of people

Community Care

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Proposal for Tomelilla
- An outdoor primary school

Less is more

- Build an outdoor primary school with a few super simple woodden structures that sit lightly on the ground.
- Classroom in tents.
- Create large gardens and farming.

EXTENDED THOUGHT ON LIFE CYCLE ASSESSME

FOR THE BUILT ENVIRONMENT

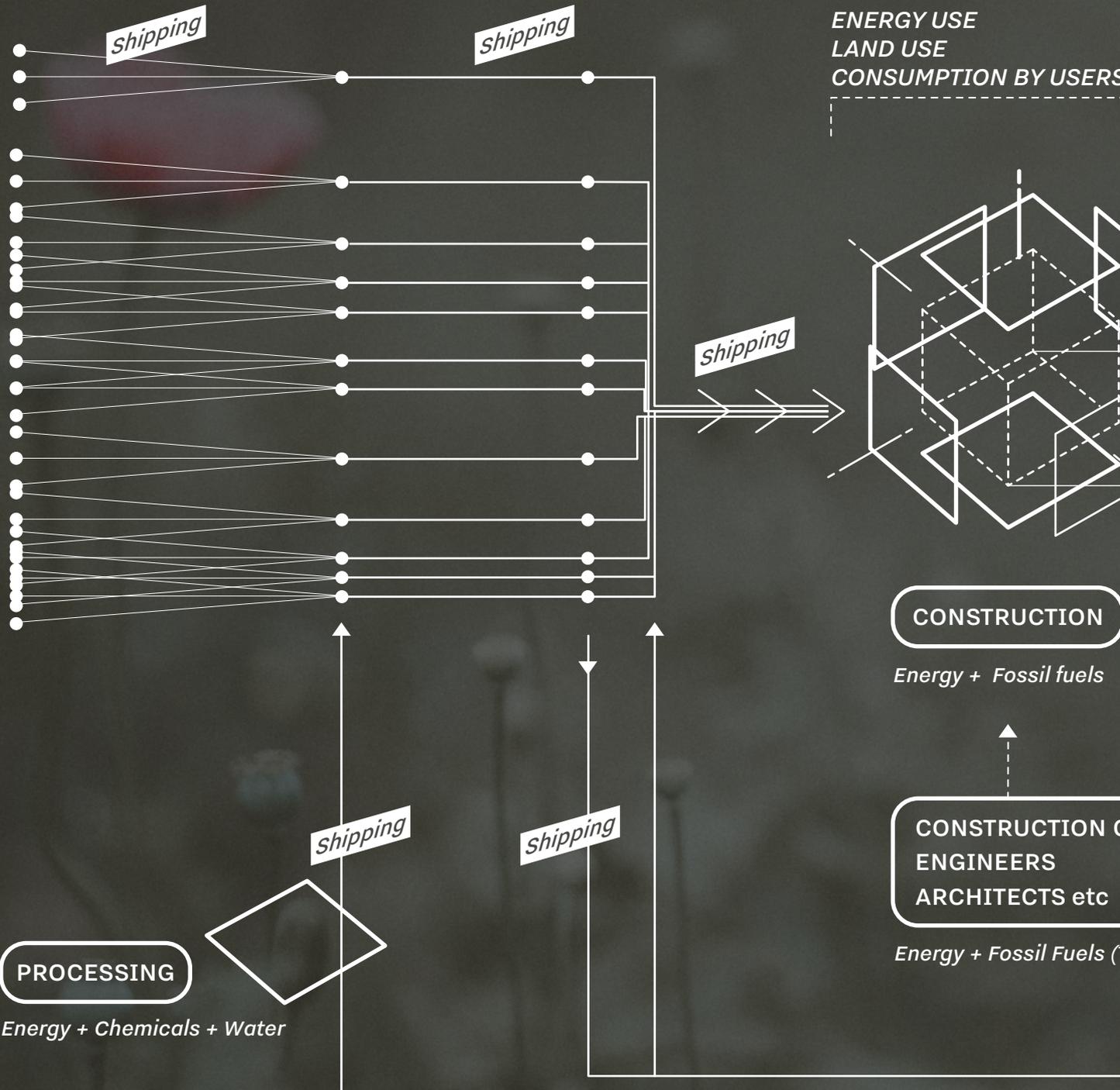**Finite resources** *(natures gifts to everyone, not just a few)*

MINING

Energy
Biodiversity loss

MATERIAL PRODUCTION

Energy + Chemicals + Water

MATERIALS

Energy storage
+ Fuels supply chains

Shipping

Shipping

ENERGY USE
LAND USE
CONSUMPTION BY USERS

Shipping

Shipping

Shipping

CONSTRUCTION

Energy + Fossil fuels

PROCESSING

Energy + Chemicals + Water

CONSTRUCTION C
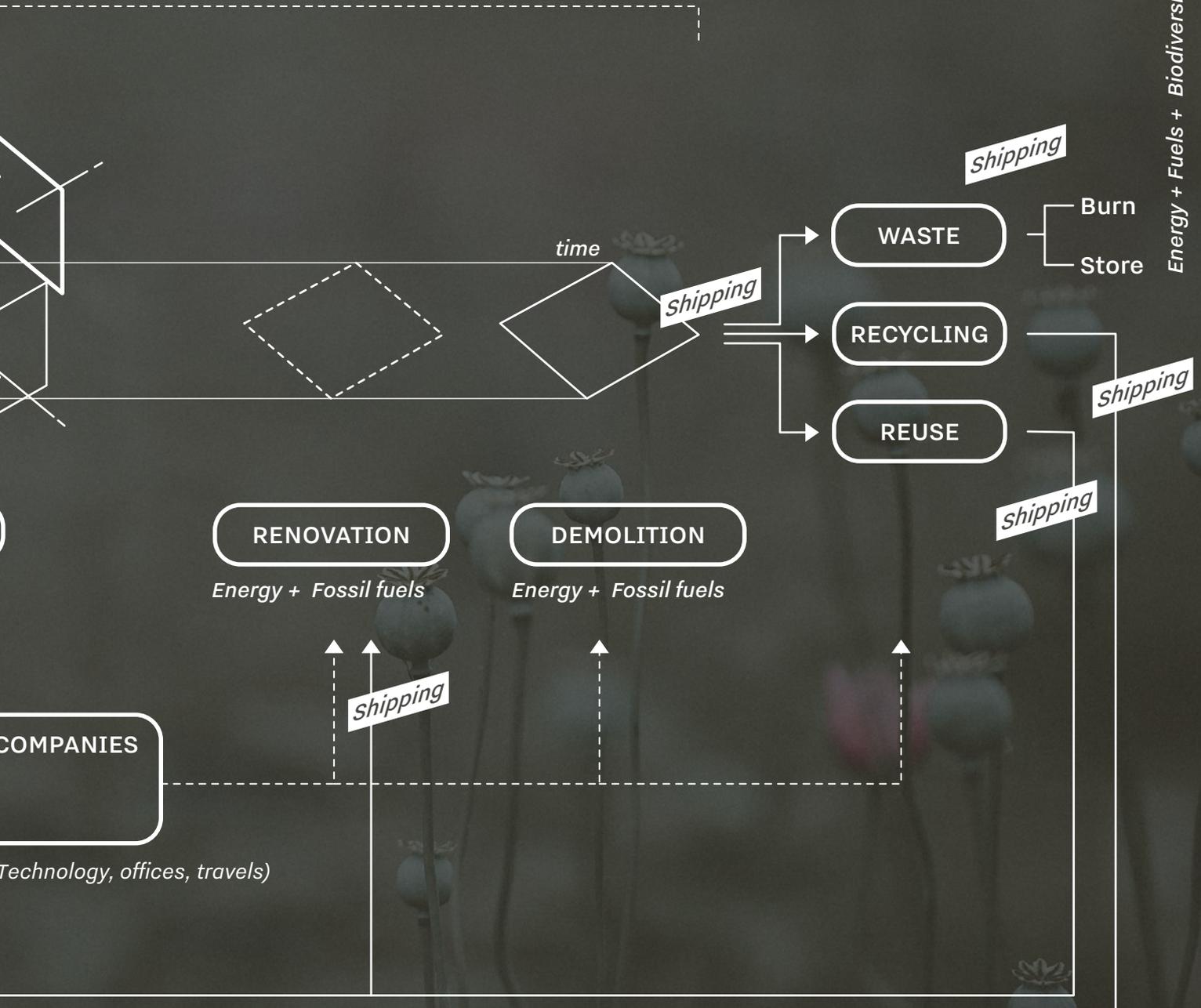**ENGINEERS**
ARCHITECTS etc

Energy + Fossil Fuels (

NT *(LCA)*

Every shipping accounts for a complex chain of CO2 emissions through fossil fuels, production of vehicles and other chain reactions with a severe impact on the climate and ecosystems.

S TO FILL SPACES

Energy + Fuels + Biodiversity loss

Shipping

time

WASTE ── Burn / Store

Shipping

RECYCLING

Shipping

REUSE

Shipping

RENOVATION

Energy + Fossil fuels

DEMOLITION

Energy + Fossil fuels

Shipping

COMPANIES

Technology, offices, travels)

WHEN!WHEN!

UUHEN!UUHEN!

Tomelilla kommun