ESTONIAN INDUSTRIAL SYMBIOSIS AGROPARK

EISAP Concept Masterplan

November 2021

IVIA EXPAND YOUR BUSINESS

RAHANDUSMINISTEERIUM
REGIONAALARENGU TOETUSEKS

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I. INTRODUCTION

The concept report in front of you describes the vision, goals, and ambitions for the Estonian Industrial Symbiosis Agro Park (EISAP). It contains a concept masterplan for the development of the park, as well as the properties of the site itself.

This concept masterplan was initiated by IVIA, in participation with all stakeholder companies. A development team, consisting of IVIA, Enefit, Narva-Jõesuu Municipality, Adven, Alkranel, Project 363, and Except Integrated Sustainability are currently working on the development of the masterplan.

1.1 GOALS AND AMBITIONS

Ida-Virumaa Industrial Areas (IVIA) is a public-sector development organization, active in the east of Estonia. It is a cooperation between three cities, a municipality and the Estonian Republic, and develops industrial and business parks in Ida-Viru County. The goal of IVIA is to attract new industrial and logistics companies to the area, and through them create new workplaces. IVIA does this by purchasing land for industrial and commercial investment and development, establishing the necessary infrastructure, and by supporting customers with individual guidance, easing the introduction of foreign organizations into Ida-Viru County. IVIA currently owns more than 300ha of land, and aims to acquire a new area of 1500ha to expand its development offering.

1.2 ABOUT THE LOCATION

The site for EISAP is situated close to Auvere, south-west of the Enefit oil-shale extraction site and power plant. It sits on a former oil-shale surface mine, largely overgrown with young pine trees, with limited ecological value and low biodiversity. The power plant enables the area to have a direct connection to the power grid, saving on cost and increasing efficiency of energy production. The power plant also offers steam on various heat and pressure levels, and is looking for ways to capture CO_2 and connect this with nearby users of the greenhouse gas. By doing so, the environmental impact of the power plant, and as a result of Estonia as a whole, would be improved. CO_2 capture from oil-based power plant exhaust gases is a new technology that requires significant investment. A business model to support the CO_2 capture is welcomed as part of the development plan for the area.

1.3 THE CONCEPT MASTERPLAN

At the core of the masterplan lies the desire to create industrial symbiosis, a concept in which wastes or by-products of industrial processes are used as a feedstock for other industrial processes. Applying this to an agropark has major benefits to all parties involved. The masterplan goes into strategies for the greenhouses, industries and offices, but also into the landscape, services, infrastructure and logistics, water, agroforestry, and more.

Finally, the impacts of the development are described, supported by recommendations for the next steps of the process.

II. GOALS & VISION

The goal of the Estonia Industrial Symbiosis Agro Park (EISAP) is to make a considerable and systemic contribution to the sustainability of Ida-Viru County, by establishing long-term sustainable workplaces in the region. In addition, the hope exists to reinforce the local economy by means of national and foreign investment, and to boost the development potential of both the County and Estonia as a whole.

2.1 GOALS FOR THIS PHASE

The goals for the development of the concept masterplan are:

- To explore possibilities the land may offer for industrial and commercial use
- To explore synergies between different industries, and concepts for attractive business models to make the project a success
- To explore feasibility for the project, including the social impact in terms of jobs the project will generate
- To develop a sketch masterplan document sufficient for funding application and informing potential future partners
- Find funding for development of the concept masterplan and creation of partnerships

It is desired to already start exploring and engaging with potential future users, investors and knowledge partners for the execution stage.

2.2 VISION

EISAP is a unique opportunity for Ida-Viru County, as well as Estonia as a whole. It delivers opportunities for the application of industrial symbiosis, smart energy grids and circular economy principles, new food industries such as alternative protein sources, and the application of innovative growing technologies beyond standard greenhouse practice.

Creating an agropark like this, EISAP becomes an example for industrial symbiosis in Europe, and helps solve several challenges the EU is dealing with. It helps reduce a heavy (mostly industrial) carbon footprint, it creates bio-based and circular industries, and it provides sustainable jobs, resources, and innovation.

Finally, it strengthens international partnerships and trade, by attracting international businesses and companies to Estonia.

INDUSTRIAL SYMBIOSIS

The park's development is ideally situated to become an exemplary development of industrial symbiosis. Industrial symbiosis is the practice of planning an industrial area with closed loop, circular resource flows in mind. The resource use and waste outflow of organizations are connected to each other, and thereby enhance efficiency, circularity, while also reducing ecological footprint.

The practice of industrial symbiosis is supported by the European Union. The vision of the EU is that this strengthens both the local and the economy of Europe as a whole. New funding sources can be obtained to help support the development of EISAP towards industrial symbiosis, such as with the Cir©Lean program of the EU.

In conversation with relevant parties from the Club of Rome, associated with several European agencies, such as the EIT Raw Materials Alliance, the plan can garner support for the development of an industrial symbiosis approach.

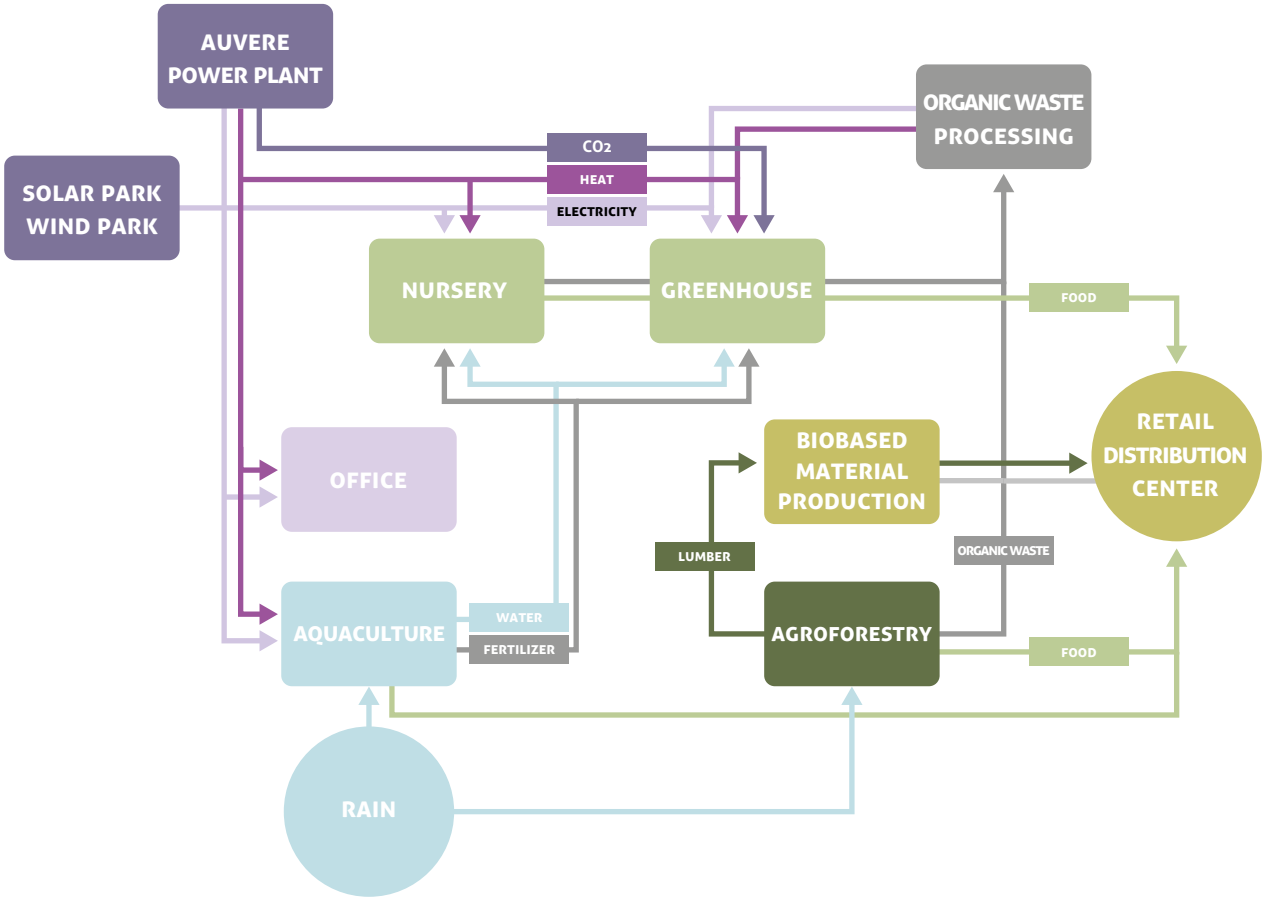


Image 1: EISAP is symbiosis at scale, including industries such as agro-food and greenhouses, using CO_2 and waste heat from the adjacent power plant.

2.3 GOAL LIST

During the process of development of the concept masterplan, the project team came together in a two-day co-creation session to further define the goals of EISAP. These goals are subdivided based on the Symbiosis in Development framework for sustainable development, and ordered on energy, materials, ecosystems, species, culture, economy, health and happiness.

Image 2: ELSI stack topical explorations during the first stakeholder co-creation session.

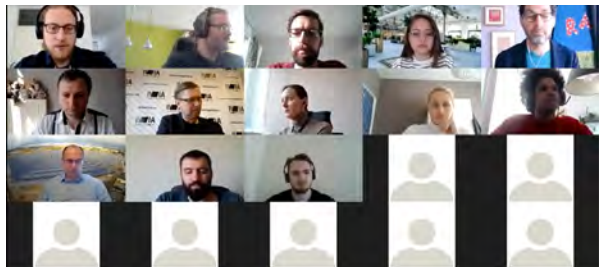
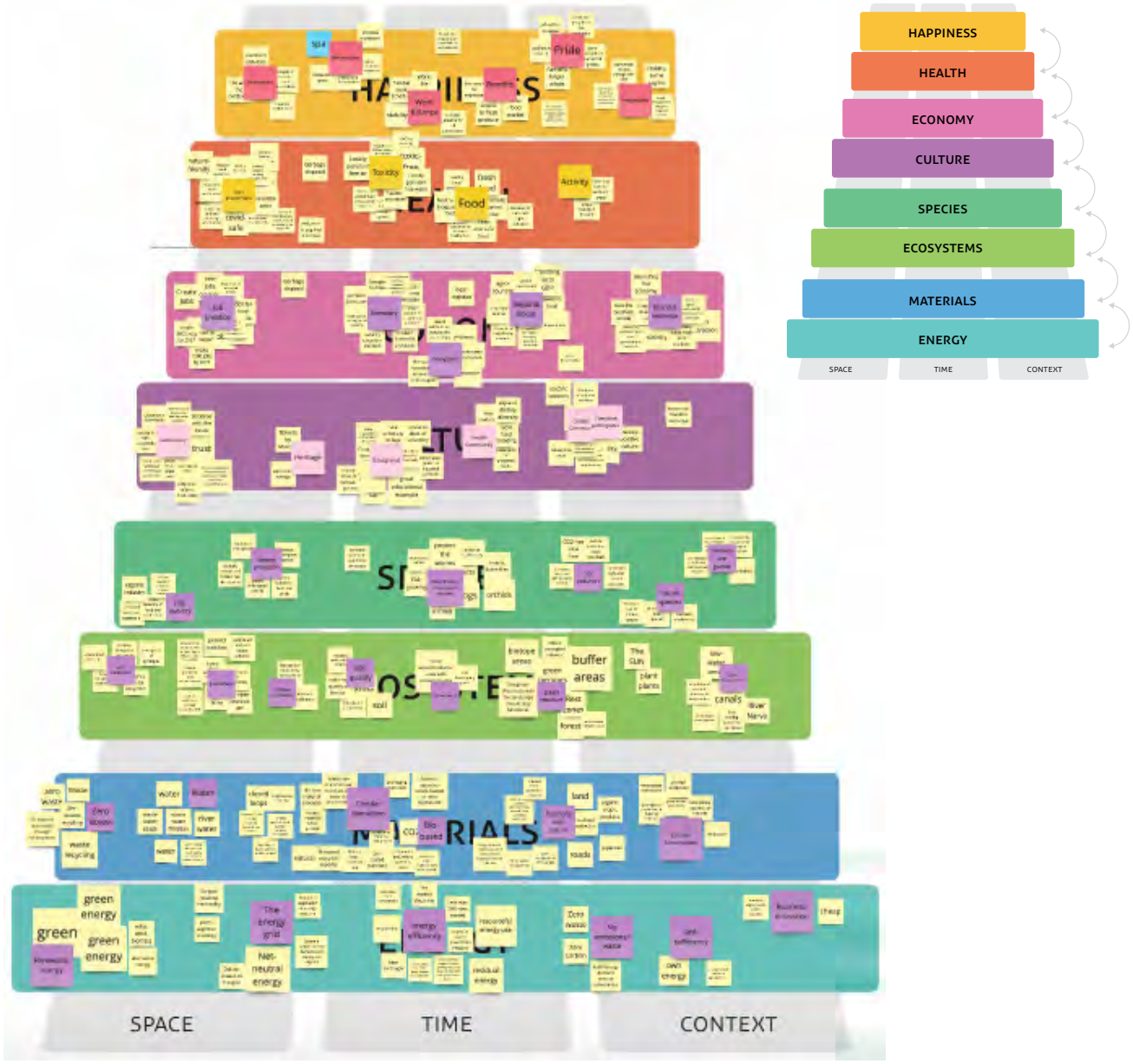


Image 3: Zoom co-creation session



HAPPINESS
- Inspiring environment
- Recreation & sports
- Work balance
- Benefits
- Pride
- Integration

HEALTH
- Work rnvironment
- Elimination of toxicity
- Food
- Activity

ECONOMY
- Job creation
- Example project
- Innovation
- Regional boost
- Financial resilience

CULTURE
- Connectivity
- Heritage
- Education
- Healthy community
- Inclusivity

SPECIES
- Crop diversity
- Species protection
- Diversification of species in the area
- No pollution
- Native species
- Humans are guests

ECOSYSTEM
- Eco-management
- Protection
- Increase biodiversity
- Soil quality
- Experiments
- Green structure
- Water management

MATERIALS
- Zero waste
- Water system
- Circular operations
- Circular construction
- Bio-based
- Harmony with nature

ENERGY
- Renewable energy
- Self-sufficiency
- Net energy exporter
- Energy efficiency
- No emissions/ waste
- Energy business/ energy Innovation

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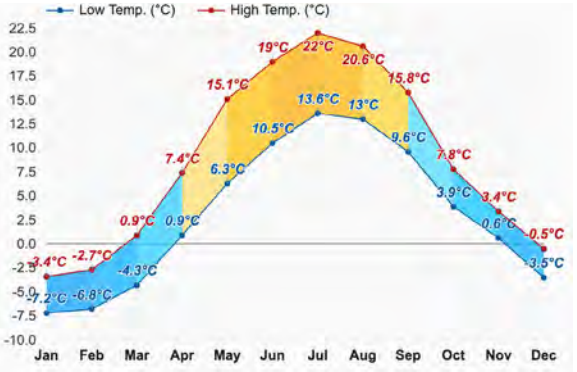
III. SITE PROPERTIES

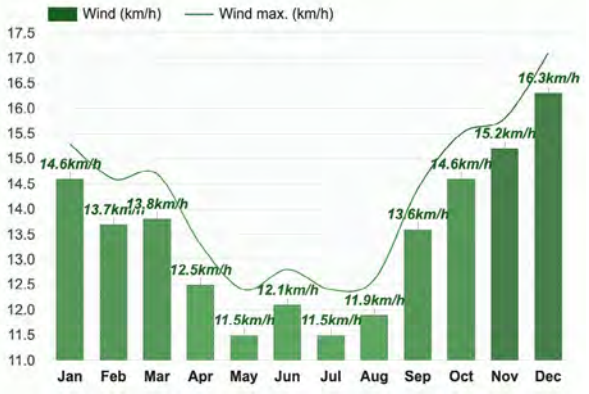
This chapter holds contextual information regarding the location of EISAP. The data has been used in the process of the masterplan sketch, and as such has already contributed to the initial phases of development. Throughout the working process the data has been verified as much as possible.

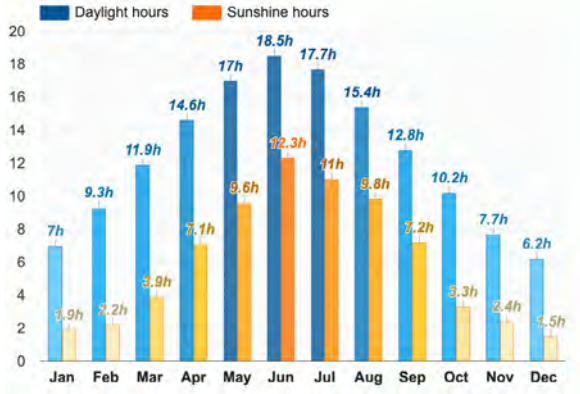
3.1 LOCATION KEY DATA

Proposed name: Auvere Agropark
Area: 1507 ha
Location: 40111 Ida-Viru County, Estonia
Geolocation: 59.250307, 27.854404
Zoning: Agro-Industrial
Soil condition: Poor, crushed shale rock

3.2 CLIMATE DATA







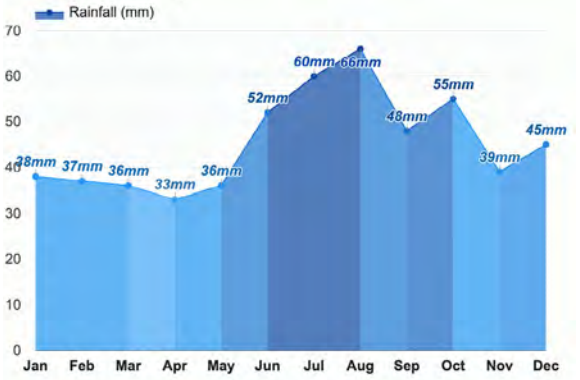


Image 4/5/6/7: Temperature/ Wind/ Daylight - Sunshine Hours / Rainfall in Auvere, Estonia (Source: Weather Atlas)

3.3 MASTERPLAN KEY DATA

Current zoning: Profit yielding land, mining land
Total plot size: 1507ha
Number of lots: 87
Individual lot size range: 4.5ha / 146.2ha
(individual greenhouse lot / agroforestry lot)
Max build height: 28m
(anything higher needs military consent)

GREENHOUSES

Area: Approx. 386.3ha / 276.5ha operational space
Energy use: 465.000MWh
Heat use: 1.120.000MWh
Water use: 2.200.000m³
CO_2 use: 60.000t

AGROFORESTRY & SILVOPASTURE

(including commercial agriculture)
Area: Approx. 370ha

OFFICES & SUPPORT FACILITIES

(including renewable energy production)
Area: Approx. 292ha
Solar Energy Park: 100ha

INDUSTRY & PROCESSING

Area: Approx. 52ha

TRANSPORT

Road distance to Tallinn: 209km, 2h40min
Road distance to St. Petersburg: 183km, 3h12min, crosses border with Russia
Railway connections: Direct connection to Narva, Tallinn, Sillamäe
Nearest deep water port: Sillamäe, 32km by road or rail, 40min
Nearest airport: Tallinn

WORK FORCE

Local inhabitants: 150.000
Local unemployment: 19,500 (13%)
Job creation on site: 1000 jobs within 5 years, 3000 within 15 years
Average worker wage: €1,025/m

TAX RATES

VAT: 20%
Reinvested Profits tax: 0%
Wages (PIT): 20%
Social tax: 35%
Distributed Profits: 20%

ENVISIONED LAND COSTS

Industrial: €10,=/m²
Service cost: TBD
Offices & Businesses: €15,= - 20,=/m²
Service cost: TBD

COSTS & AVAILABILITIES

Electricity: *10 kV connections*
costs TBD (estimated negotiations € 45,=/MWh, currently ~ 100,=/MWh)
Water: *Purified Source*
costs € 1,=/m³
Separate Waste Water System
costs € 1,=/m³
Heat: *Low grade (60 °C)*
costs: TBD (Narva Industrial uses € 40/MWh)
High grade (90 °C)
costs: TBD
CO_2: via pipe
costs: TBD

***Note:** Text in gray represents working data, which either needs to be collected and calculated, or needs to be verified further.*

3.4 INCENTIVE SOURCES

ENTERPRISE ESTONIA

Large investor support scheme. Aimed at investors into Estonian rural areas, and tourism products. The amount of grant is € 1.000.000 to € 3.000.000. Grant rate is up to 10% of eligible costs. Project duration limited to 24 months.

STATE SHARED SERVICES CENTER

Ida-Viru industrial investments support scheme, aimed at (non agricultural) industries. The grant amount is € 90.000 – € 990.000 (depends on number of jobs created). Grant rate is 25% for large companies, 35% for medium, and 45% for small companies (EU standards).

UNEMPLOYMENT INSURANCE FUND

Various subsidies for hiring unemployed, disabled and young people. Also offer training and retraining programs for employees. This organization steps in to help the recently unemployed find new work.

JUST TRANSITION FUND SUPPORT SCHEMES

JTF is a support mechanism to aid the green transition towards achieving Estonia's energy and climate goals. JTF mainly targets the territory of Ida-Viru County due to its high concentration of oil shale industry. It aims to support investments in renewable energy, energy efficiency, circular economy, regeneration of brownfield areas, digitalization and research and innovation activities. The total volume of JTF in Estonia is € 340 M, of which 153 M are available as Ida-Viru Grand Investment Grant. This grant could provide support of up to € 15 M, depending on the size of the project, size of enterprise, and number of jobs created.

PRIA.EE AGRICULTURE CALLS

Variety of calls with specific deadlines. Activities supported are growing of fruits and vegetables, growing of organic produce, export of agricultural products, blue economy, forestry, fisheries, etc. Specifically aimed at growers, not producers or processors.

ENVIRONMENTAL INVESTMENT CENTER

A variety of activities are supported: Co-financing of environment and climate projects, heat management development plans, environmental loans, flood risk studies, preserving and restoring protected species and habitats, recycling and reusing waste, etc.

3.5 INTENDED PERFORMANCE & AMBITIONS

- To develop a commercially successful park that leads the way in closed loop energy and material cycles.
- To establish long-term sustainable workplaces in the region.
- To increase local food resilience.
- To increase recycling, and decrease waste streams.
- To increase the sustainability performance of the area.
- To increase the ecological value and biodiversity of the former oil-shale surface mine.
- To reinforce the local economy by means of national and foreign investment.
- To boost the development potential of both the County and Estonia as a whole.

3.6 INDUSTRIAL SYMBIOSIS PARAMETERS

- Electricity
- Heat, Low Grade
- Heat, High Grade
- Water, Technical
- Water, Recycled
- Sewage
- Carbon Dioxide
- Organic Waste, Aqueous
- Organic Waste, Solid
- Wood, Construction
- Wood, Pulp
- Food, Raw
- Food, Processed
- Fibre, Organic
- Fuel, Shared Logistics

Additionally, savings are made on the following aspects: shared waste burden, centralized collection, shared logistic hubs, and centralized on-site transport.

3.7 SERVICES

ENEFIT POWER PLANT

- *Maximum output:* 215MWh per operational block, 5 old in use, 1 new in use. 2 blocks can operate on biomass.
- *Input streams:* oil shale, biofuels, gas (byproduct of oil shale plant)
- *Output streams:* high quality fly ash, used as soil conditioner,steam 6 atm and 25 atm, electricity, hot water.

INTENDED SERVICES

- *Logistics Areas:* warehouses, transport to local hubs, maintenance and repair facilities, parking.
- *Office and Reception Area:* supporting offices and reception area for visitors
- *Water System:* Separate water system for purified water supply, and separate waste water system with purification to return to the Narva river.
- Joint Waste Collection
- Cleaning Services
- Resource Exchange Control Center

3.8 NATIONAL SOLUTIONS

Several waste streams exist in Estonia that could be dealt with on site, to aid a national cause, including for example plastic and rubber tire mountains. There are advanced technologies available that would provide a more favorable solution to these waste streams compared to the current landfilling and/or thermal "recycling" (incineration). While this can be done their contribution to the industrial symbiosis are most likely limited to heat exchange, and potentially their primary product (i.e. clean plastic/rubber).

CAR TYRES

- Additive in sports fields
- Devulcanization

Additional reading material.

TEXTILE WASTE

- Sorting
- Processing
- Respinning

Additional reading material.

PLASTIC RECYCLING

- Sorting
- Remelting
- Plastic to fuel processing
- Monomerization

Additional reading material.

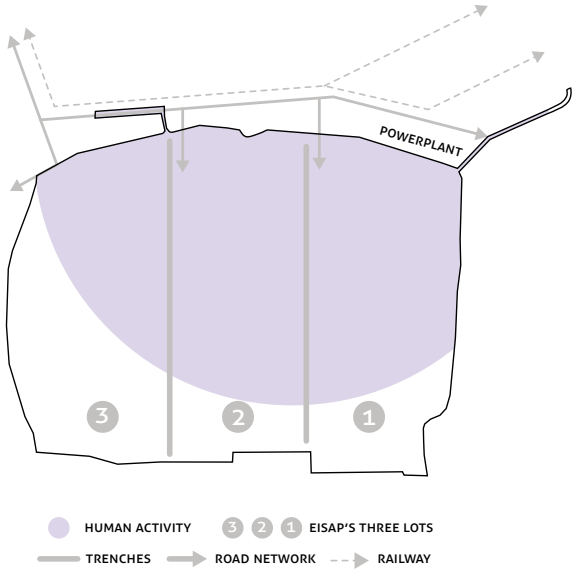
CALCIUM CARBONATE PRODUCTION

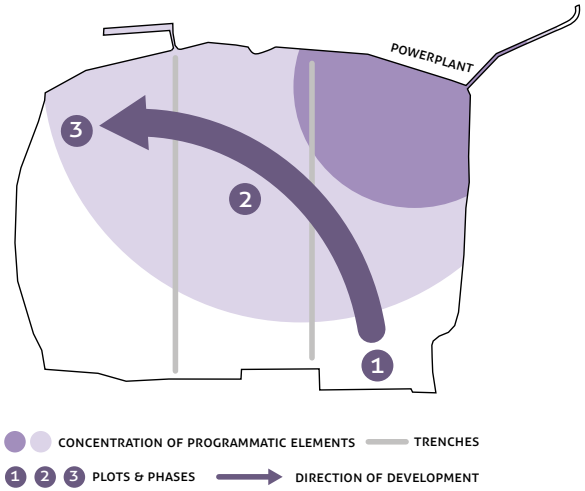
IV. CONCEPT MASTERPLAN

This chapter describes the concept masterplan for EISAP. It includes descriptions of the zoning, phasing, and main properties of the plan. It also includes an explanation of how industrial symbiosis flows would define the development of the site. Finally, it highlights the different elements of the park.

4.1 DESIGN PRINCIPLES

The design principles are formed based on the EISAP goals, characteristics of the location and the constraints of the site. Eight design principles have been identified, which in combination with smart sustainable design practices determine the final proposal for the concept masterplan of EISAP.



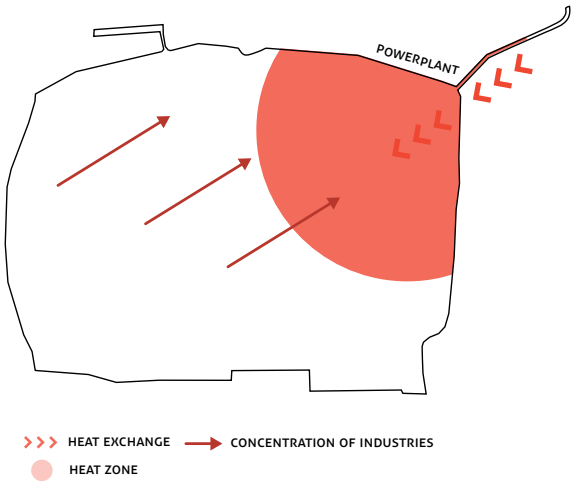


EISAP DESIGN PRINCIPLE 1: ZONES

- The site is split into three, roughly equal sized parts. The division is made by trenches that have been left over after the oil shale digging activities. With an approximate depth of nearly 15m, they will be used as water channels going forward.
- Most human activity is centered on the northern half of the site. This includes storage, transport, and logistics that can be shared optimally when organized like this.
- The north-west of the site focuses on logistics, with the primary road and railway connections being located in that area.

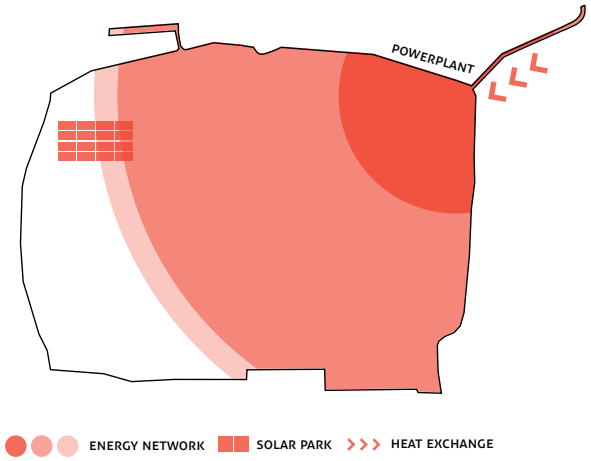
EISAP DESIGN PRINCIPLE 2: PHASES

- Due to the proximity of the power plant and its resources in the north-east, it is likely that the initial developments on the site occur in that area.
- The masterplan foresees a phased development, where the eastern part of the site is developed first, the middle part follows, and the western part comes last.
- Temporary functions may find a place in the middle and western parts, to later get replaced by other agropark functions.
- The northeastern part of the site has the highest concentration of programmatic elements, to allow for compact resource exchange.



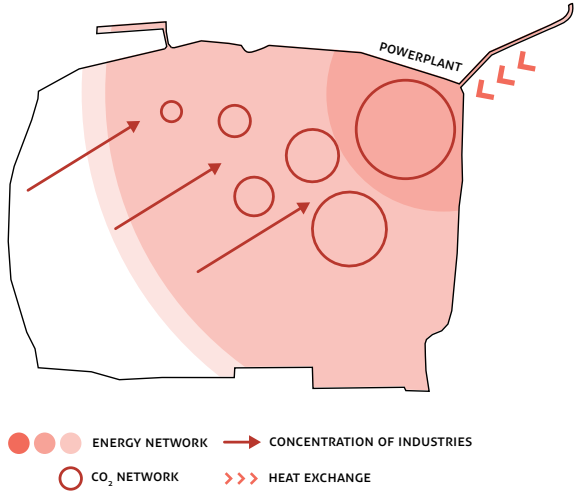
EISAP DESIGN PRINCIPLE 3: HEAT NETWORK

- The power plant delivers steam in different temperatures at different pressure levels.
- Industries that require high quality heat (high temperature) will be located closer to the power plant, to optimize the heat transport through the network.



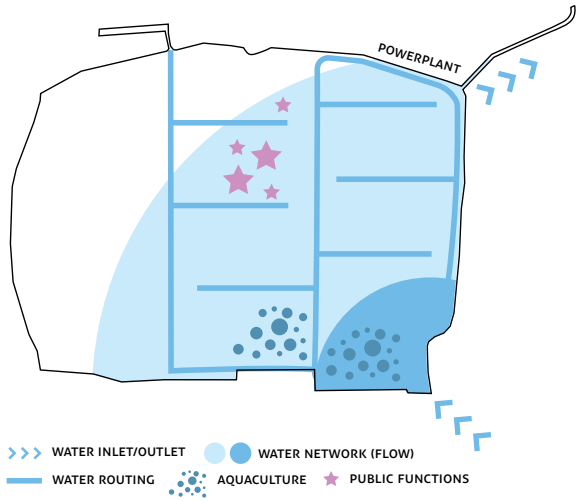
EISAP DESIGN PRINCIPLE 4: ENERGY NETWORK

- The energy network of the site is closely connected to the power plant in the north-east.
- A solar plant is planned in the industrial zone in the northern half of the site.
- Due to the close proximity to the Estonian-Russian border, the masterplan has no wind turbines planned.
- The energy network is closely related to the road network. The profile of the main roads has significant reservations for power cables, CO_2 and steam pipes to allow for future upgrades or extensions to these networks.



EISAP DESIGN PRINCIPLE 5: CO_2 NETWORK

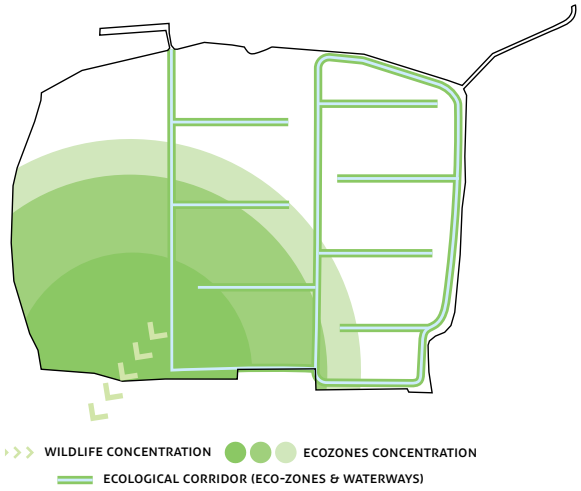
- With proper adjustments and investments, the power plant can deliver cleaned and purified CO_2.
- Industries that require high amounts of CO_2 will be located close to the power plant.
- Throughout the site, other industries can also develop their own CO_2 scrubbing facilities and act as secondary distribution hubs.



EISAP DESIGN PRINCIPLE 6: WATER FLOWS

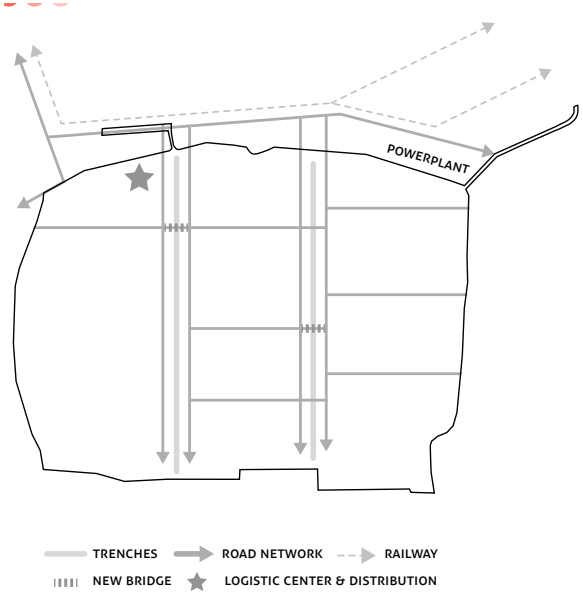
Water network has been split in two separate systems:

- The inlet system is connected to the river in the south-east, pre-treats the water for greenhouse use at a treatment plant in the south, and distributes water through main channels and side channels to all plots.
- An outlet system collects waste water from the green-houses, and cleans this at a treatment plant in the north-east. The outlet dumps the water into the inlet channel of the power plant's treatment system at river quality level and quantities, in order not to disturb the power plant's system.
- The middle part of the site organizes public functions around a recreational water flow, while the southern part houses industrial scale aquaculture through fish ponds.



EISAP DESIGN PRINCIPLE 7: ECO-CORRIDORS

- The trenches that split the site in three are used as ecological corridors with minimal road crossings, to minimize wildlife disturbance.
- Between the trenches, the ecological corridors are connected along the waterways and some of the east-west distribution roads.



EISAP DESIGN PRINCIPLE 8: INFRASTRUCTURE

- Logistics and distribution are located in the north-west of the site, close to existing infra-structure. This connects the site to the road network, and potentially the rail network.
- The main arteries of the site are organized along the trenches in north-south direction, with distri-bution roads running east-west. Where the trenches and roads meet, a minimal number of bridges and culverts has been designed, to minimize construction costs.

4.2 INDUSTRIAL SYMBIOSIS IN EISAP

Industrial symbiosis is a concept in which wastes or by-products of an industrial process are used as a feedstock for another industrial process. Making use of industrial symbiosis ensures a major reduction of material use, a stronger connection between involved parties, and a drastic contribution to a more sustainable society.

One of the most successful examples of industrial symbiosis, Kalundborg in Denmark, has shown that industrial symbiosis is dependent on a strong identity and coordination. This allows the industrial symbiosis network to develop and evolve over time. The industrial symbiosis partners are strengthened through the local network, where entities in the network gain environmentally but also economically from the ability to share waste streams in the local network as raw materials for a different entity.

Including the Enefit Power AS power plant in concept is vital for the industrial symbiosis of the site, as the power plant can offer electricity, heat, water, and CO_2.

In the metabolic diagram (image 1, page 7), a proposed industrial symbiosis concept between industrial entities is shown. The diagram includes the circular agro-industry, aquaculture industry, business facilities such as offices, and the power facilities.

The circular agro-industry produces food and materials while delivering organic waste to the organic waste processing plant. Aquaculture industry will produce water and fertilizer for the agro-industry while producing food for the food market. Business facilities and offices will offer the space for businesses to provide services, not just to the agropark itself. The energy generation industry provides all the local entities with affordable electricity. Furthermore, it delivers CO_2 to the greenhouses.

The energy generation industry offers low and high grade heat or steam to the circular agro-industry or aquaculture industry depending on the heat energy needs of these industries local product creation and processing.

Image 8: Concept Masterplan of the EISAP

(Appendix 2 shows a future Phase 2 scenario for the expansion of the greenhouses)

4.3 PROGRAM ELEMENTS

Following the design principles, a series of programmatic elements are strategically spatially organized within the site, constituting the EISAP masterplan.

ENERGY

The Enefit AS power station is currently equipped to deliver waste heat to the site. Implementing carbon capture technologies to the power plant with an additional carbon scrubber allows it to provide captured and purified CO_2 to the nearby greenhouses, where CO_2 is used as a feedstock for crops. This lowers the carbon footprint of the power plant and creates a local circular carbon flow.

In the concept masterplan, new energy generation facilities are proposed, increasing the energy autonomy and resilience of the region. Low carbon energy technologies such as solar, wind, and biomass emit much less greenhouse gasses per kWh of heat or electricity, compared to oil based or natural gas based technologies. Furthermore, the use of logging waste as a fuel further increases the circularity of the concept.

The integration of several energy generation options will provide a flexible initial capacity, where capacity can be increased when a higher need is apparent by users through installation of additional PV panels or wind turbines.

Furthermore the use of these new energy generation options strengthens the energy sector through the creation of local high skilled energy generation jobs and the exchange of low carbon and circular energy generation technology knowledge.

GREENHOUSES, INDUSTRIES, COMPANIES

Greenhouses cover almost half of the site as the main land use and productive activity. The central and east plots, which fall within the more developed industrial north-east side of the EISAP, are subdivided on smaller plots, allowing for groups of greenhouses, as well as singular units to be developed. Each plot includes enough space for the greenhouse infrastructure and its service area, and is connected to the local road infrastructure, water and energy networks. Due to the proximity of the power plant to the north-east of the site, greenhouses and food processing facilities that require high quality heat are best located in that area. All greenhouses are oriented in a north-south direction, to make use of an optimal layout of a standard greenhouse.

The industrial area within EISAP also includes food processing, part manufacturing units, and workshops. These are strategically located nearby the greenhouse plots, and close to the heat transfer zone in the north-east, and main transportation infrastructure to the north of the site.

PROCESSING INDUSTRY

A1

HEAT EXCHANGE ZONE

A2

GREENHOUSES / LOT 1

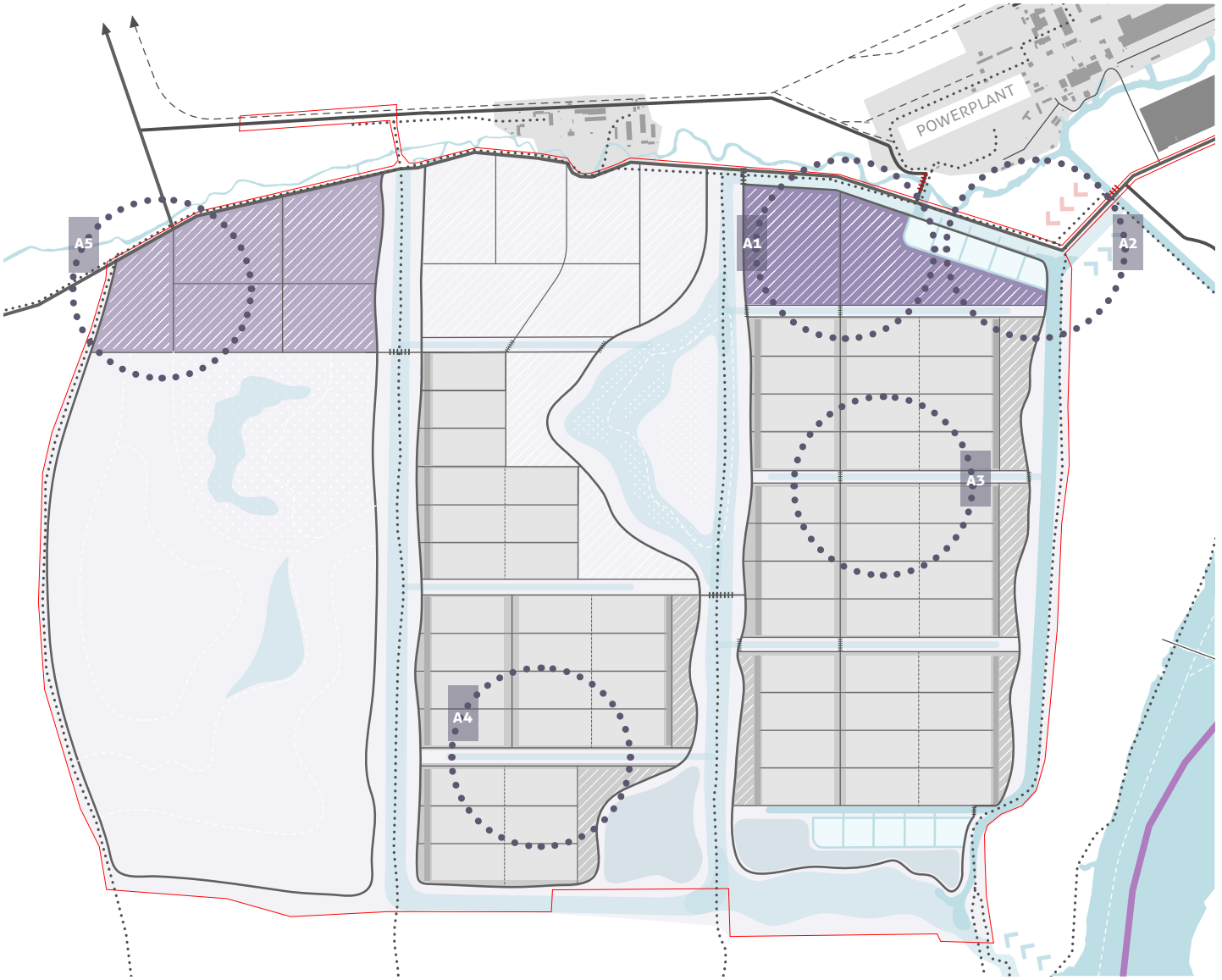
A3

GREENHOUSES / LOT 2

A4

SOLAR PARK / BIOMASS

A5



POWERPLANT & EXISTING INFRASTRUCTURE
PRIMARY ROAD NETWORK
SECONDARY LOCAL ROADS
TERTIARY SERVICE ROADS
PRIVATE ACCESS
GRAVEL ROAD
RAILWAY
POWER NETWORK
INTERNAL WATER CONNECTION
NATIONAL BORDER
PROJECT AREA
HEAT EXCHANGE
EXISTING BRIDGE
PROPOSED NEW BRIDGE
PROPOSED WATER TUNNEL
INDUSTRY (HEAT TRANSFER ZONE) (FOOD PROCESSING, PART MANUFACTURING & WORKSHOPS)
GREENHOUSES (PRODUCTION)
GREENHOUSE FACILITIES (SERVICE & EMERGENCY AREAS)

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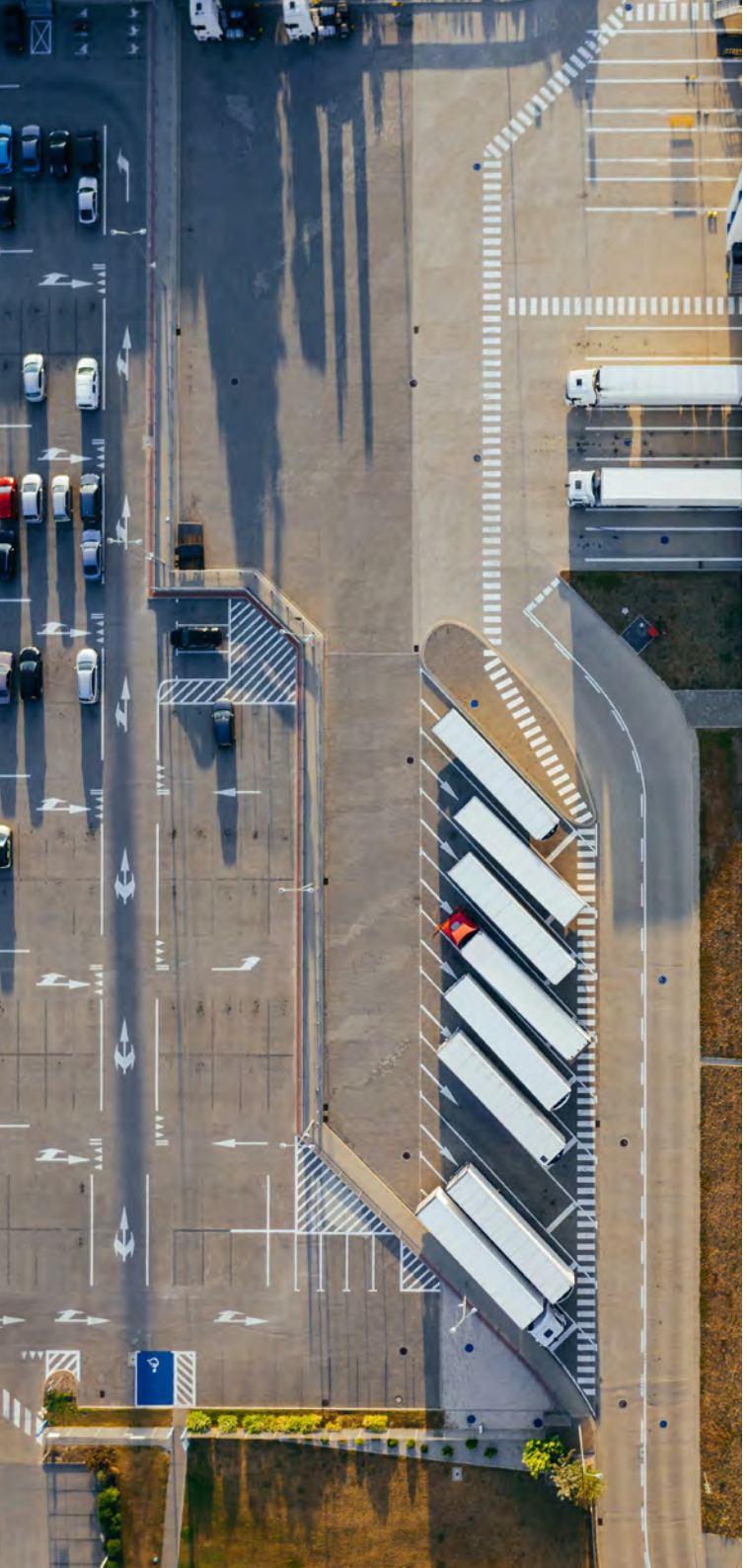

INFRASTRUCTURE & LOGISTICS

The concept masterplan takes in consideration the existing local infrastructure and improves that with the purpose to create better and faster connections that serve the entire agro-industrial park. Therefore, the north belt of the site becomes an important logistic area, where both road infrastructure and the existing railway facilitate the mobility of people and goods. Aiming to keep heavy transportation, and the sound and air pollution that come with it, limited and mainly on the north-east part of the site, strategic service roads go along the ecological corridors, meandering far from the natural areas and closer to the industrial plots. A series of local roads then provide access to these plots, avoiding crossing through natural areas.

Road infrastructure is limited on the west plot, with the purpose to give agroforestry and silvopasture all the needed space and privacy from the industrial area. This also allows for future repurposing of this plot, in case the park would want to expand greenhouses to this part of the site. Instead, pebble pathways provide access throughout the area during this stage of the project, without any major road infrastructure interventions.

In order to complete the proposed road infrastructure network, considering all the ecological areas and waterways, a number of bridges and water tunnels have been introduced. The number of bridges has been kept at a minimum, with only three major bridges (A, B and C as shown on the masterplan). The other connections have been resolved through water tunnels (a, b, c, d, e, f, g, h, i, as shown on the masterplan).

Other logistic facilities, including the logistic center, truck service, auction house, recycling center, solar park, biowaste to energy plant, and municipal compost facility, have been located on the north-west of the site, close to the main road and railway, and within the industrial belt of EISAP.

OFFICES & SUPPORT FUNCTIONS

Offices and other support services have been located on the central plot, within the industrial belt of EISAP, close to the main road and railway infrastructure. This area also represents the core management center of EISAP, where the more recreational sites are also located, together with a series of co-working areas, makerspaces, a visitor center, university facilities, the control center, warehouses, packaging and distribution facilities. The area integrates natural sites as well, including the ecological corridors by which it is confined, as well as the experimental park, surrounded by waterways and aquaculture. This setting creates a welcoming atmosphere to the EISAP, while providing inspiring working environments.

LOGISTIC CENTER

A6

OFFICES & FACILITIES

A7

SUPPORT SERVICES

A8

PEBBLE PATHWAYS

A9

WATERWAYS & BRIDGES

A10

POWERPLANT & EXISTING INFRASTRUCTURE
PRIMARY ROAD NETWORK
SECONDARY LOCAL ROADS
TERTIARY SERVICE ROADS
PRIVATE ACCESS
GRAVEL ROAD
RAILWAY
POWER NETWORK
INTERNAL WATER CONNECTION
NATIONAL BORDER
PROJECT AREA
HEAT EXCHANGE
EXISTING BRIDGE
PROPOSED NEW BRIDGE
PROPOSED WATER TUNNEL
OFFICES & SUPPORT SERVICES
(CO-WORKING, MAKERSPACES, VISITOR CENTER, UNIVERSITY FACILITIES CONTROL CENTER, WAREHOUSES, PACKAGING, DISTRIBUTION)
FACILITIES
(LOGISTIC CENTER, TRUCK SERVICE, AUCTION HOUSE, RECYCLING, SOLAR PARK, BIOWASTE TO ENERGY, MUNICIPAL COMPOST)

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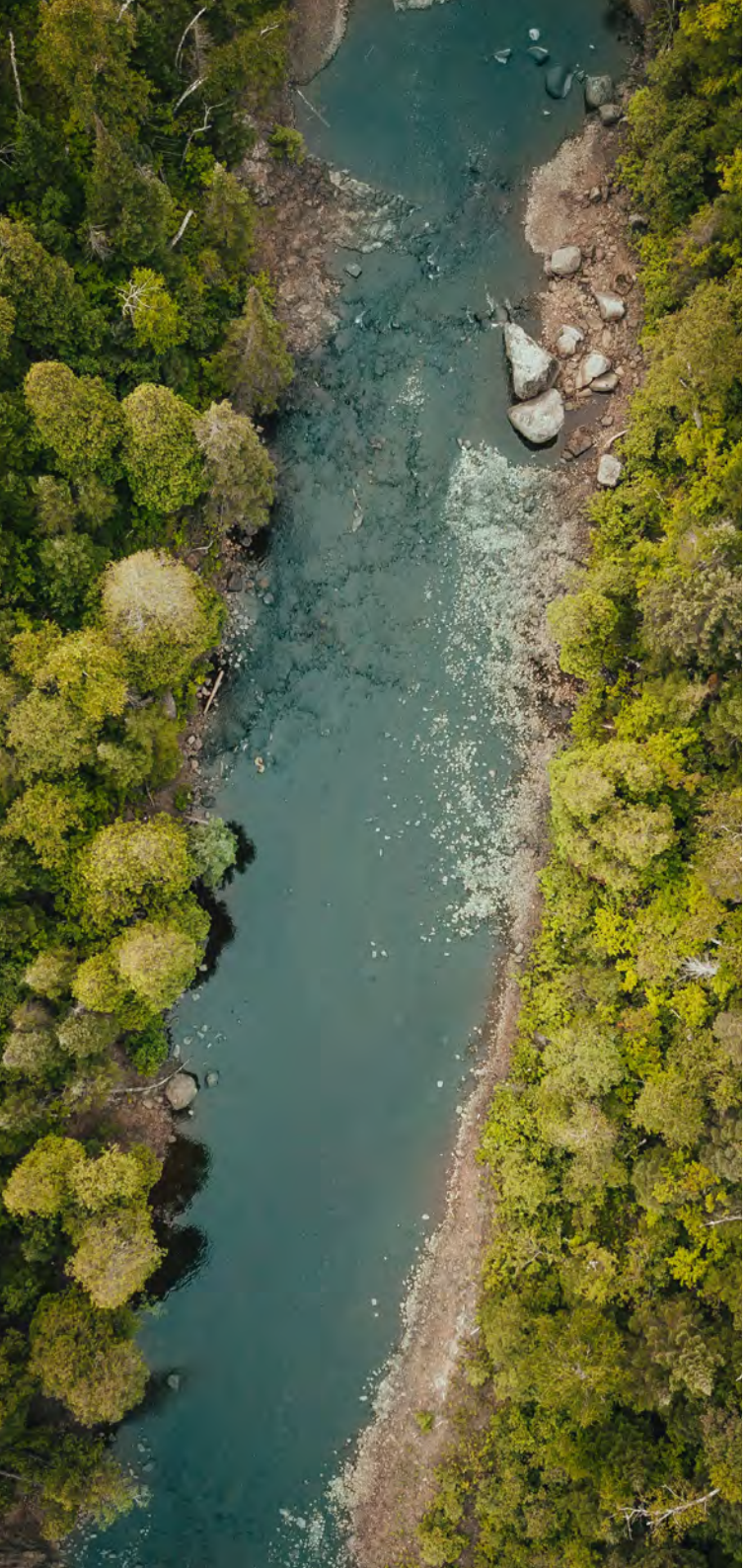

WATER NETWORK

EISAP is located next to the Narva reservoir and Narva river, which represent an important water source for the region. Water from the river has been pulled in on site, through an inlet on the south-east, servicing the entire site through waterways that are integrated along the ecological corridors. A series of local water channels provide water for the smaller greenhouse plots and their operational needs. On the central plot waterways are larger and surround the experimental forest.

Two constructed wetland areas are located on the west plot, among the agroforestry and silvopasture plots, with the purpose of enhancing the local habitat, removing pollutants, improving water supply, and for recreational uses.

Towards the south-east of the site, aquaculture is integrated next to the ecological corridors and greenhouse plots. Two water management facilities are located within the site; one near the water inlet on the south-east, and the other close to the water outlet, nearby the power plantt in the north-east. Both the inlet and outlet points were strategically located along the river so that they don't affect the inlet of the power plantt. The water stream that borders the north of the site has been kept in its natural form, and is not integrated with the proposed water network, considering its size and capacity.

AQUACULTURE

As part of the local ecosystem, freshwater aquaculture is integrated within the plan, in the form of running water culture and static water ponds. This allows for the breeding and harvesting of fish, algae, and other aquatic organisms. Aquaculture can be useful for treating wastewater on site, where the aquatic vegetation can gain nutrients from the waste as they clean the water, which then can re-enter the system. Furthermore, waste generated from the farms can be transformed into fertilizers that can be used on site.

INLET/OUTLET & WATER MANAGEMENT FACILITY

A11

WATERWAY & WATER CHANNEL

A12

CONSTRUCTED WETLAND

A13

FISHPOND & LAKE

A14

AQUACULTURE PARK

A15

POWERPLANT & EXISTING INFRASTRUCTURE
PRIMARY ROAD NETWORK
SECONDARY LOCAL ROADS
TERTIARY SERVICE ROADS
PRIVATE ACCESS
GRAVEL ROAD
RAILWAY
POWER NETWORK
INTERNAL WATER CONNECTION
NATIONAL BORDER
PROJECT AREA
HEAT EXCHANGE
EXISTING BRIDGE
PROPOSED NEW BRIDGE
PROPOSED WATER TUNNEL
WATER NETWORK ON SITE
AQUACULTURE
WATER NETWORK (WATERWAYS & CHANNELS)
FISH FARMS
WATER MANAGEMENT FACILITY

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NATURAL LANDSCAPE

EISAP is located between the Vaivara Nature Preserve, Kurtna Nature Park and Puhatu Nature Reserve, which rests on one of the largest wetlands in Estonia, composed of mires and alluvial forests. The project site currently sits on a former oil-shale surface mine, largely overgrown with young pine trees. The proposed scenario develops on a series of interventions, which aim to improve the limited local ecological values and low biodiversity.

This is done by introducing an ecological network, which stretches along the site in the form of ecological corridors, using the existing trenches, and in the form of ecological zones, including agroforestry, silvopasture (both aimed at improving the current soil quality), wetlands, open field agricultural and recreational parks. A network of waterways and water channels, as well as aquaculture and fish ponds integrate with the ecological network, providing the needed resources for the EISAP to operate, but also making room for local biodiversity to heal and thrive.

AGROFORESTRY / SILVOPASTURE

Almost the entire west plot of EISAP is dedicated to agroforestry and silvopasture. Purposing the west plot for these specific uses as part of a multifunctional land use strategy over time, and considering the ecological network proposed on site, the plan maintains an optimal balance between the more developed and industrial north-east, and the more natural area to the south-west.

Over time, agroforestry and silvopasture help improve the current soil quality. They enrich soil organic carbon, improve soil nutrient availability and soil fertility due to the presence of trees in the system, and enhance soil microbial dynamics. In the long term the improved soil quality can facilitate productive open field agriculture on the west plot, expanding the variety of practices and produce within the EISAP.

ECOLOGICAL CORRIDOR

A16

OPEN FIELD AGRICULTURE

A17

AGROFORESTRY

A18

ECOLOGICAL ZONE (PARK)

A19

AQUACULTURE PARK

A20

POWERPLANT & EXISTING INFRASTRUCTURE
PRIMARY ROAD NETWORK
SECONDARY LOCAL ROADS
TERTIARY SERVICE ROADS
PRIVATE ACCESS
GRAVEL ROAD
RAILWAY
POWER NETWORK
INTERNAL WATER CONNECTION
NATIONAL BORDER
PROJECT AREA
HEAT EXCHANGE
EXISTING BRIDGE
PROPOSED NEW BRIDGE
PROPOSED WATER TUNNEL
ECOLOGICAL NETWORK (CORRIDORS & PARKS)
EXPERIMENTAL PARK
AGROFORESTRY / SILVOPASTURE
OPEN FIELD AGRICULTURE (RENT A SMALL FARM, PICK YOUR OWN FOOD)

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V. IMPACT

By developing an industrial symbiosis agro park, EISAP has the following impacts:

- Primary investment: € 1,5 - 5 billion
- Long term jobs: 600-1000
- CO_2-savings: up to 90% compared to more traditional developments
- Food produced: up to 185.000 tons per year
- Greatly reduced waste (ambition >80%)
- Increased efficiency and productivity due to shorter supply chains and shared services
- Developing a foothold for innovative & growing markets
- Increase in local and regional biodiversity
- Decrease in water use compared to other more traditional developments
- Environment cleaning by capturing carbon
- Creation of an Estonian Industrial Symbiosis Organization

VI. RECOMMENDATIONS & NEXT STEPS

With the initial partnership, and the concept masterplan in hand, EISAP stands at the start of a fruitful journey. IVIA and the project partners aim to ensure the project achieves its impact on Estonia and Europe as a whole.

This aligns with the current European Just Transition strategy, to move Estonia away from a fossil based industry. EISAP is the most promising and most impactful project to transition the country into a sustainable long term industrial platform to date.

Moving on, IVIA is taking the following steps:

- Acquisition of funding for the next development
- Expanding partnerships for ensuring national and European support
- Scoping initial agreements with future users and execution partners
- Technical masterplanning and feasibility

VII. COLOPHON

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Nele Rogenbaum

EESTI ENERGIA
Jevgeni Ossovik

CITY OF NARVA-JÕESUU
Kaie Metsaots
Olga Batluk

ALKRANEL
Alar Noorvee
Elar Põldvere
Paula Nikolajeva

ADVEN
Juri Zenin

PROJECT 363
Reimo Ilp

EXCEPT INTEGRATED SUSTAINABILITY
Tom Bosschaert
Jeroen van der Vlist
Jacob Verhaart
Eranda Janku
Jon Woning
Ruben Bosschaert
Claudia Cammack
Mykola Liasovskyi
Kelvin Tirta Kusnaidi
Dico van Aalderen
Pelle Berkhout
Rick Amado

APPENDIXES

CO-CREATION RESULTS

In April 2021, the project team came together during a 2-day online co-creation session. During this session, the team exchanged intelligence about the EISAP site, agropark development, and industrial symbiosis. In smaller sub-teams, they also developed scenarios for the concept masterplan, and action plans for the involvement of potential partners and stakeholders.

SUMMARY SESSION 1

Online session - April 20, 2021

The first of the two sessions held an official introduction between all parties present and presentations on the concept of industrial symbiosis, which stands at the core of the agropark. Except presented its definitions, relevant trends (on European level), precedents both successful and unsuccessful, provided relevant context on sustainable agriculture, circular economy, and upcoming trends in the agrosphere. In addition, a short summary presentation was given on greenhouses, their operation, technology, and industry, as these are to play a significant role in the agropark.

In this session the perspective and goals of individual stakeholders were collected and discussed. Additionally, open questions of stakeholders were collected, in the hope of answering them in these initial sessions, or in the near future, to secure and strong working collaboration.

Some of the remarks regarding the main features considered on this scenario include:

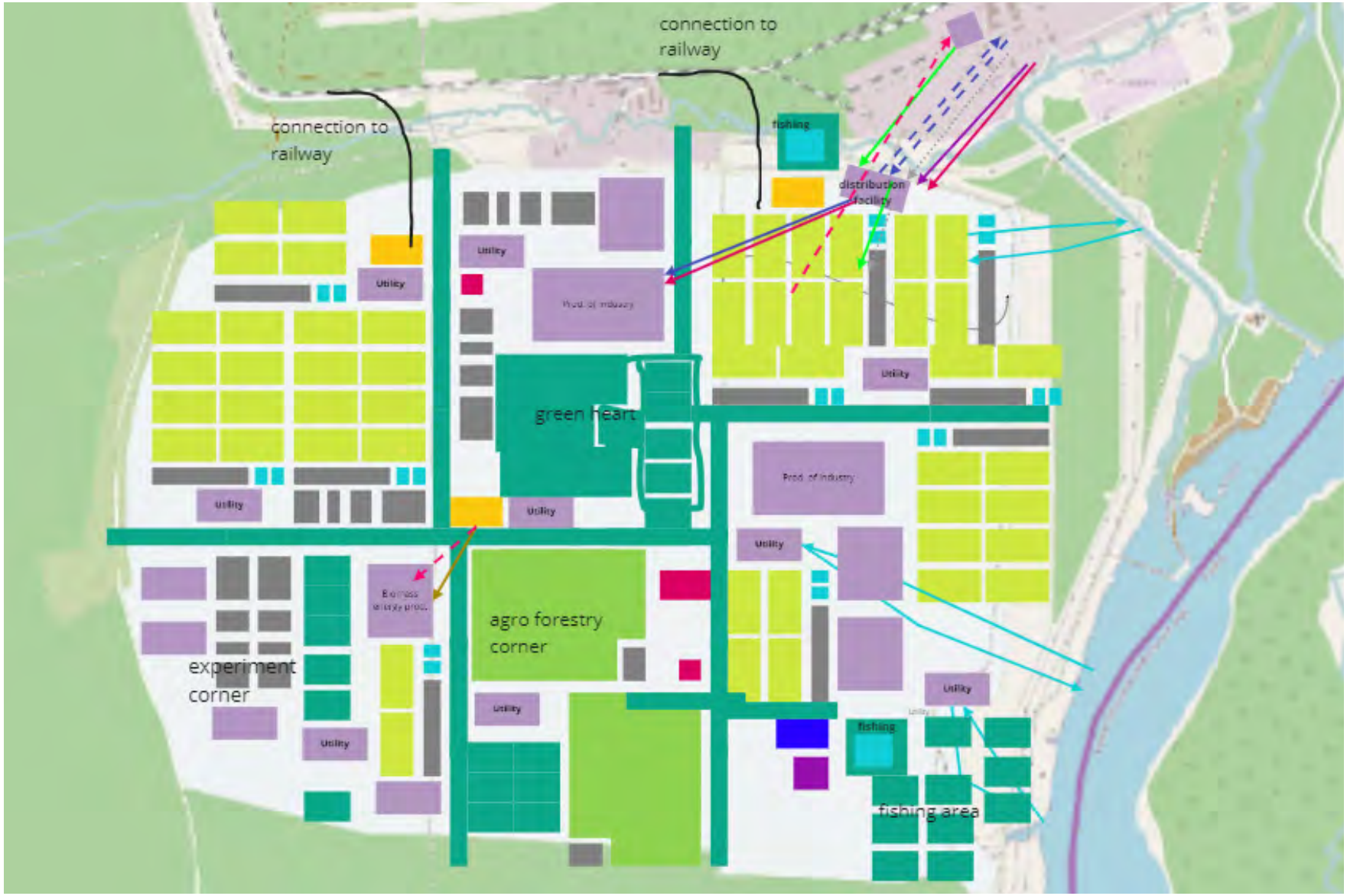
- Program-spread over the entire area
- Integration of a green heart in the center of the site
- Trenches are transformed into ecological corridors and these corridors divide the side into three main sub-parts
- Distribution of resources from the power plantt directly
- Fishing industry located near the river on the south-east corner

Points of attention:

- Necessity for a distribution center near the power plant
- Using greenhouses to model scale
- Connectivity between facilities

Lessons learned:

- Significant interests in natural elements, and integration with the surrounding ecosystem.
- Energy plant interested in more sustainable performance, for long term continued operation.
- Relevance of nature based solution, biobased industries, and integrated ecosystem services.
- Contextual dependence on the type of industries to take part in the industrial symbiosis, which requires more investigation on resource level.



Map 1: Example of one of the four spatial scenarios developed during the first round of the co-creation session
Illustrated scenario developed by Group 2: Juri, Jevgeni, Ruben and Jeroen

SUMMARY SESSION 2

Online session - April 22, 2021

The second session was kicked off by initiating a common goal, including an ELSI-stack exercise to establish relevant object level goals. The result was a focus set of object oriented goals.

A second exercise intended to collect potential partners from a wide range of potential entities, including government, funding, education, NGO's, and companies.

The remainder of the session was spent on two successive rough scenario development exercises, fueled by knowledge present within the teams and a limited set of "lego block" ingredients. This exercise was repeated after a short presentation from each team, to be built upon in the next round under new teams.

Some of the remarks regarding the main features considered on this scenario include:

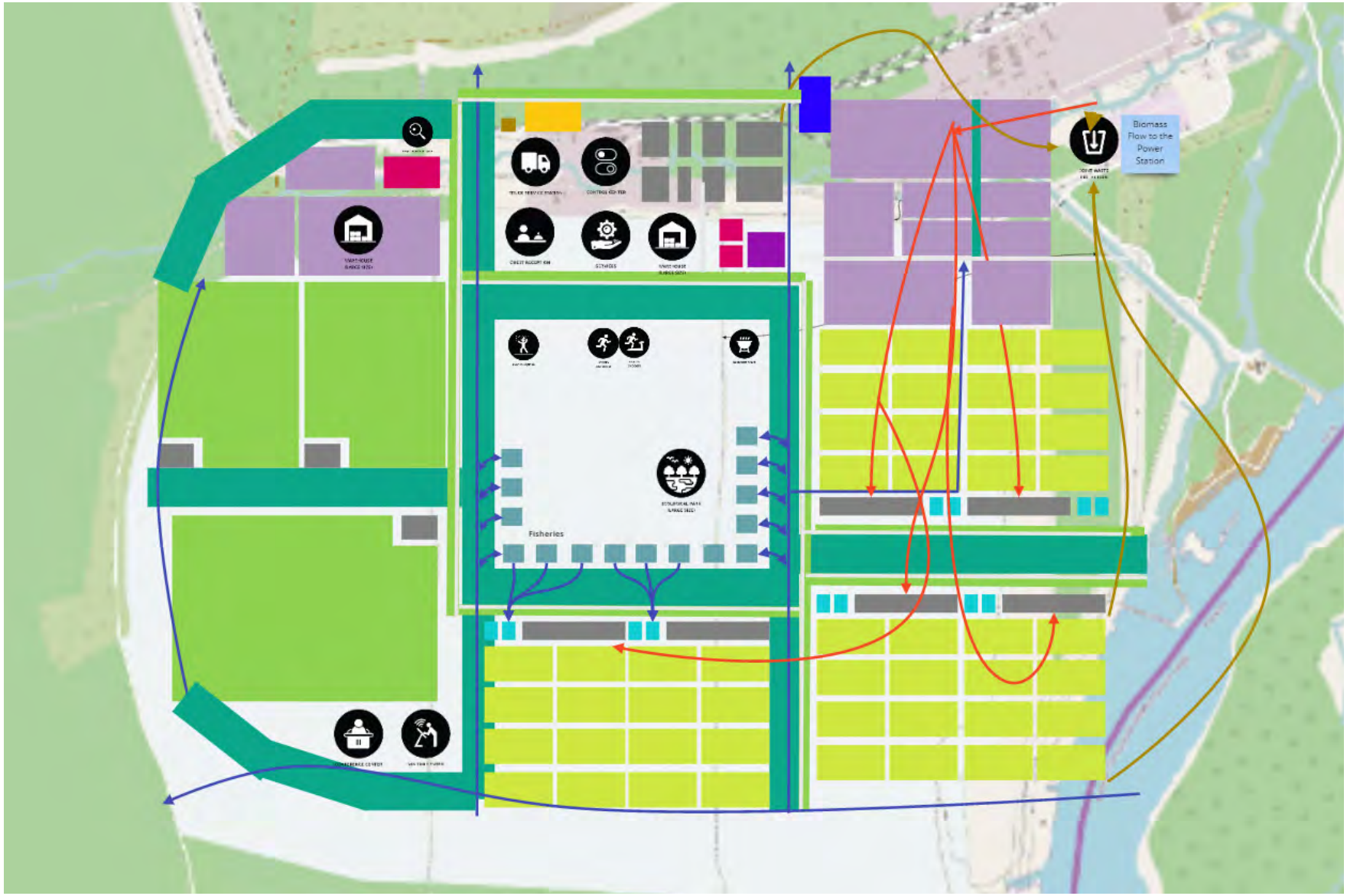
- High density of programmatic elements on the north-east of the site (compact resource exchange)
- Large ecological corridors with minimal road crossings
- Industrial scale aquaculture through fish ponds
- Human activity is centered on the north of the site
- Central focus of the logistics of shared resources (heat, CO2, etc.)
- Logistics and distribution are located on the north-west corner, close to existing infrastructure

Points of attention:

- River integration in the landscape
- Scale of fish production in relation to both greenhouses and agroforestry

Lessons learned:

- A collective goal for the agropark was reachable, and the first attempt showed significant alignment.
- The goal setting exercise revolving around ELSI showed a healthy diversity along the sustainable spectrum, a good sign for a holistic approach.
- A plethora of potential partners and additional stake-holders exists, with a decisive potential for govern-mental, university, and funder involvement.
- During the sketch exercises for the agropark several aspects quickly converged, showing high potential for common ground and an agreeable masterplan.
- A whole collection of considerations from different stakeholder perspectives was gathered as part of the scenario developments, all of which will be taken along in further preliminary sketches.



Map 2: Example of one of the four spatial scenarios developed during the second round of the co-creation session
Illustrated scenario developed by Group 4: Alar, Jevgeni, Jacob, Jon, Nick

OUTCOMES

- During goal setting 37 focus areas were identified (see chapter 2.3) that influence the design and performance metrics of the agropark concept.
- Throughout the two sessions programmatic elements were collected in a preliminary program.
- Additionally, a list of potential future stakeholders was identified for pursuit.
- Two iterations of agropark sketches were made (detailed below), dealing with spatial allocation on site, created through flexible collaboration in small teams.

Scenario exercises outcomes

From these exercises several design strategies surfaced already, which are being collected in a Program of Requirements going forward. These form the framework for the masterplan, outlined in chapter 5.

The five most important preliminary elements:

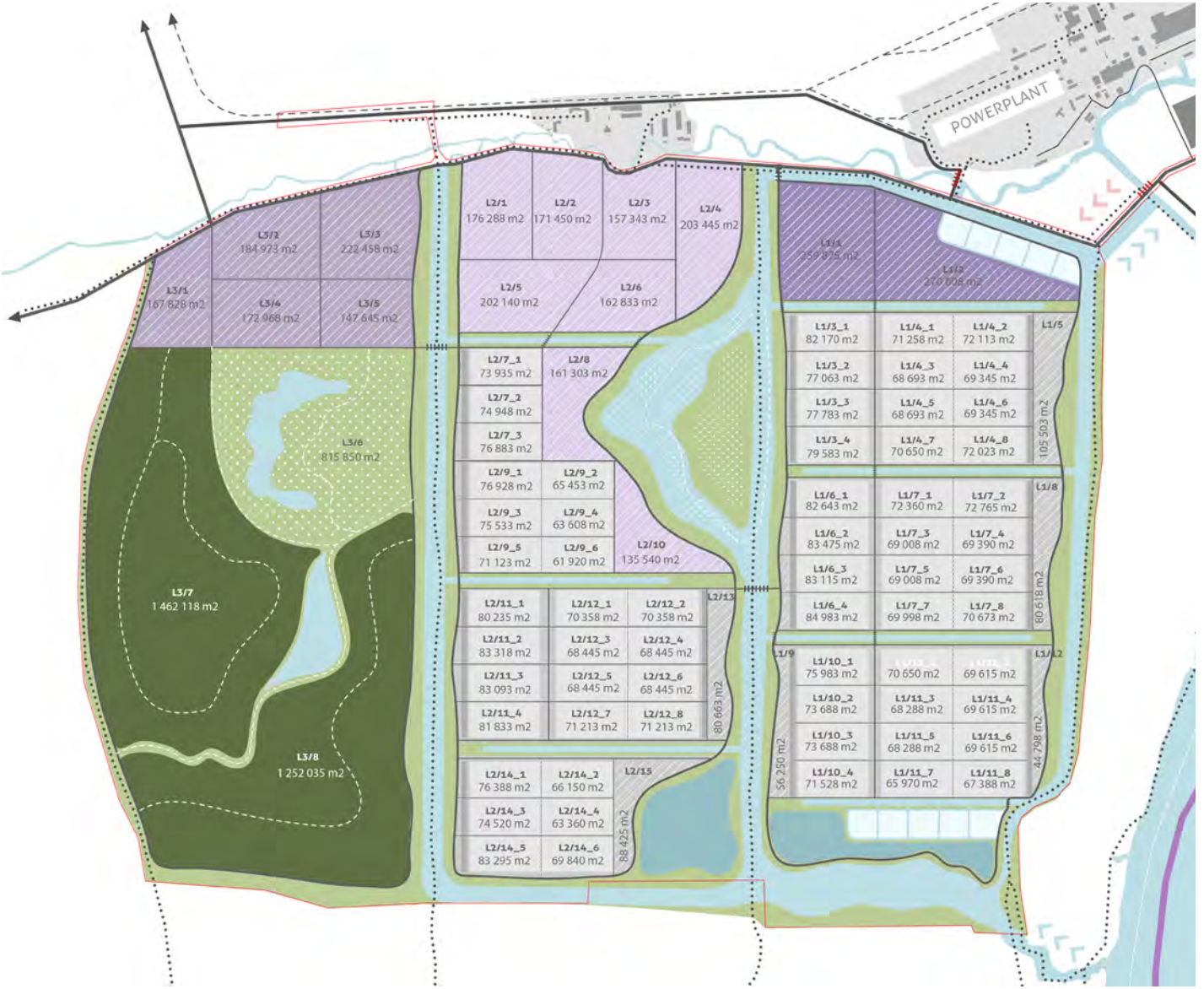
- Trenches remain, turned into ecological corridors
- Water to enter the site from the south-east corner
- Connection of all material flows on the north-east corner of EISAP
- Low to high density gradient from south-west to north-east
- Infra connectivity located along north axis

Map 3: Co-creation results and further explorations were finalized by the Except team on a third spatial scenario, which integrated all-important features and addressed all critical points, raised during the co-creation sessions

LEGEND

- POWERPLANT & EXISTING INFRASTRUCTURE
- PRIMARY ROAD NETWORK
- SECONDARY LOCAL ROADS
- TERTIARY SERVICE ROADS
- PRIVATE ACCESS
- GRAVEL ROAD
- RAILWAY
- POWER NETWORK
- INTERNAL WATER CONNECTION
- NATIONAL BORDER
- PROJECT AREA
- HEAT EXCHANGE
- WATER NETWORK ON SITE

- **LIGHT INDUSTRY (HEAT TRANSFER ZONE)** (BIOCHEMISTRY, CONSTRUCTION MATERIALS, FOOD PROCESSING, & WORKSHOPS)
- **BUSINESS, RESERACH & EDUCATION** (OFFICES, FLEX-WORK PLACES, STARTUP-HUB, PROTOTYPING, LAB FACILITIES, CONTROL CENTER, WAREHOUSES, PACKAGING, DISTRIBUTION)
- **HEAVY INDUSTRY (FACILITIES)** (LOGISTIC CENTER, PART MANUFACTURING, AUCTION HOUSE, RECYCLING, SOLAR PARK, FIBRE PROCESSING, MUNICIPAL COMPOST)
- **GREENHOUSES** (PRODUCTION)
- **GREENHOUSE FACILITIES** (SERVICE & EMERGENCY AREAS)
- **ECOLOGICAL NETWORK** (CORRIDORS & PARKS)
- **EXPERIMENTAL PARK**
- **AGROFORESTRY / SILVOPASTURE**
- **COMMERCIAL AGRICULTURE** (RENT A SMALL FARM, PICK YOUR OWN FOOD PARK)
- **AQUACULTURE**
- **WATER NETWORK** (WATERWAYS & CHANNELS)
- **FISH FARMS**
- **WATER MANAGEMENT FACILITY**
- **EXISTING BRIDGE**
- **PROPOSED NEW BRIDGE**
- **PROPOSED WATER TUNNEL**



Concept Masterplan of the EISAP - Phase 1
(greenhouses are located only on Lot 1 and Lot 2)

LEGEND

- POWERPLANT & EXISTING INFRASTRUCTURE
- PRIMARY ROAD NETWORK
- SECONDARY LOCAL ROADS
- TERTIARY SERVICE ROADS
- PRIVATE ACCESS
- GRAVEL ROAD
- RAILWAY
- POWER NETWORK
- INTERNAL WATER CONNECTION
- NATIONAL BORDER
- PROJECT AREA
- HEAT EXCHANGE
- WATER NETWORK ON SITE

- **LIGHT INDUSTRY (HEAT TRANSFER ZONE)** (BIOCHEMISTRY, CONSTRUCTION MATERIALS, FOOD PROCESSING, & WORKSHOPS)
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- **AQUACULTURE**
- **WATER NETWORK** (WATERWAYS & CHANNELS)
- **FISH FARMS**
- **WATER MANAGEMENT FACILITY**
- **EXISTING BRIDGE**
- **PROPOSED NEW BRIDGE**
- **PROPOSED WATER TUNNEL**

Concept Masterplan of the EISAP - Phase 2
(further expansion of greenhouses on Lot 3 at a second future phase)

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