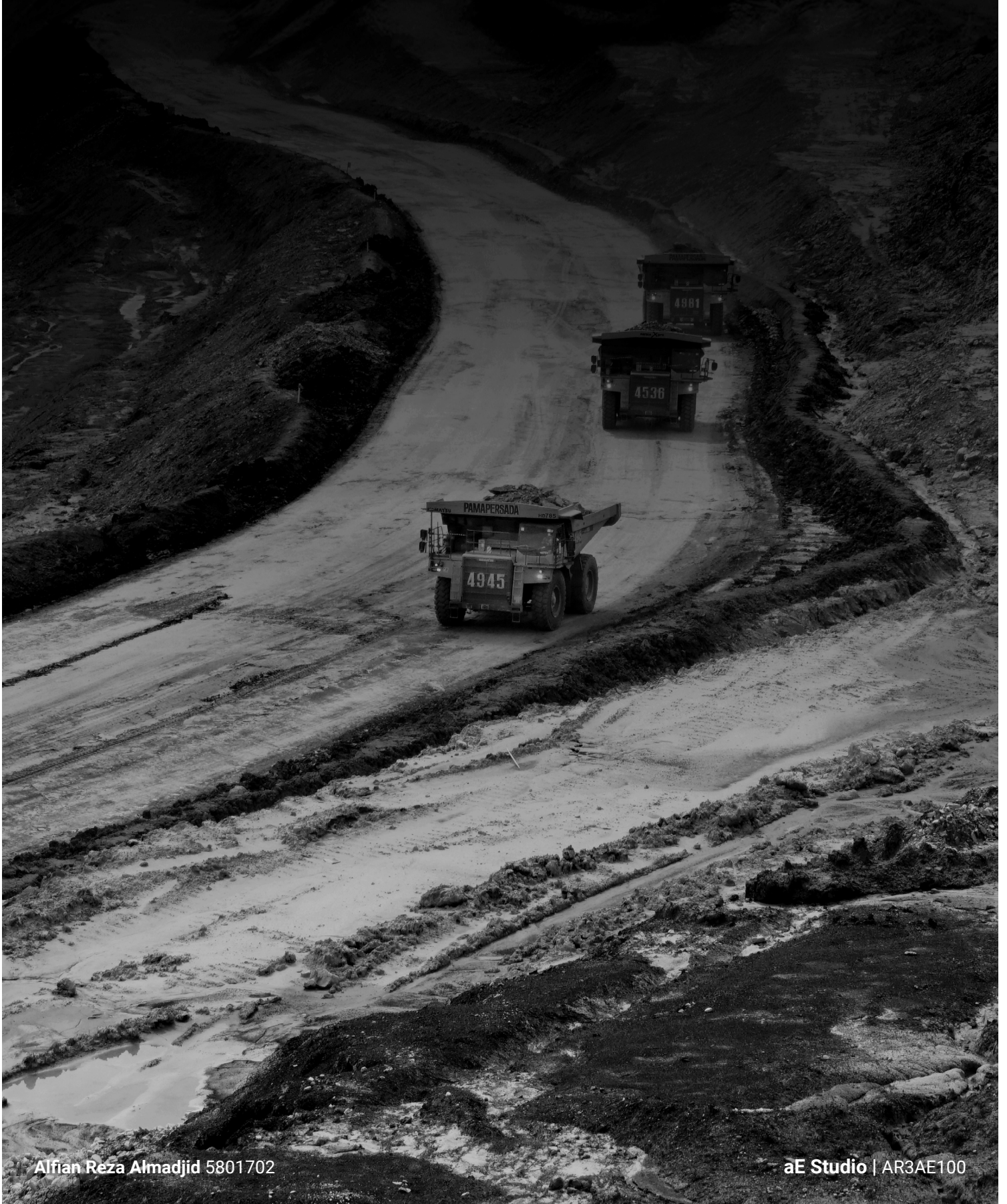


Rising from the [Coal] Ashes: Envisioning a Circular Post-Coal Community in Muara Enim

_Graduation Plan



Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Alfian Reza Almadjid
Student number	5801702

Studio		
Name / Theme	Architectural Engineering / Harvest	
Main mentor	Mo Smit Jos de Krieger	Architecture Architecture
Second mentor	Arie Bergsma	Building Technology
Argumentation of choice of 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 very interesting. On top of that, this studio also gives us the freedom to formulate our own programs and context based on our personal fascination.	

Graduation project	
Title of the graduation project	Rising from the [Coal] Ashes: Envisioning a Circular Post-Coal Community in Muara Enim
Goal	
Location:	Muara Enim, Indonesia
The posed problem,	<p>Coal mining closure as part of the energy transition and global shift towards sustainability will have significant impacts on society, especially for coal-producing regions in developing countries that not only have to deal with the technical aspects but also the complex social, environmental, and economic dimensions.</p> <p>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.</p>

	<p>Drawing insights from other coal regions that experienced an economic and social disruption after their coal mining closure, comprehensive planning is therefore 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.</p> <p>Above all, this transition should also encourage a shift away from an extractive and capitalist mindset in every aspect (including buildings and urban development) towards a more circular and generative one.</p> <p>This thesis highlights problems that are currently happening and will happen in Muara Enim region after the coal mining closure, namely:</p> <ul style="list-style-type: none"> • Environmental damages from open-pit coal mining activity. • Need for alternative economy and energy generator. • Lack of public participation in the current transition strategy. • Loss of architectural identity & building culture. <p>Looking at the history of Muara Enim and the aspirations of local people, agroforestry is proposed as the future substitute activity and will serve as a framework around which the architectural interventions will be centered.</p>
<p>research questions and</p>	<p>Main Design Question: How can architecture interventions help facilitate energy transition & environmental restoration in a coal mining region by envisioning a circular agroforest community with a public participation approach in Muara Enim?</p> <p>Sub Questions:</p> <ul style="list-style-type: none"> • How to develop a spatial strategy that addresses the current and future problems of the coal mining village related to alternative economy and energy generators using agroforest practice? • 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 culture of a post-coal era?
<p>design assignment in which these result.</p>	<p>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 that will demonstrate the new architectural paradigm emerged from this transition. In this case, an agroforest facility in the former coal mining area is proposed as an exemplary model to show what approach architecture can take in the future without coal and, at the same time, create a model of how local people can reclaim and cultivate their land. This facility will integrate fish farms, agriculture land, and forestry, with additional programs like workshops, processing center, and temporary settlement for the farmers.</p>

Process

Method description

Thematic Research : Transition from coal to agroforestry economy

Material Flow Analysis (MFA) & Literature Study

- 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 substitute 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

Site Visit, Interview & Literature Study

- 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

Site Visit, Interview & Literature Study

- 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 :

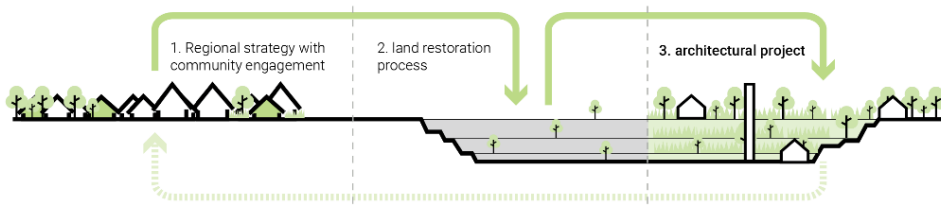
- Community involvement strategy
- Architectural Expression & Material selection

- 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 :



Inspired by Luke Jones's statement in the book *Non-Extractive Architecture. On Designing Without Depletion* (2021) that "...every building constitutes a commitment to, or dependency on, a certain kind of future... the checks written by the tectonics of today's buildings may turn out to be worthless, or worse than worthless, in 2050 or 2060, if their futurism proves inaccurate." I believe that before proposing any architectural interventions, 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, the project started 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 is used as the main method to map the problem and potential related to the energy and material in Muara Enim and how agroforestry practice can contribute to create better conditions. The expected outcome will help define the regional strategies and architectural concepts that will be the starting points in the design assignment.

Following that, further research on the physical condition and the cultural aspect of Muara Enim will be conducted through a site visit, interview, and literature study. This research gives contextual and technical knowledge that will be used to involve the community and integrate the building with the resources available on-site and the future reclamation process.

Moving to the design phase, all the architectural concepts, programs, and a list of resources that have been formulated in the research phase will be worked out further. Sketching and model-making will be the main methods to test and explore the possibilities of different design solutions. In the end, this project will generate a complete guideline on how local people in a soon-to-be-closed coal mining region can reclaim their land. From a regional scale to the landscape, to the building scale.

Literature and general practical preference

- Barrett, M. (2020). *Simec Uskmouth Power Station Development ES - Non-Technical Summary*. <https://simecatlantia.com/wp-content/uploads/2021/05/Uskmouth-Power-Station-Conversion-ES-NTS-complete-low-res-final.pdf>
- Casau, M., Cancela, D. C. M., Matias, J. C. O., Dias, M. F., & Nunes, L. J. R. (2021). Coal to Biomass Conversion as a Path to Sustainability: A Hypothetical Scenario at Pego Power Plant (Abrantes, Portugal). *Resources*, 10(8), 84. <https://www.mdpi.com/2079-9276/10/8/84>
- Christian, Y., Afandi, A., Prabowo, B., Rikardi, N., & Desmiwati, D. (2023). The feasibility of converting ex-coal mining void into aquaculture in North Kalimantan. *Journal of Degraded and Mining Lands Management*, 10, 4143. <https://doi.org/10.15243/jdmlm.2023.102.4143>
- Commission, E. (2023). *Driving Change: How to implement a successful regional just transition*.
- Enim, P. M. (2004). *Peraturan Daerah Kabupaten Muara Enim Nomor 4 Tahun 2004 tentang Pemanfaatan Lahan Bekas Tambang Batubara PT Bukit Asam (Persero) Tbk di Kabupaten Muara Enim*. Muara Enim: Pemda Muara Enim
- Graedel, T. E. (2019). Material Flow Analysis from Origin to Evolution. *Environmental Science & Technology*, 53(21), 12188-12196. <https://doi.org/10.1021/acs.est.9b03413>
- Hermawan, B. (2016). Sustainable Agroforestry Models for Proposed Food Production in Post-Mined Land Sites of South Sumatera. *International Journal on Advanced Science, Engineering and Information Technology*, 6, 245-251. <https://doi.org/10.18517/ijaseit.6.2.727>
- Hermiati, E., Fatriasari, W., Yanto, D., Falah, F., & Risanto, L. (2013). *NATURAL RUBBER-BASED WOOD ADHESIVE TO SUPPORT GREEN BUILDING*.
- IESR. (2021). *Beyond 443 GW: Indonesia's infinite renewable energy potentials*.
- IESR. (2023). *Just Transition in Indonesia's Coal Producing Regions, Case Studies: Paser and Muara Enim Regency*.
- Kaiser, E. (2020). *Chhattisgarh abandoned mine turns as livelihood source for poor tribals*. The New India Express. <https://www.newindianexpress.com/good-news/2020/Jan/20/chhattisgarh-abandoned-mine-turns-as-livelihood-source-for-poor-tribals-2091758.html>
- Kontan.co.id. (2021). *Punya lahan pasca tambang yang luas, Bukit Asam (PTBA) dukung pengembangan EBT*. <https://investasi.kontan.co.id/news/punya-lahan-pasca-tambang-yang-luas-bukit-asam-ptba-dukung-pengembangan-ebt>
- Manurung, D. Y., Kumara, I. N. S., W.G. Ariastina, W. G. A., & Pangaribuan, J. (2022). Analisis Perkembangan PLTS di Provinsi Sumatera Selatan Menuju Target 296,6 MW pada Tahun 2025. *Jurnal SPEKTRUM*(1), 54-61%V 59. <https://doi.org/10.24843/SPEKTRUM.2022.v09.i01.p7>
- Muhsin, H. (2020). *Analisis Tingkat Penggunaan Daya Listrik dan Lama Waktu Pemakaian Terhadap Total Energi Listrik di Aceh Besar Universitas Islam Negeri Ar-Raniry*].
- Nair, P. K. R., Kumar, B. M., & Nair, V. D. (2021). Definition and Concepts of Agroforestry. In P. K. R. Nair, B. M. Kumar, & V. D. Nair (Eds.), *An Introduction to Agroforestry: Four Decades of Scientific Developments* (pp. 21-28). Springer International Publishing. https://doi.org/10.1007/978-3-030-75358-0_2
- Otchere, F., Veiga, M., Hinton, J., Farias, R., & Hamaguchi, R. (2004). Transforming open mining pits into fish farms: Moving towards sustainability. *Natural Resources Forum*, 28, 216-223. <https://doi.org/10.1111/j.1477-8947.2004.00091.x>
- Pertamina. (2021). *Kuota dan Realisasi Premium Pertamina per Kota Kabupaten Tahun 2021*. <https://pertamina.com/id/Kuota-Dan-Realisasi-Premium-Pertamina-per-Kota-Kabupaten-Tahun-2021-Update-September-2021>
- Regency, B.-S. o. M. E. (2023). *Muara Enim Regency in Figures 2023*.
- Resources, D. G. o. O. a. G. M. o. E. a. M. (2022). *Statistic Oil and Gas Semester I 2022*
- Riyandanu, M. F. (2023). *PLN Tak Siap Serap Produksi Listrik, Aktivitas PLTU Sumsel-8 Tertunda*. Katadata.co.id. Retrieved 28/12 from <https://katadata.co.id/desysetyowati/berita/63e0f665d5bca/pln-tak-siap-serap-produksi-listrik-aktivitas-pltu-sumsel-8-tertunda?page=2>
- Space, C., & Foundation, V. A. C. (2021). *Non-extractive architecture : on designing without depletion*. V-A-C Press ; Sternberg Press.
- Stremke, S., Oudes, D., & Picchi, P. (2022). *Power of landscape : novel narratives to engage with the energy transition*. nai010 publishers.

Suri, T. M., Sair, A., & Yusuf, S. (2021). Sejarah Penambangan Batubara Bukit Asam di Tanjung Enim. *HISTORIA Jurnal Program Studi Pendidikan Sejarah*, 9(1), 87-96.
<https://doi.org/10.24127/hj.v9i1.2672>

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), 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, as a practice closely related to technology and society, 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 or to the future (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, to engage in the energy transition conversation and challenge the current discourse that is dominated by politicians.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

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.