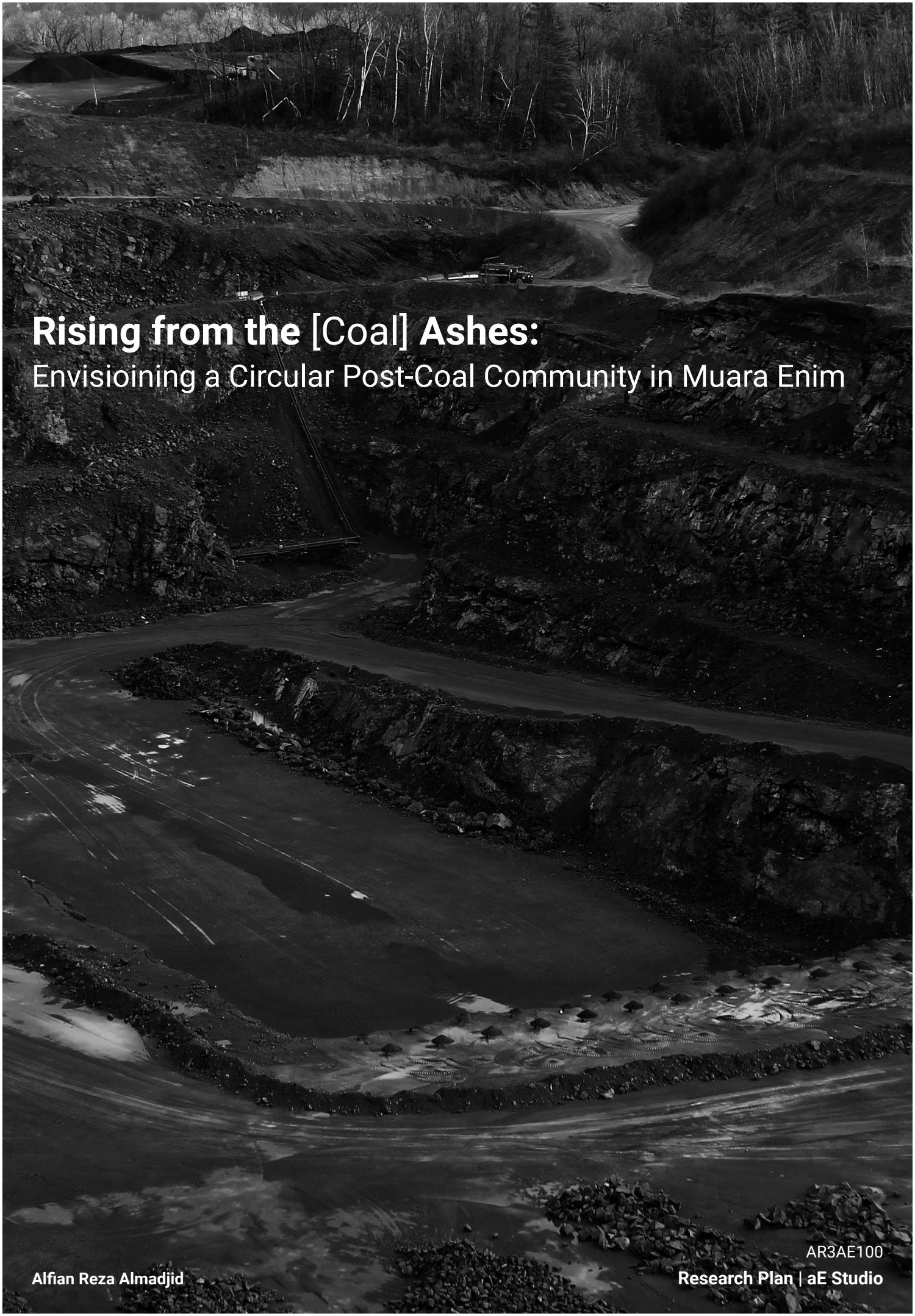

Rising from the [Coal] **Ashes:**
Envisioining a Circular Post-Coal Community in Muara Enim

AR3AE100

Alfian Reza Almadjid

Research Plan | aE Studio

Personal Information

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Graduation Project

Project Tittle	: Rising from the [Coal] Ashes
Keywords	: Regenerative Design, Energy Transition, Post-Coal Community, Agroforestry

Studio

Name of studio	: Architectural Engineering
Design tutor	: Mo Smit
Research tutor	: Jos de Krieger

Argumentations of choice for the studio

I've always been interested in learning what architecture can actually do to help mitigate climate change or improve the environment since at the moment, it seems like we are doing more harm than good. I am also curious to find out how the future would / should look like when we finally move from fossil fuel. Therefore, I found this studio's focus on addressing environmental and societal challenges using technology quite interesting. On top of that, this studio also gives us the freedom to formulate our own programs and context based on our personal fascination.

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Problem Statement

As we are grappling to avoid climate catastrophe and trying to shift toward sustainability, we need to rethink the way we use our natural resources and generate our energy. For far too long, our reliance on fossil fuels, deforestation, and unchecked industrial activities have taken a toll on our planet's ecosystems. The consequences are evident, from rising global temperatures, more frequent and severe natural disasters, to the loss of biodiversity.

The urgency of addressing climate change and mitigating its impacts has prompted countries around the world to reassess their policies and initiate a transition to renewable energy. At the heart of this transition is the phasing out of coal, which has been the main discussion topic for the last decade since coal is the most polluting energy source, accounting for about 67% of the total global emissions related to energy in 2022 (ember-climate.org). While most Western countries have rapidly moved to solar panels and wind turbines, things are more complicated in coal-producing countries, especially at the local level. Apart from the technical and environmental aspects, they also have to address the complex social dimension that is intertwined around the mining activity.

Indonesia, one of the biggest coal producers in the world, is among the nations that have pledged to phase out coal by 2050. The colonial legacy that has shaped the nation's economic and environmental landscape will soon be ended with the issuance of Presidential Regulation No. 112/2022. As one of the oldest and most active mining regions in Indonesia, Muara Enim in Sumatra is among the first regions to experience the impact of that transition. Since the Dutch's coal discovery in 1919, followed by massive expansion by national coal companies, coal-related activity has been part of their people's lives. It has also changed their way of life from an agricultural village to a coal mining region.

Drawing insights from other coal regions that experienced an economic and social disruption after their coal mining closure, comprehensive planning is needed to ensure a just and seamless transition. Planning that is not only addressing the political and technical aspects but also the community and its culture. Above all, this transition should also encourage a shift away from an extractive and capitalist mindset towards a more generative one.

This thesis will focus on three main problems that are currently happening and will happen in Muara Enim region after the coal mining closure :

Environmental Damages During and After Coal Mining Activity

Coal is one of the dirtiest energy sources when it comes to environmental impact. Beyond the well-documented greenhouse gas emissions generated when coal is burned, the entire process, from extraction to transport and utilization, has a negative impact on the surrounding environment. Water contamination, Air pollution, and depriving wildlife of their habitats are common conditions that can be found around an open pit mining area like in Muara Enim.

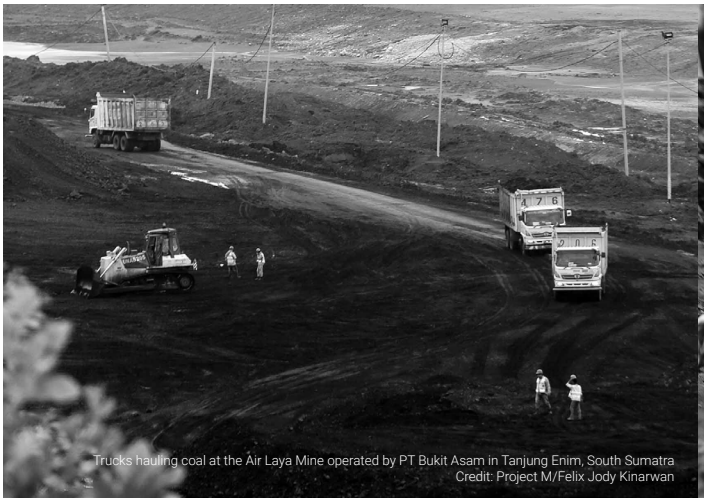
In Indonesia, the damages on the ground quite often persist even after coal mining operations have ceased, as many mining companies are struggling to fulfill their obligation to restore their mining area. Inadequate financial resources and insufficient government enforcement are among the reasons for so many mining pits being left abandoned and become death traps for local residents. At least 168 people, mainly children, have died after falling into abandoned mining pits across Indonesia over the past seven years, according to a new report.

Lack of Economy and Energy Generator

Despite its damaging impact on the environment, coal mining remains the primary sector in Indonesia, notably in Muara Enim region, where it contributed to more than 60% of their total GRDP (IESR, 2023). The temptation of the coal economy has also driven many local people to leave their jobs in the agricultural sector to be illegal coal miners. Despite the high risk and lack of safety measures, it is believed to be more profitable than working on a farm or rubber plantation. Alternative employment is therefore urgently needed to counter this heavy reliance and create a sustainable economy in the future. A similar case applied for the energy aspect as the government also needs to prepare a new energy infrastructure before they can stop the coal powerplant.

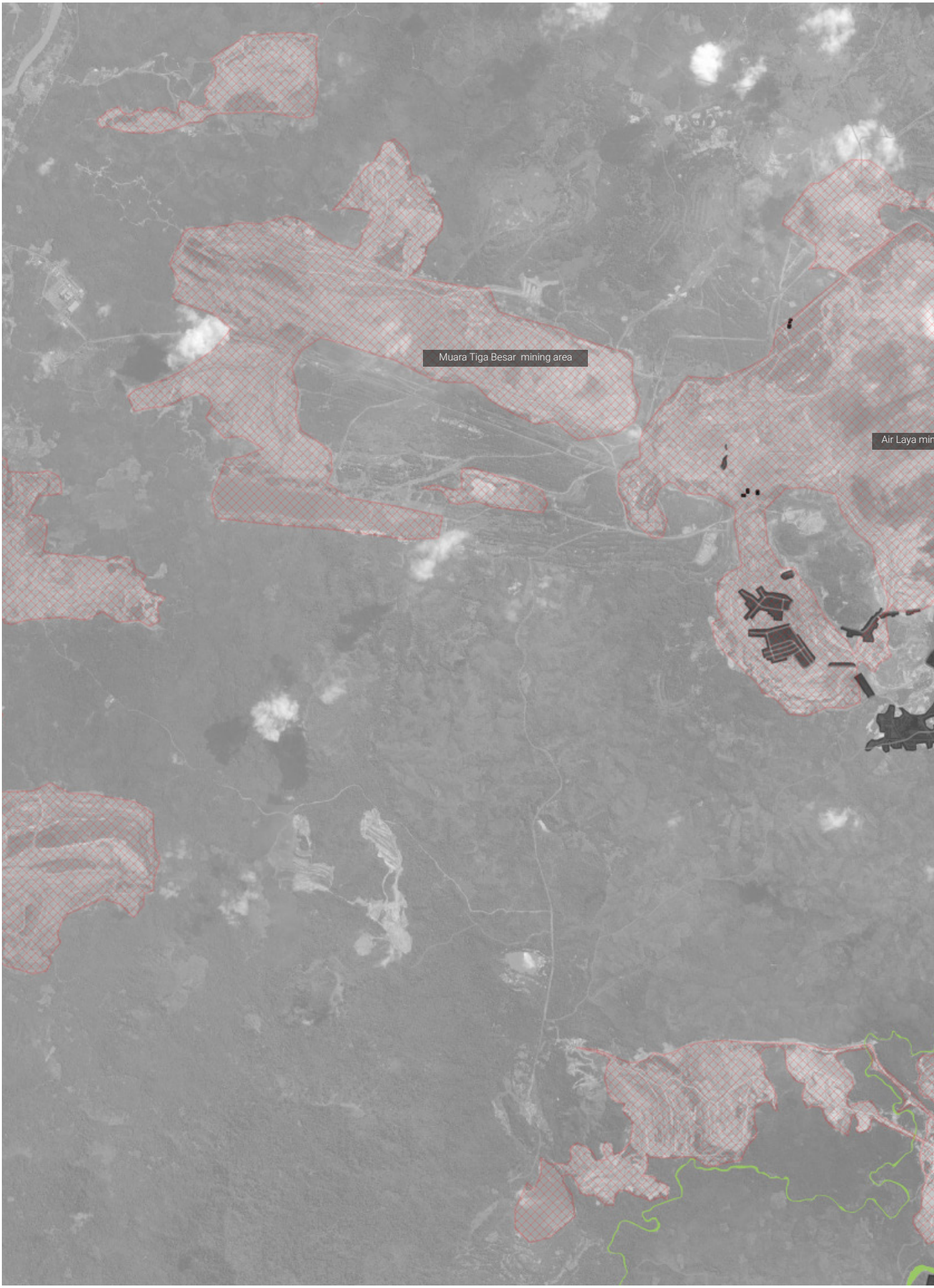
Loss of Architectural Identity & Building Culture

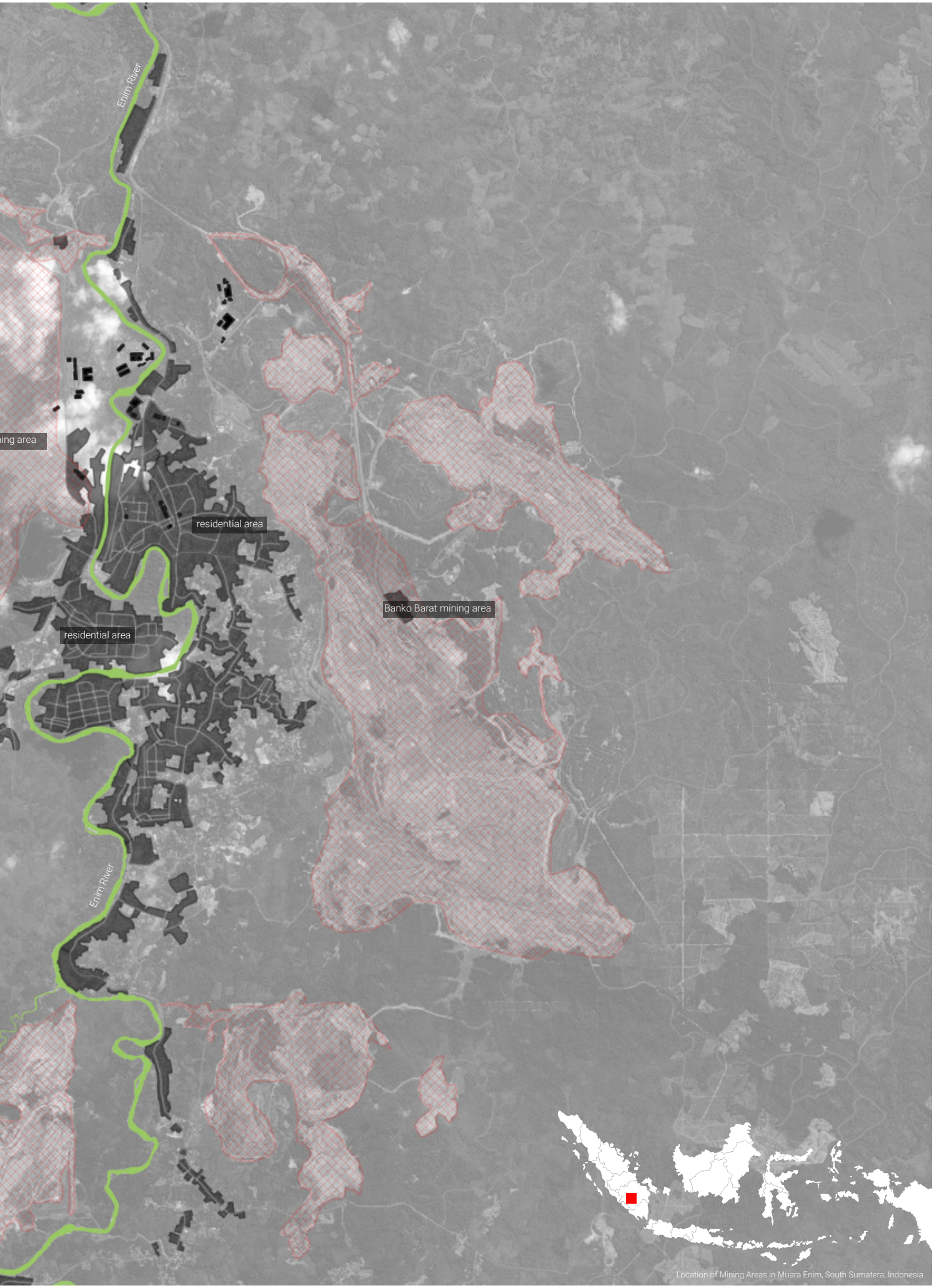
The rapid economic boom driven by coal mining activities without being balanced with education has, in many instances, contributed to cultural degradation in the urban fabric. The pursuit of a modern lifestyle and the depleted natural resources because of the mining activity make it seem more sense for people to choose cheap and readily available materials like concrete and steel instead of using local wood and preserving their architectural Identity. The (seemingly) abundance of energy sources from coal power plants also makes it easy to ignore the climatic condition of the site and rely on mechanical stuff like air conditioners to control the thermal comfort.



Trucks hauling coal at the Air Laya Mine operated by PT Bukit Asam in Tanjung Enim, South Sumatra
Credit: Project M/Felix Jody Kinarwan

Illegal miner swings a pickaxe to dig coal
Credit: Project M/Rafael Miku Beding


Muara Tiga Besar mining area
Air Laya min



Location of Mining Areas in Muara Enim, South Sumatera, Indonesia

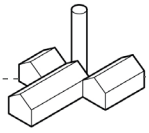
Design Objective

The main goal of this graduation project is to **revitalize the environment** and **improve people's life quality** in a (soon-to-be-closed) coal mining region while using the transition momentum to envision a new community in a post-coal era that revolves around **circularity and regenerative principles**.

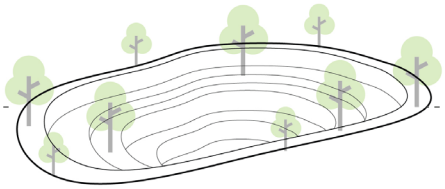
Looking at the context of Muara Enim, which is located around communities with agricultural and forestry cultures, an agroforestry-based economy is arguably the most promising and suitable option to replace the current coal economy. It is also supported by the aspirations of the local people who hope that the former mining sites will be restored and they could have access to cultivate the land. With spatial and technological intervention to optimize productivity, reclaiming the coal mining site for agroforestry practice will not only repair the ecological damage caused by the mining activities but also improve the livelihood of the community by providing suitable jobs, more sustainable construction materials, and potential alternative energy sources.

Understanding that designing a single building in itself will not be enough to address the complexity of transitioning coal area into agroforestry activity, this project will first present a transition strategy on a regional scale to build a framework of the future economy & energy model, followed by intervention on the coal mining ground and finally focus on specific infrastructure (s) that will demonstrate the new architectural paradigm emerged from this transition. .

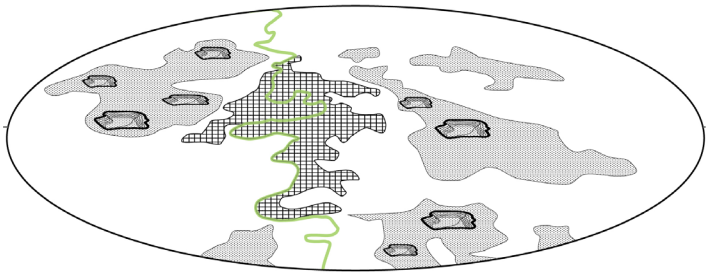
3. building design



2. landscape restoration



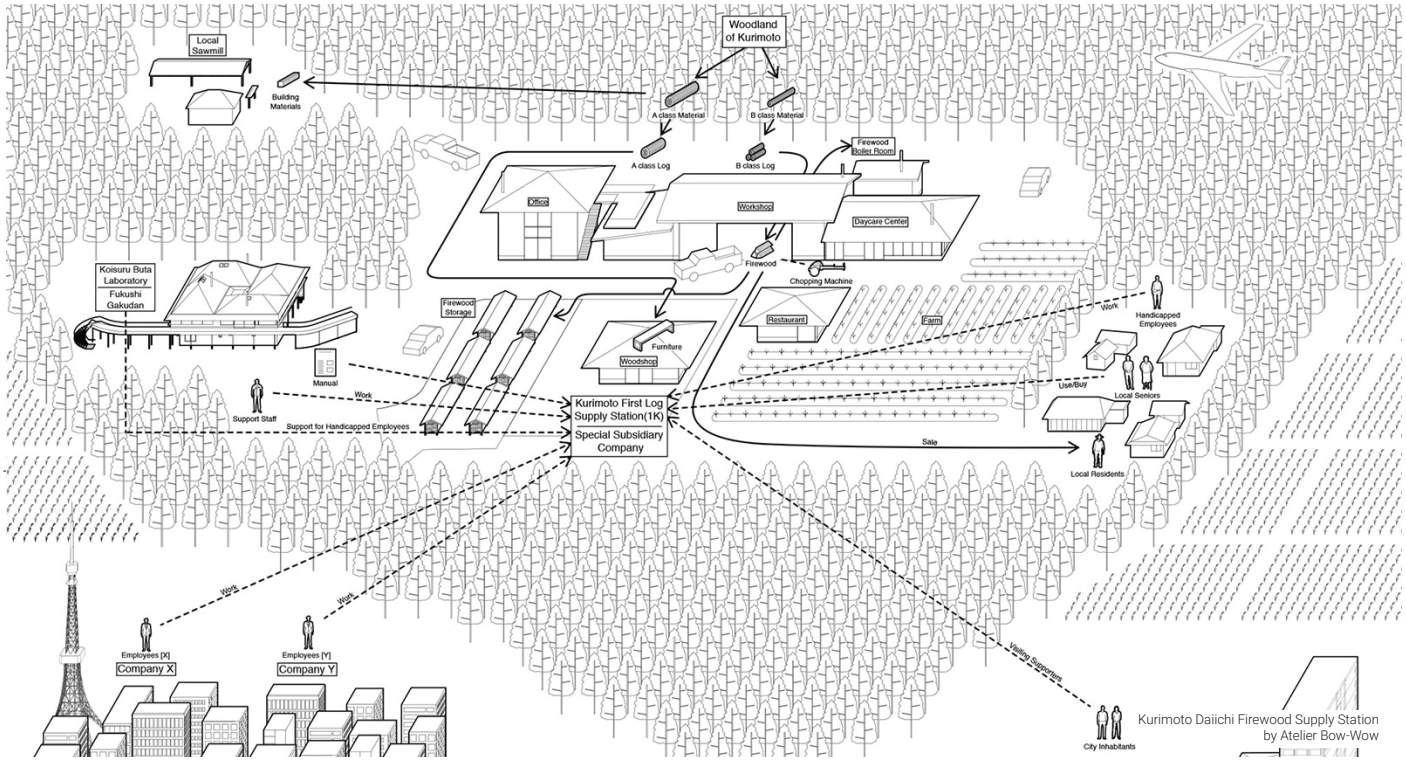
1. regional strategy



In the end, the essence of this project is to use this energy transition narrative to call for a change in a much wider aspect of our life. Not only about finding a better way to fulfill our basic needs, but also to reconnect with our precious nature and culture.

Heathrow Mycelium Factory Village
by Shu Chung

Living Band-Aid, REVIVING MINES: SHANDONG PARK Competition
by Mulkiye KART



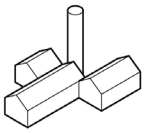
Kurimoto Daiichi Firewood Supply Station
by Atelier Bow-Wow

Design Question

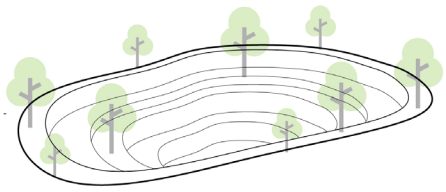
Main Question :

How can architectural interventions help facilitate **energy transition** & **environmental restoration** in a coal mining region by envisioning a **circular agroforest community** in Muara Enim?

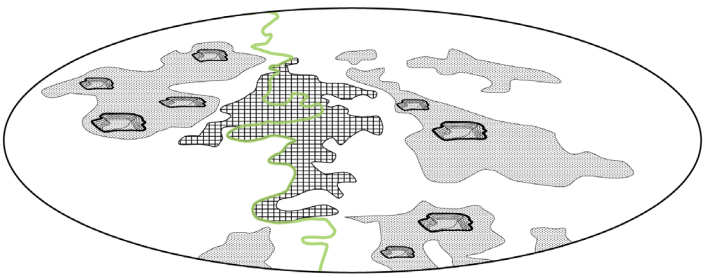
Sub Questions :



How to design a **self-sustained agroforest facility** that demonstrates the building culture of post-coal era?



How can the coal mining area be transformed into a **productive landscape while enhancing biodiversity**?



How to develop a spatial strategy that addresses the current and future problems of the coal mining village related to **alternative economy and energy generator**

Relevance

Phasing out coal and transitioning to renewable energy is a huge challenge for many countries, particularly those with a strong dependency on coal for employment and electricity like Indonesia. 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.

A shepherdess watches over her flock of sheep grazing near a coal-fired power plant
Credit: Kemal Jufri

Research Framework

Thematic Research :
Transition from coal to agroforestry economy

- What are the current flow of the economy, energy, and the waste.
- What are the future scenarios after coal closure, and what is needed

- What is agroforestry
- What are the spatial components
- How it can subtitute coal in term of economy, energy, and waste.

- What are the Intervention solutions in regional scale
- What is the Proposed infrastructure design

Expected outcomes :

- Regional Strategy
- Program requirements for the design assignment

Contextual Research : Physical Condition

- How mining activity has changed the landscape
- What is the current soil condition
- What is the native species & biodiversity
- Value assesment of existing mining infrastructure

Expected outcomes :

- Land restoration process
- Selection of vegetation
- Possibility of reusing material

Contextual Research : History and Culture

- How was the culture and the way of life of people in Muara Enim
- How mining activity has influenced the culture, architecture, and urban development.

Expected outcomes :

- Community involvement strategy
- Architectural Expression & Material selection

How to develop a spatial strategy that addresses the current and future problems of the coal mining village related to **alternative economy and energy generator**

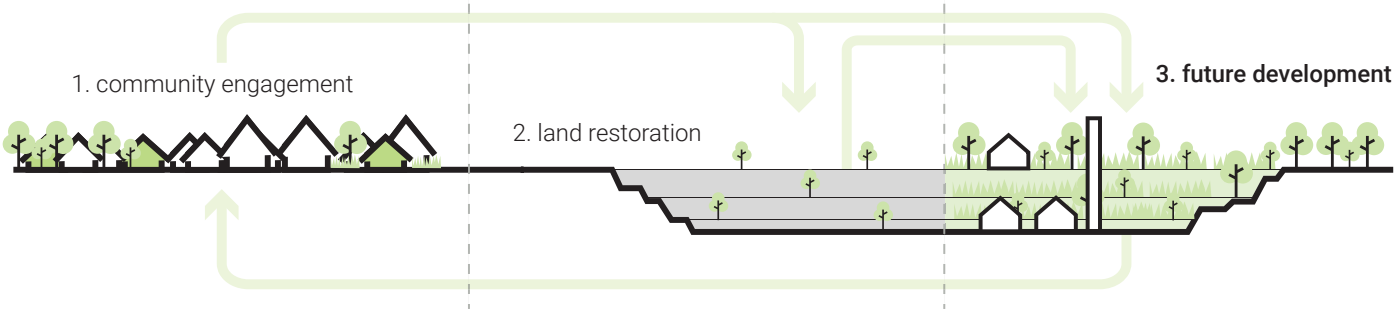
How can the coal mining area be transformed into a **productive landscape while enhancing biodiversity**

How to design a **self-sustained agroforest facility** that demonstrates the building culture of post-coal era?

Research by Design :

Programming | Context & site analysis | Concept Design | Technical iteration | Detailed Design

Expected Final Outcomes :



Thematic Research Objective

The objective of the thematic research is to assist the design process with a clear understanding of urban metabolism in a coal mining region and give the toolkits needed to address the current and future problems related to the closure of coal mining activities.

As stated in the design objective that agroforestry has the potential to substitute the coal mining industry, this thematic research will focus on investigating the opportunity of spatial intervention using that new economic model in three main fields, namely: **economy/employment**, **energy**, and **waste material**. The expected outcome will help define the regional strategy and specific programs needed in the future (that will be the subject of the design assignment).

Thematic Research Question

What are the **current and future problems and potentials** of Muara Enim related to the ongoing mining activity and how would the (re)introduction of **agroforestry as the substitute activity** help create a **better economy and energy generator ?**

Thematic Research Structure

1. Context
    - Problem
    - Opportunities

2. Methodology
    - Literature, MFA
    - Data collection
    - Research question

3. Muara Enim Analysis (current and future)
    - Economy
    - Energy
    - Waste
    - Water

4. Agroforestry
    - Introduction
    - Component needed in regional scale
    - Component needed in Building scale

5. Intervention Solutions (Region Scale)
    - Economy
    - Energy
    - Waste

6. Proposed Infrastructure (Building Scale)
    - Program & requirements

7. Conclusion

Research Methodologies

Thematic Research : Transition from coal to agroforestry economy	**Research Method**
• What are the current flow of the economy, energy, and the waste. • What are the future scenarios after coal closure, and what is needed	• Material Flow Analysis (MFA) + Interview & Site Visit Understanding of the processes in and around the mining site and Muara Enim region, by identifying and quantifying resource, waste, and energy flows.
• What is agroforestry • What are the spatial components • How it can subtitute coal in term of economy, energy, and waste.	• Literature Study Study of the literature on Agroforestry and its connection to circular economy and sustainable energy production.
• Intervention solution in regional scale • What is the Proposed infrastructure design	• Case Study Exploring relevant examples of spatial interventions related to Agroforestry economy and energy production.

Contextual Research : Physical Condition	**Research Method**
• How mining activity has changed the landscape • What is the current soil condition • What is the native species & biodiversity • Value assesment of existing mining infrastructure • How is the process of land restoration	• Literature Study Study of the literature on Coal mining process, Regenerative design, and Ecology restoration. • Interview Discussions with experts to gain more technical knowledge of land restoration • Case Study Exploring relevant examples of Land restoration projects after coal mining closure • Site Visit Experiencing the spatial condition of the site to get a more intuitive understanding of its physical condition and climatic aspects.

Contextual Research : History and Culture	**Research Method**
• How was the culture and the way of life of people in Muara Enim • How mining activity has influenced the culture, architecture, and urban development.	• Literature Study + Archival Reseach Study of the literature on the Culture of Muara Enim and the History of their coal mining activity • Interview Discussion process to enable the project to align or challenge the overarching strategies and visions for the region • Site Visit Experiencing the spatial condition of the site to get a more intuitive understanding of its people and culture.

Literature & References

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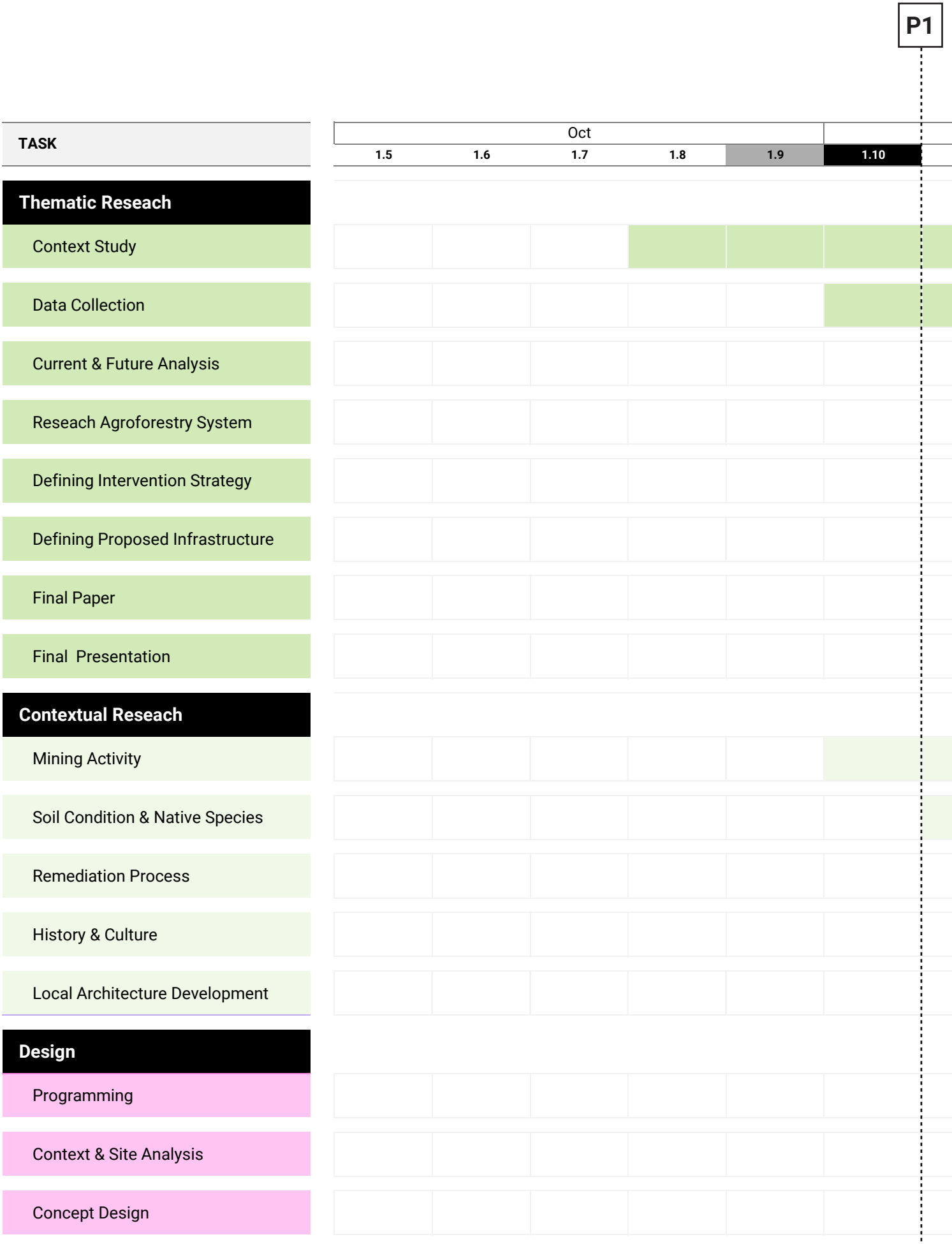
Study Cases

Kurimoto Daiichi Firewood Supply Station by Atelier Bow-Wow	Building program
Rwanda Institute for Conservation Agriculture by Mass design group	Building program
Eden Project, Cornwall, UK by Grimshaw Architects	Landscape Restoration
ReGen Villages by Effekt	Self sustained community

Planning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Current & Future Analysis
Reseach Agroforestry System
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Mining Activity
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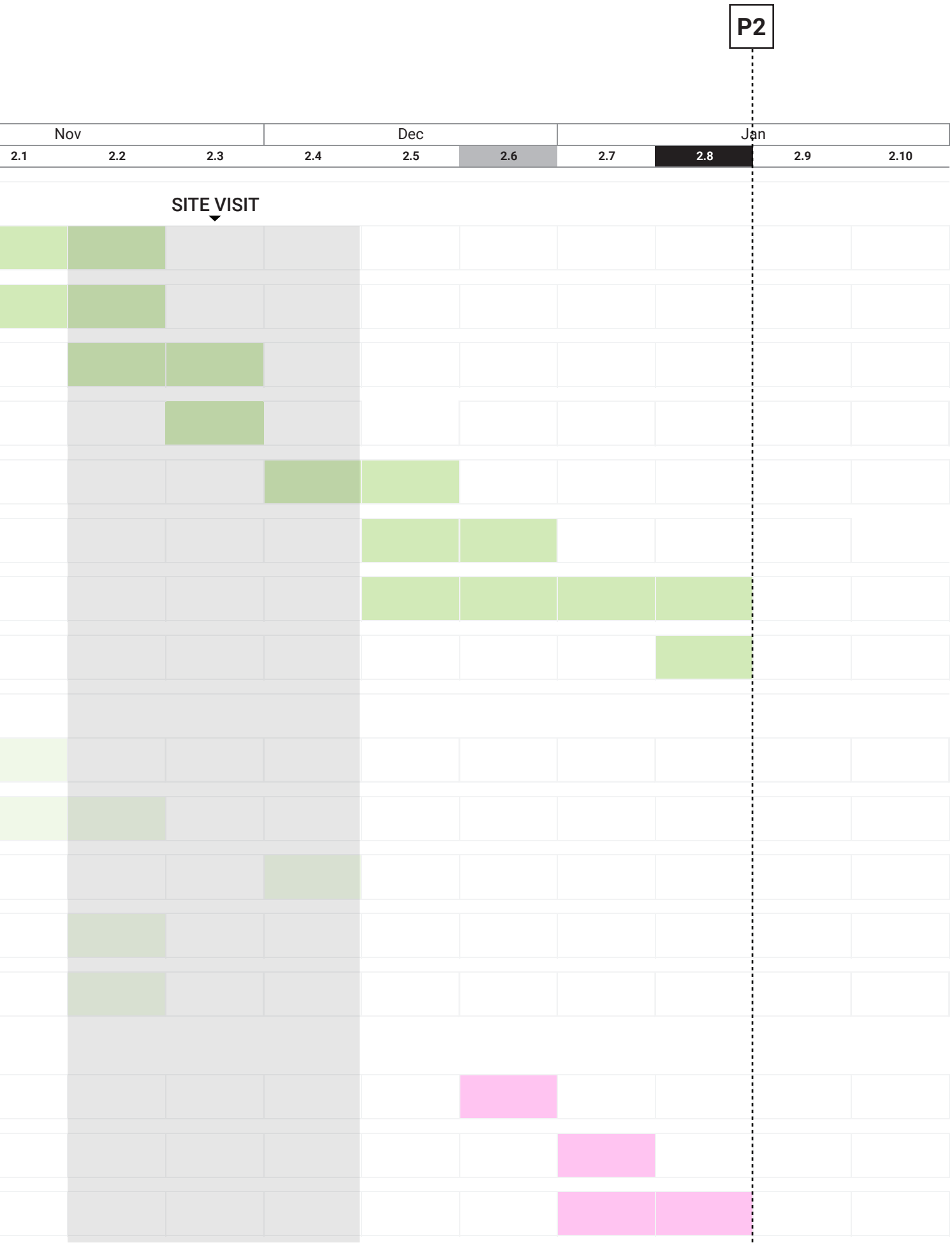
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