

Rising from the [Coal] Ashes: Envisioning a Circular Post-Coal Community in Muara Enim **_Reflection**

Reflection Paper

Rising from the [Coal] Ashes:

Envisioning a Circular Post-Coal Community in Muara Enim

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Motivation

As a practice related to many aspects of society, architecture will always have an interesting role in almost every discourse. Especially when it comes to social and environmental issues. While it may not always give the answer, architecture can offer an alternative way to see, analyse, and synthesize problems in society and turn them into somewhat tangible things where people can react and respond, which, in the end, can spark more ideas and discussions. But in its practical world, architecture often gives up to the existing economic and political system of construction and resource extracting for the sake of efficiency and modernity. Neglecting the hidden cost behind it that is now coming back to haunt us in the form of environmental degradation. Based on that thought, I see the ongoing discussion about transitioning from coal to renewable energy as a potential turning point where we have to rethink our energy production, economic system, and, ultimately, the way we build and select materials. Therefore, in this graduation project, I would like to imagine where architects can play a role in the transition scenario, aiming to create *a new model of regenerative development that integrates the energy transition scenario into architectural guidelines*.

Methode & Process

1. Research

Before proposing any architectural interventions, I believe it is important for architects to understand where and in what condition their building will be placed. What resources will be available, and what will be the expectation from the system around it. Therefore, after choosing Muara Enim in Indonesia as my study case, I started this project with a thematic research that investigated the possibility of (re)establishing agroforestry as the substitute activity in the soon-to-be-closed coal mining area in Muara Enim and its implications for its future urban metabolism as well as future architectural development. Material Flow Analysis (MFA) is used as the main method to map the problem and potential in Muara Enim and how agroforestry practice can contribute to creating better conditions.

Collecting data and reliable information became the main challenge in this stage, as I only had two weeks on-site for both collecting data for the thematic research and understanding the place and its cultural aspect that will be used in the later stage. The limited data available forced me to readjust the urban metabolism aspects I would like to analyse. I removed the economic aspect from my MFA list and focused only on the energy and materials that are more closely related to architecture. I also had to complement the lack of numeric data with observation and interviews with the local people. Although the result is far from perfectly accurate in terms of numbers, It gives me a good overview of what the future is like without coal and possible interventions using agroforestry framework to improve the condition.



Figure 1. Collecting data from the Government & Discussion with the coal mining company staff

To gain more inspiration and contextual knowledge, further research on the cultural aspect of Muara Enim is conducted through a site visit, interview, and literature study. As today's Muara Enim is overwhelmingly associated with coal activity, it is hard to see its true identity and sense of place. Trying to reflect the local context without glorifying the coal industry, this research aims to extract Muara Enim's history before the coal mining era. How was life back then, how was the building culture, and what can we learn from that.



Figure 2 Visiting one of the traditional houses & Discussion with the Cultural leader

The last research is about the reclamation of an open-pit mining area. It is important to understand the future landscape of the former coal mine, what steps are needed, and how long it will take to rebuild the ecosystem in the area. Apart from the literature study and site visit to the community that turns mining sites into fish farms, I did interviews with an expert who has expertise in that field to give some insight and suggestions. Although reclamation processes are normally unique and have to be site-specific due to the number of reasons for soil and climatic conditions, there are some principles that are universal and thus can be a starting point in integrating this process with the proposed programs/ build-ings.

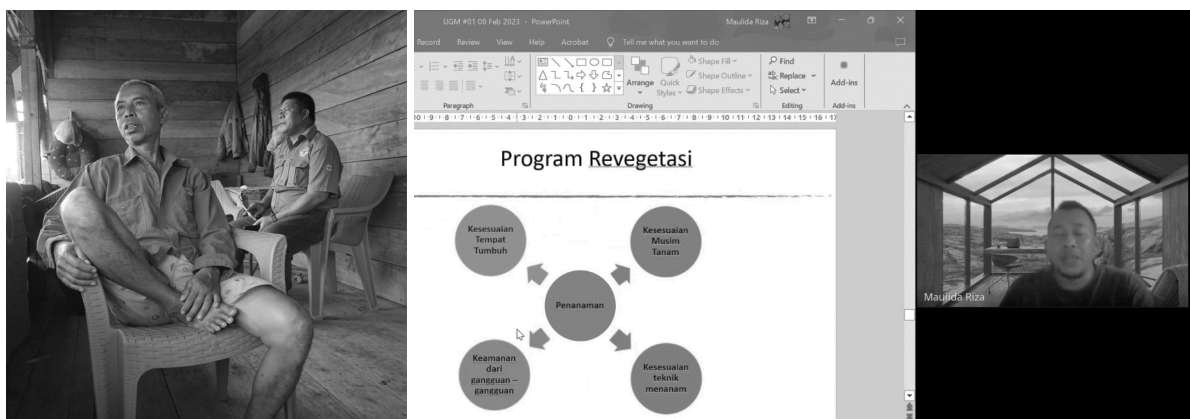


Figure 3 Interview with fish farmer & Mine Reclamation expert

From that multi-layered research, I then created a drawing that summarizes the condition of coal mining and the potential outcome once these activities cease and reclamation efforts begin (*figure 3*). I also made a timeline table where I can put all the interventions and scenarios I have in mind, from the regional scale to their implications on material selection and phase of development (*figure 4*). It was actually a response to the feedback I got from my research mentor that demanded a clear scenario year by year of what is happening on the site. It turned out that this method also helped me navigate all the ideas of the scenario, as I was quite overwhelmed with the scale of this project in terms of space and time span.

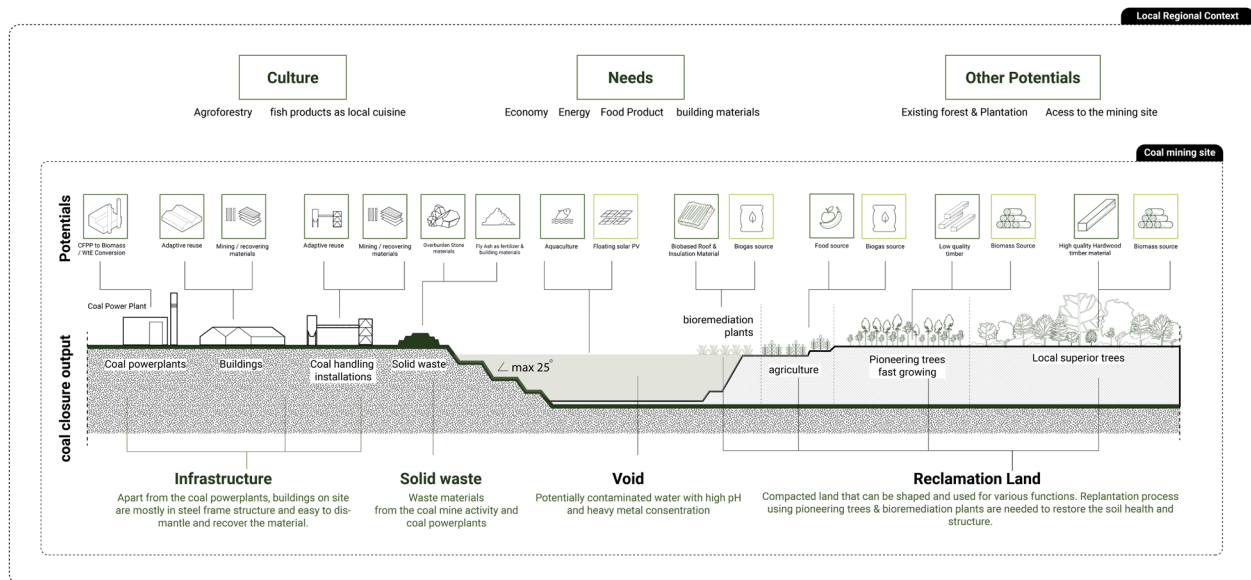


Figure 3. Summary of research related to coal mining closure.

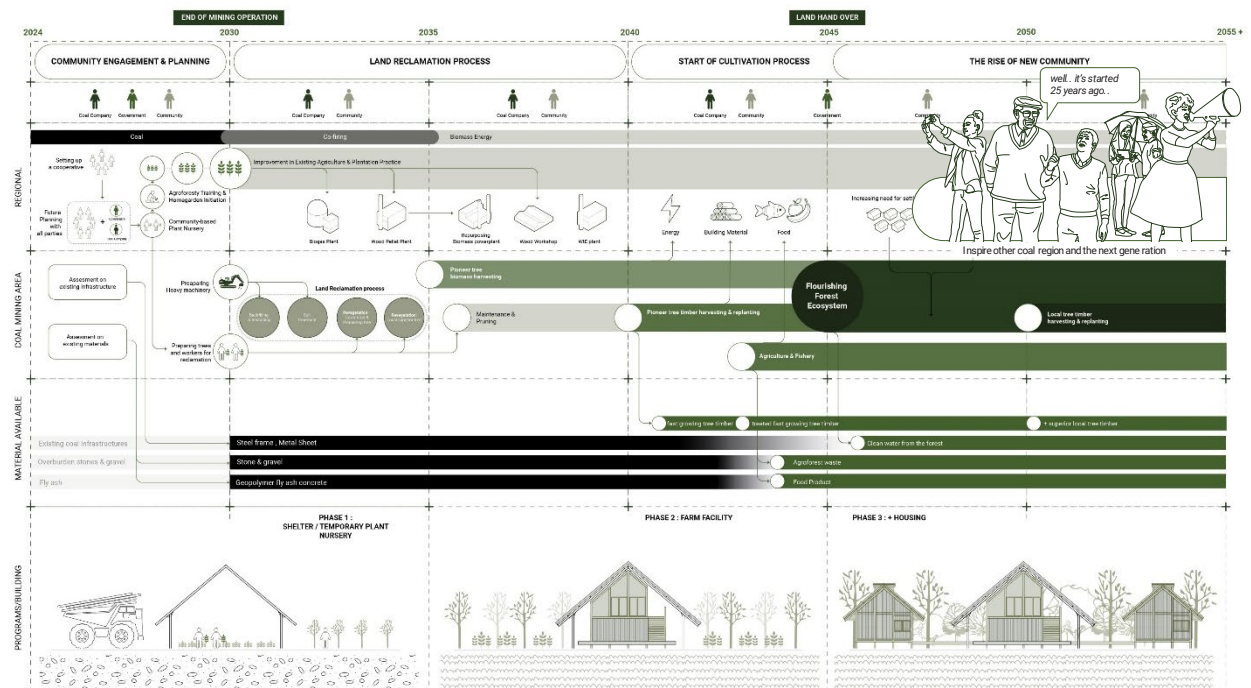


Figure 4. Timeline of Scenario

2. Design

The proposed program, scenario, and material options are relatively set in this phase. I wanted to design a facility that can help local people cultivate the reclaimed land for agroforestry, using materials that are available and will be available in the mining area. This facility will then grow into a village to showcase the new building culture in the future without coal. However, defining the scale, starting points, and guidelines for the design process is far from easy. My main struggle mostly stemmed from the fact that this project is located in an “imaginary” reclamation area. A blank canvas where almost everything is possible. How large it is, how the contour is, and where to put the building has no straight answer. Remembering the feedback from my design tutor to research more about the local practice of agroforestry, I then broadened my contextual research to other regions in Indonesia to find an example of regenerative practice in an area with a similar condition/contour (in this case, Kampung Naga in West Java). That study case helped me to form the reclamation land and site planning the programs.

Then came the design exploration, which involved putting all those preliminary research findings together to create a building design with a distinct character that somehow reflects the long story of energy transition and land reclamation behind it. Sketching and 3D & physical modelling were my main methods for testing ideas and finding new forms and layouts (*figure 5*). Struggling to find the desired starting point to ‘create’ the site, In the early phases I focused too much on the masterplan scale (trying to create a design principle that unites many building masses to be built on-site) and neglected the human scale and user experience. Fair enough, my mentors said my design layout ended up looking more like a labour camp instead of a village, which was not what I wanted it to be. Trying to find the balance between showing the integration of buildings on a larger scale and giving the organic and low-tech character on the human scale turned out to be quite challenging. Especially when there is not much consideration from the site that can help define the design. I then tried to divide the project into smaller parts (processing facility and future village) and design it separately, focusing on the human scale quality. I was also not quite satisfied with the use of “conventional” timber for the main building material as it didn’t show enough innovation in the construction. Therefore, I tried to dig deeper into the dimensions of the fast-growing timber and use it to show the land reclamation story behind the building material.

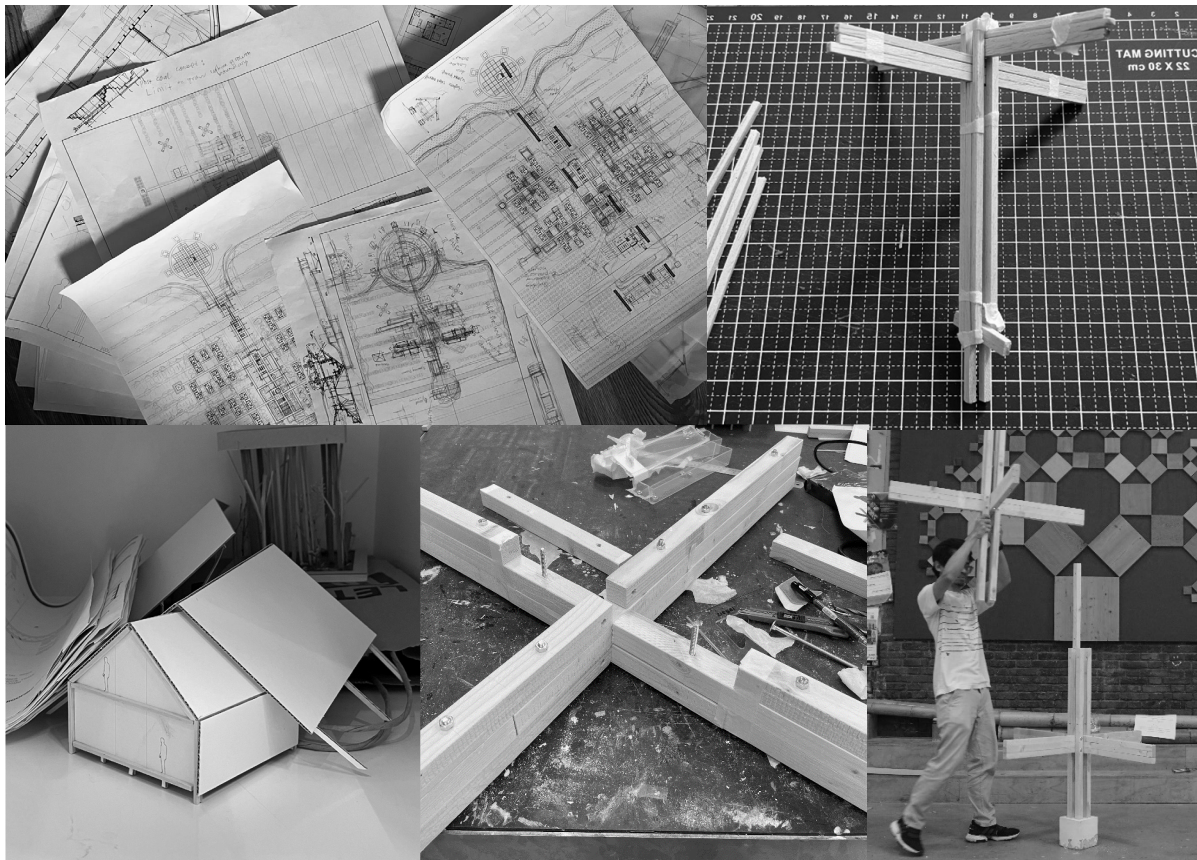


Figure 5. Some sketch and models during design Process

Conclusion Findings

From the research and design process, I found that designing a building starting from the systemic scale can be helpful in creating a comprehensive scenario for intervention and making sure that the projects proposed are grounded to the context. The preliminary findings from that process can also be a guideline for other contexts with similar cases. However, this systemic guideline and scenario alone doesn't give enough inspiration in terms of architectural expression. Therefore, it needs to be complemented with other research that potentially gives inspiration and ideas at the architectural level. In this case, literature research on related topics and study cases can be helpful. However, while doing research during the design process, a certain goal must be set in the first place to get the desired result and not get lost in the exploration. In this project, the architectural goal is to create a distinct design principle that somehow reflects (both conceptually and technically) the future after coal and connects to the background story of land reclamation behind it. I decided to narrow down my focus to these design aspects.

1. Energy

Finding a cleaner energy source is clearly the main aspect when thinking about the future without coal. In Muara Enim, the greatest potential lies in biomass from the forest and PV panels to generate electricity from the sun. A combination of both will determine the energy flow in the region and, eventually, in the building. While PV panels are more related to the form and design of a building, biomass power plants are typically placed away from the settlement and don't necessarily influence the design of a building. However, it may determine the landscape of the area as it has a low-density energy type and needs a large plantation area.

From that understanding, I then tried to integrate PV Panels into the building design and conceptually show the (normally hidden and dirty network) of energy flow in our daily lives by integrating them with elevated walkways that connect every building.

2. Material

Material can be the main defining identity in the new building identity in the future without coal, especially when it comes to opposing the extractive practices of coal mining. Instead of importing new materials from other regions and damaging their landscape, we need to start thinking about what is available and when it will be available in our system boundary.

These principles are then translated into integrating the use of reclaimed material from the coal mine infrastructure with biobased material harvested from the reclamation process. To go even further, the naturally small dimensions of fast-growing timber in its pure form can be utilized to create a distinctive new building identity instead of processing it into CLT. Apart from the lower embodied carbon in the production, it can also be easier to build and, in that way, can be adapted for a variety of uses and contexts. Turning it into a modular system can also give the possibility to be adaptable to the future scenario when buildings need to be renovated or extended. However, the amount of joinery must be considered when designing a modular system with small sections of timber, as bolts (even though they make the system easily demountable and exchangeable) are more expensive and have higher embodied energy than wooden dowels or other nature-based materials. Therefore, a trade-off between adaptability, strength, and the cost of materials needs to be carefully evaluated to achieve an optimal balance in the design.

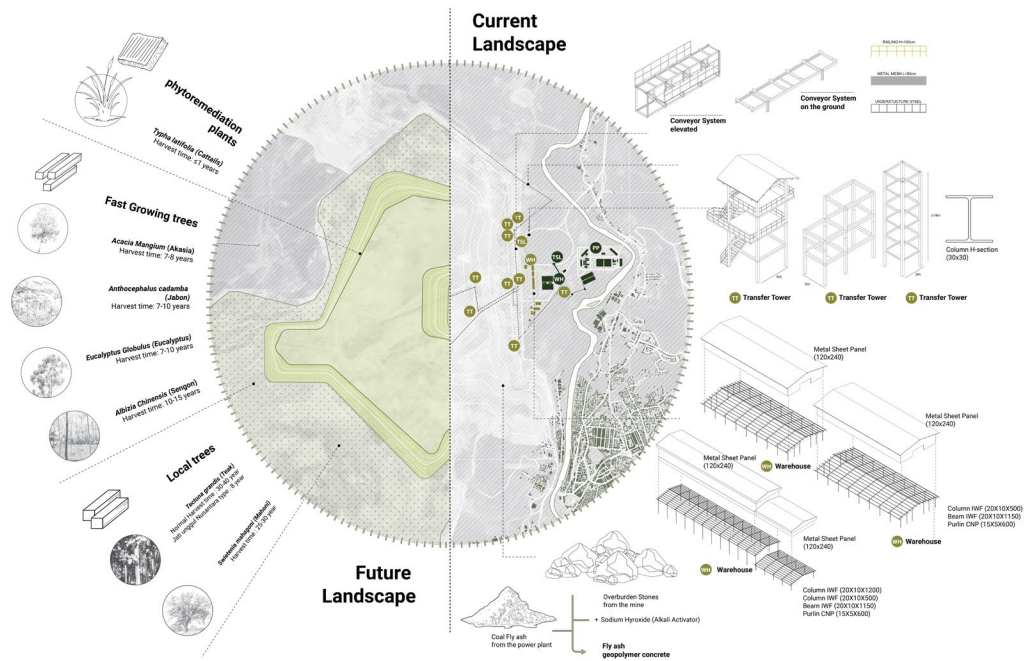


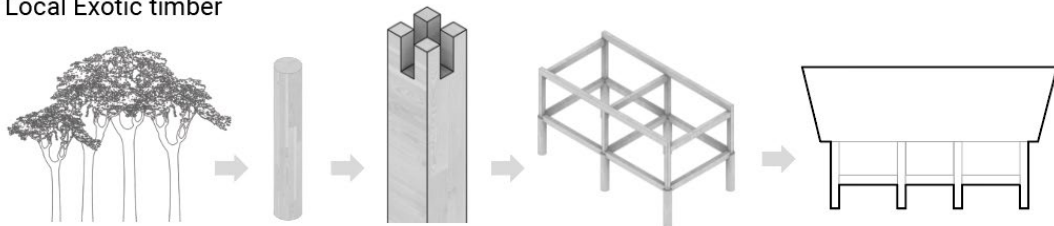
Figure 6. Assessing the available material on the mining site and future reclamation trees

3. From & Massing

I strongly believe that buildings need to be grounded in their context not only systematically but also culturally. Therefore, it is important to incorporate the cultural aspect of the site to, again, oppose the conventional practice of standardization that goes hand in hand with the extractive practice.

In my design, the local aspect mainly gained from the vernacular architecture that people have been familiar with since years before. however, with the changing climate and landscape, further assessment is needed to analyse what part of the design can still work and what not. For example, the orientation, stilt structure, and wide roof overhang to reduce the energy demand can still be relevant to the current condition, but the small window opening used to prevent wild animals may not be enough to lead the wind circulates. Building size and span will also probably different due to the different timber available in the current landscape.

Local Exotic timber



Reclamation timber

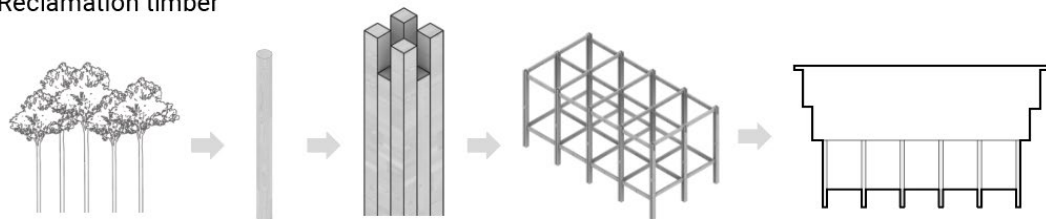


Figure 7. Adapting local building culture to the current landscape

Relevance and Looking Ahead

1. *What is the relation between your graduation project topic, your master track (A, U, BT, LA, MBE), and your master programme (MSc AUBS)?*

One of the main challenges for many coal regions in transition is to increase public awareness and convince citizens to engage in the transition. Departing from that issue, any intervention and planning also must include a tangible vision where people can see their future after the coal era. This crucial aspect is often overlooked in the current discourse on energy transition, which mostly revolves around economic feasibility and technological efficiency. Architecture, I believe can play a pivotal role in envisioning a better future in a soon-to-be-closed coal region. Beyond designing physical infrastructures, architects and designers can create a compelling narrative that engages local people and fosters a sense of hope and optimism in the community. Architectural Engineering Studio has become the ideal place to explore this role as it encourages students to use technology to answer the current societal challenges. Harvest topic, in particular, focused on the integration between a building with its landscape and the community, which I believe is an approach architects should adopt in the post-coal era. An Approach that ensures the design we propose is well grounded within the context and not just shifting environmental cost from one place to other places (as we experience now with the coal industry). In the end, the alternative strategies and interventions generated from this project hopefully can encourage other architects and designers from MSc AUBS to engage in the energy transition conversation and challenge the current discourse that is mostly dominated by politicians.

2. *How did your research influence your design/recommendations and how did the design/recommendations influence your research?*

The initial research on urban metabolism helps the design process to see beyond the building scale and assess the source of every component/material that will be used and the energy source for the buildings. However, the result does not necessarily provide architectural expression. Therefore, my design exploration (which is more focused on massing and tectonic) leads me to conduct other research focusing on climate and materiality to back up the ideas. In the end, it becomes an iterative process of exploration and reasoning.

3. *How do you assess the value of your way of working (your approach, your used methods, used methodology)?*

The Material Flow Analysis method used in the early phase helped me to create a framework in the future and determine the tools that I could use in the project. However, when it comes to the design process and putting everything together, there are some challenges in defining the starting point and guideline, mainly because the MFA result is more about interventions or scenarios (especially for a regional scale analysis), and the site is more or less still “imaginary” thus leaving many possibilities open. I also found it difficult to balance the real condition with my subjectivity as a designer when it comes to reusing existing material. My initial idea was to try to use the existing materials from the infrastructure that will be abandoned. However, the limited access during the site visit and lack of documentation of the existing structure left a lot of space for assumption and, in the end, filled mostly with my subjectivity to create a nice design, not necessarily responding to the real available materials. I was also a little bit too late to find out that the small section of timber of the reclamation process could give a distinct characteristic to my building, so I didn't have enough time to go deeper into the joinery system of the timber structure I proposed. Working on that using a 1:2 mock-up in my last days before the presentation, I found out there are some concerns as well as potentials to explore further.

4. *How do you assess the academic and societal value, scope and implication of your graduation project, including ethical aspects?*

Phasing out coal and transitioning to renewable energy is a huge challenge for coal-producing countries. Such a transition requires careful consideration of the socio-economic implications, including potential job losses in the coal sector and the need to ensure continued access to affordable electricity for the population. Creating regenerative spatial interventions that are inspired by the local culture can be a solution to integrate all those considerations into an object

that can be understood and appreciated by the community while softening the usual top-down approach from the government. Moreover, It also presents an opportunity to envision a more resilient and environmentally responsible community that can serve as a model for other regions facing similar challenges. In a broader perspective, this approach hopefully can inspire the acceleration of the energy transition, especially for a developing country that is still struggling to find a new direction in the coming post-coal era.

5. *How do you assess the value of the transferability of your project results?*

My project acts as a model of how local people in the coal mining area can reclaim their land and use it in a more circular and sustainable way. It started by analysing the urban scale and then looking closely at the building scale. This results in a set of interventions that respond to the common characteristics of coal mining as well as the contextual aspects of coal mining. That methodology of analysing and integrating different scales and different timelines during coal mining closure with the new development can be applied in another coal region with similar problems. Moreover, the fact that the materials used in the project are mainly sourced from inside the mining area, which started with a well-known reclamation process, makes it easy to replicate the construction method in other open-pit coal mine areas.