

WP5 SUITABLE LOCATION FOR A POWER-TO-X PLANT

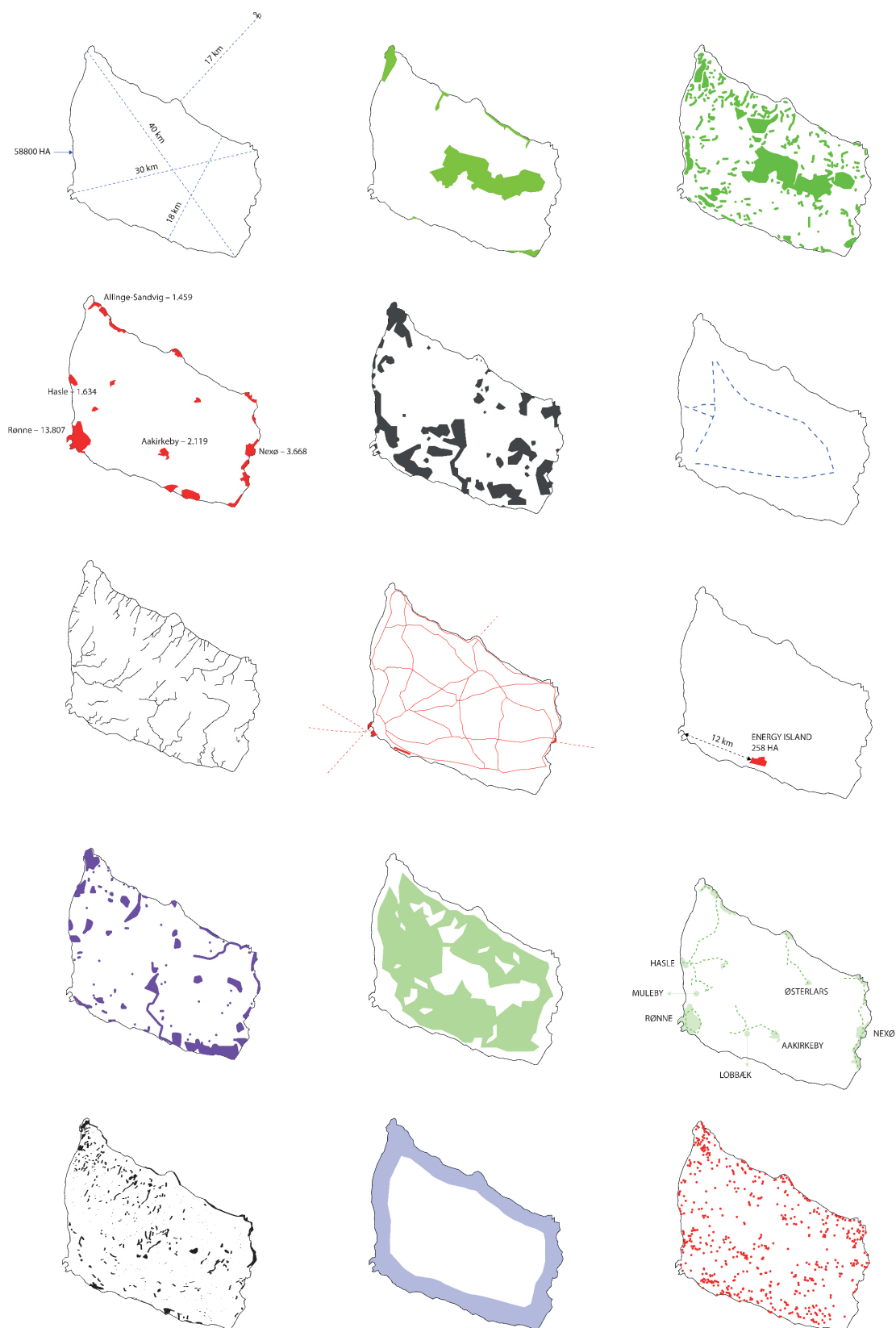


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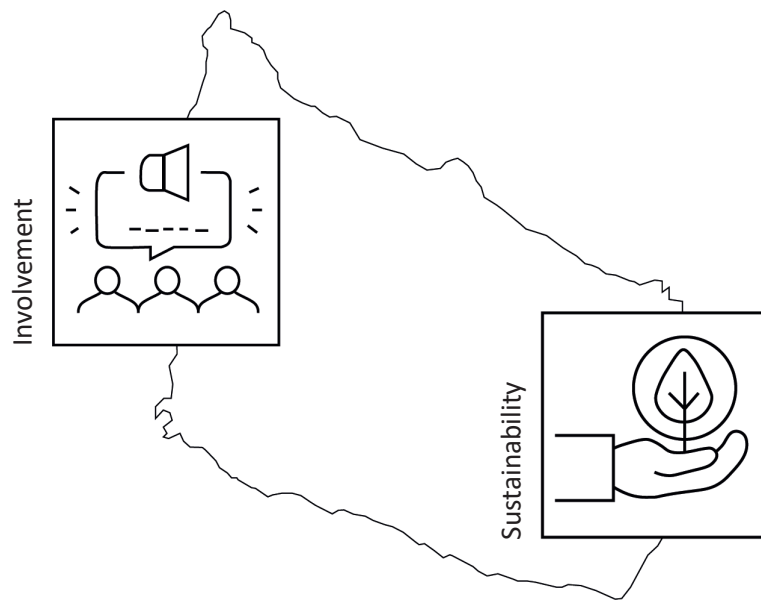
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WP5

This document is a guide describing the planning process for a future PTX project on Bornholm. It includes an overview of the following considerations: the municipal plan as a strategic planning tool, topology and land-use, transport of product, storage of product, the approval process, and an approach to landscape design and architecture.

Bornholm is standing on the brink of exciting possibilities for the implementation of a new energy industry. The chemical industry, with which a Power-to-X plant can be associated, has historically had only a limited presence in Denmark - and none on Bornholm. There are innate challenges with the development of this technology on the picturesque island of Bornholm and it is of the utmost importance that the upcoming PTX project's location and design is adapted to the context. The location of a PTX plant and its storage facilities depends on a number of factors, such as the physical parameters for the project, the business case and the context. Not least, the process must be transparent and occur in close dialogue with relevant authorities.





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PLANNING - A POLITICAL PROCESS

Planning - a political process

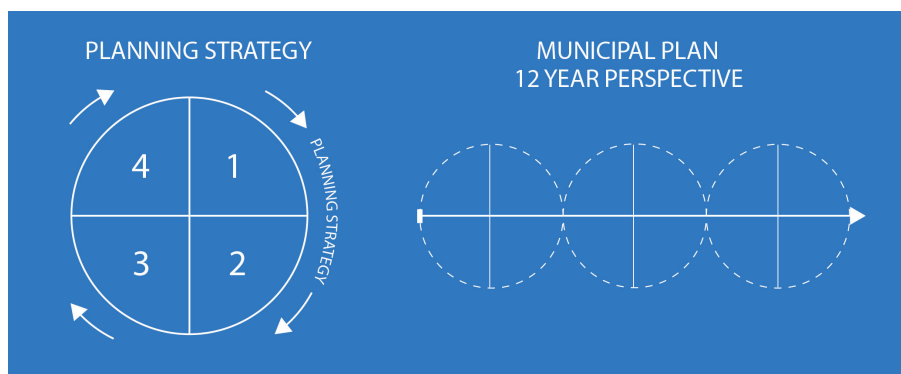
As planning for a PTX plant and its storage facilities will be a new initiative for Bornholm, there is no approved strategy in the existing municipal plan, "Kommuneplan," for pinpointing a suitable location. The following is a description and overview of the municipal planning process.

The national Planning Act defines the framework for a municipal plan.

The municipal plan is a strategic document based upon the municipal council's priorities for physical planning. It defines the objectives and strategies for a municipality's spatial and land-use development, including the precise framework for the content of local plans. It is both a political document and a practical document. All municipalities are required to maintain and revise the municipal plan.

The municipal plan includes a comprehensive vision for a given context and a strategy for how the vision can be brought to fruition. The process is open and transparent, incorporating input from stakeholders and citizens.

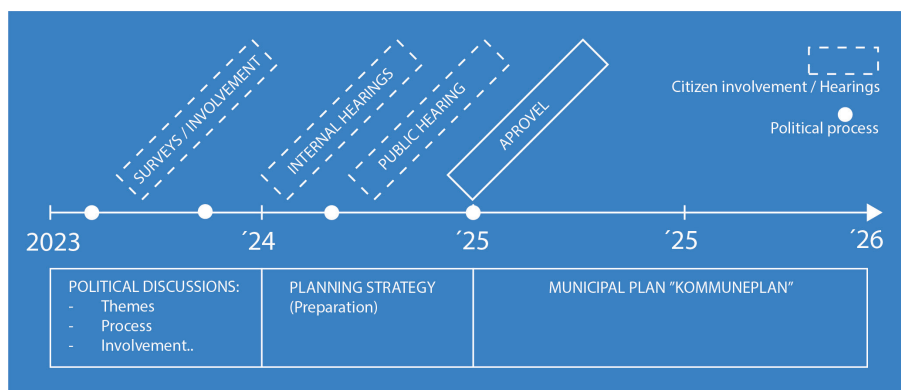
The municipal council must devise and adopt a planning strategy within the first 2 years of their 4-year election period. The strategy has a 4-year cycle and the municipal plan has a 12-year perspective.



Planning strategy og municipal plan

A PTX project will require a local plan and an environmental statement. This is described and illustrated in detail in the chapter, Approval Process.

The municipal council can choose to initiate the local planning process, even if it is not included in the planning strategy or municipal plan.



Planning strategy - Flow diagram

Recommendations - The political process

- Initiate as early as possible dialogue with authorities, politicians and interest groups regarding large-scale projects.
- Work with the planning phase in parallel with the development phase, since they are dependent on each other.
- Municipal planning includes public hearing and debate. Therefore, it is important for to engage in an early overall political discussion about a new potential industry.
(As of February 2023: The planning strategy 2023 is currently underway and the municipal council has approved that the project, Energy Island, and spin-off projects will be a main focus).

SUITABLE LOCATION FOR A POWER-TO-X PLANT

Bornholm is located in the southern part of the Baltic Sea, 145 kilometers from Copenhagen, 37 kilometers from Sweden, 88 kilometers from Germany and 90 kilometers from Poland. Bornholm has a total area of 587 square kilometers, a coastline of 158 kilometers and a population of 39500 people.

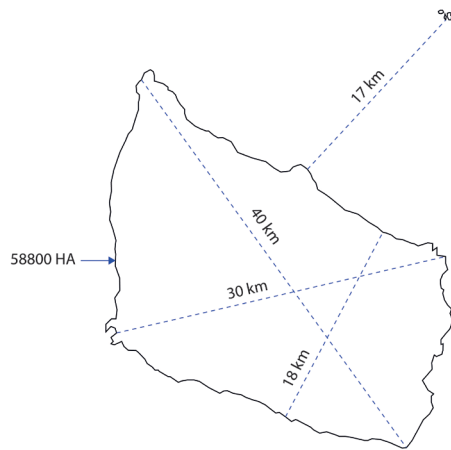
Bornholm is characterized by its unique nature and geology, with Denmark's third largest forest, Almindingen, located on the middle of the island. Forests, beaches, cliffs, idyllic towns, waterfalls and crevasse valleys are characteristic of Bornholm.

The following diagrams illustrate the factors that must be taken into consideration when planning for at large-scale Power-to-X facility.

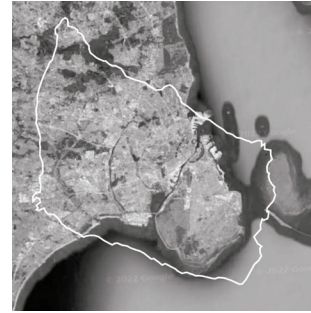


Factors combined

SIZE AND DISTANCES

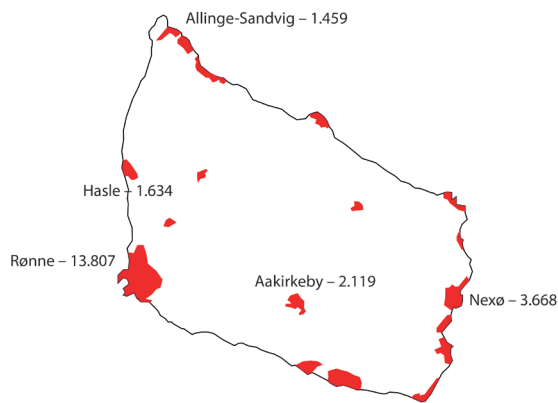


"Everything is only 30 min. away"



Bornholm + Copenhagen

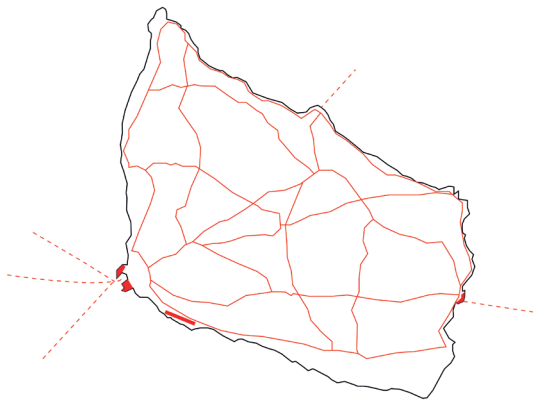
MAYOR CITIES



The municipal city strategies are described here:

<https://bornholm.viewer.dkplan.niras.dk/plan/31#/13209>

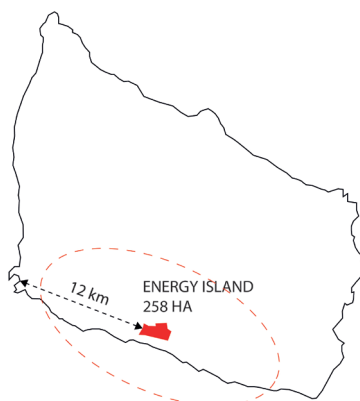
INFRASTRUCTURE



Bornholm has a developed infrastructure with well-maintained primary roads.

Infrastructure is a key factor for the localizing the plant, the storage facilities and for the transport of product.

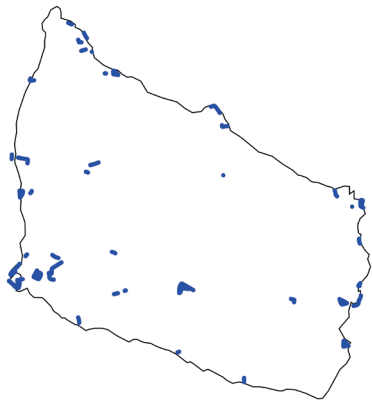
ENERGY ISLAND



The Energy Island project is to be taken into use in 2030.

If a PTX plant is to make use of the Energy Island's surplus energy, a location in close proximity to the transformer station of the Energy Island is relevant.

COMMERCIAL-AND INDUSTRIAL AREAS



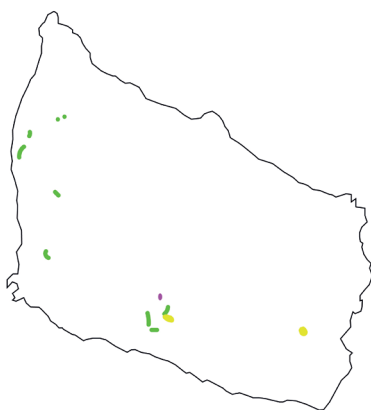
Commercial / Industrial zones are spread throughout the island, with a major concentration around Rønne.

A possible synergy with existing zones must be taken into account as well as exploring the possibility for new zoning for one or more PTX plants.



PTX commercial area – early sketch(BRK)

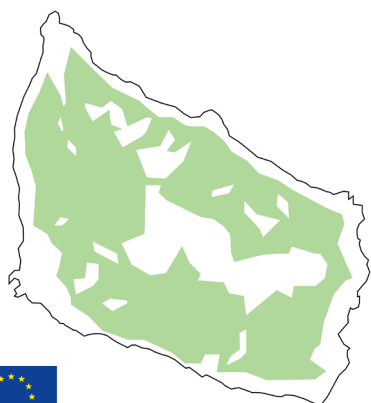
WIND, SOLAR AND BIOGAS



Green = Wind turbines
Yellow = solar power
Purple = Biogas

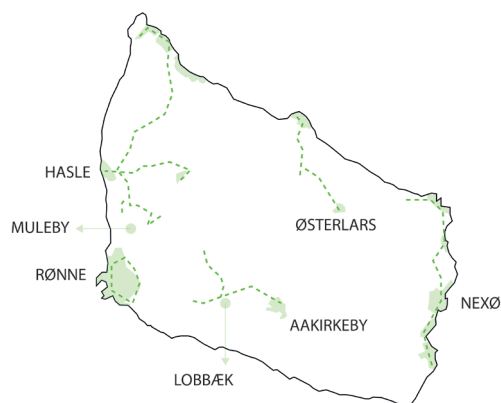
Synergy with existing green projects must be analyzed.

FARMING



Approx. 1800 people work in agriculture on Bornholm.

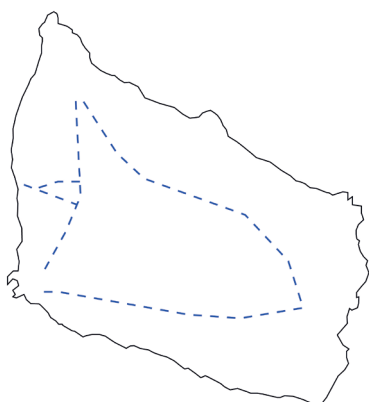
BEOF GRID FOR DISTRICT HEATING



Hasle: Wood chips, straw and wood pallets
 Muleby: Wood pellets reserve
 Rønne: Wood chips
 Lobbæk: Wood pellets reserve
 Aakirkeby: Wood chips and manure
 Østerlars: Straw and electricity
 Nexø: Straw

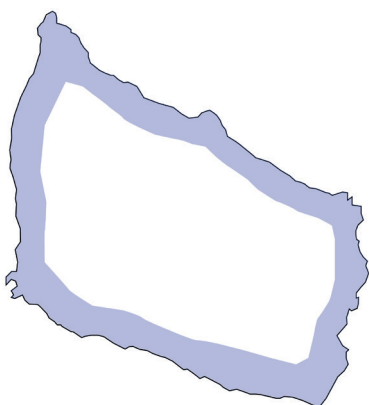
It must be analyzed whether potential surplus energy can be delivered to Beof's existing grid or if the grid needs to be developed.

60 KV POWER GRID



Authority:
 TREFOR EI-Net Øst

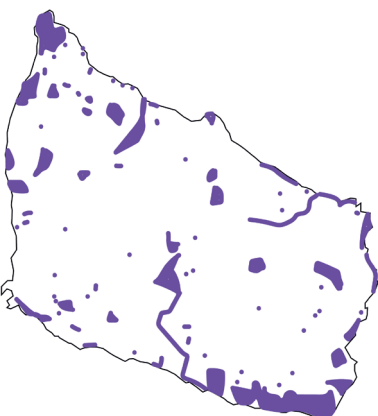
COASTAL ZONE



The coastal proximity zone includes areas zoned as rural zones or as summer cottage areas within approx. 3 km from the coast.

The coastal proximity zone is not a prohibition zone, but there are special requirements for planning in this area.

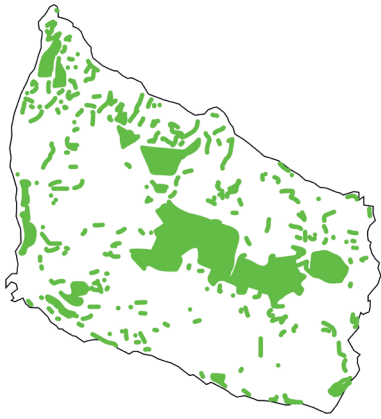
PROTECTED AREA



Authority:
 Conservation Board(Fredningsnævn/Bornholms Regions-kommune).

The protective areas are the most restrictive areas.

PROTECTED FOREST



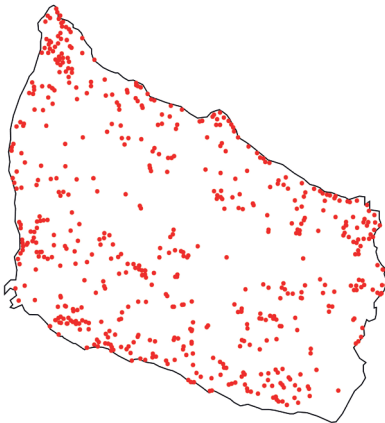
Authority:
Miljøstyrelsen

CULTURAL AREAS



Authority:
Slots- og kulturstyrelsen
Bornholms Regionskommune

HISTORICAL AREAS



Every red dot has a 100 m. safety zone

Authority:
Bornholms Regionskommune
Slots- og kulturstyrelsen

NATURA 2000



Authority:
Bornholms Regionskommune
Naturstyrelsen/Miljøstyrelsen



§3 STREAMS



Nature Protection Act
Authority:
Bornholms Regionskommune

§3 AREAS



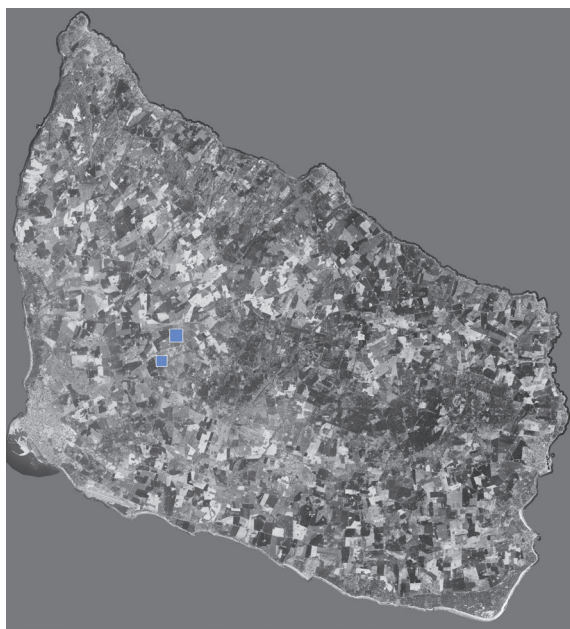
Nature Protection Act
Authority:
Bornholms Regionskommune

Recommendations - Large scale planning

- Work for a sustainable location within the context, and not against it.
- Make thorough context analyses.
- Establish early dialogue with authorities to avoid zones of conflict.

ZOOM IN – LOCAL PLANNING

The size of a PTX plant and storage is dependent on the project's structures, buildings, infrastructure and safety zones. In this facility study the sizes 30-and 50 ha for the plant are the scenarios. The sizes are significant and will have an impact on the landscape.



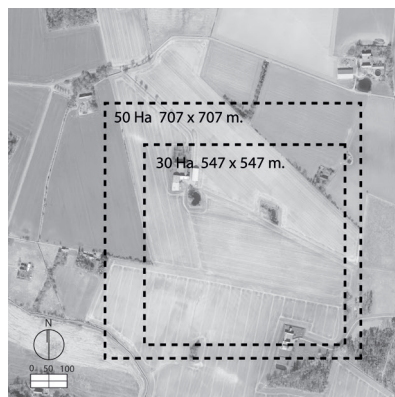
30 Ha and 50 Ha on Bornholm



30 Ha and 50 Ha in an urban scale.

On the more local scale, new topologies become crucial. The following diagrams illustrate landscape analyses that could be used to qualify the precise location of the PTX plant, storage facility and design programs. The background is a random location for the illustration purpose.

FOOT PRINT



30 ha and 50 ha, shown in a local context.

INFRASTRUCTURE



Red: Primary and secondary road
Red dotted: Future road
Green dotted: Future path

A BLUE PLAN



This plan relates to watershed planning and natural water courses.

Blue line: Existing drainage
Dotted line: Future drainage

A GREEN PLAN



The Green Plan focuses on strengthening nature, landscape and biodiversity. The green plan has potential to emphasize natural gems.

Green: Forest and green area
Dotted line: Future vegetation

A VISUAL STRUCTURE



A visual survey can highlight the uniqueness of a location.

Recommendations - Planning in a local scale

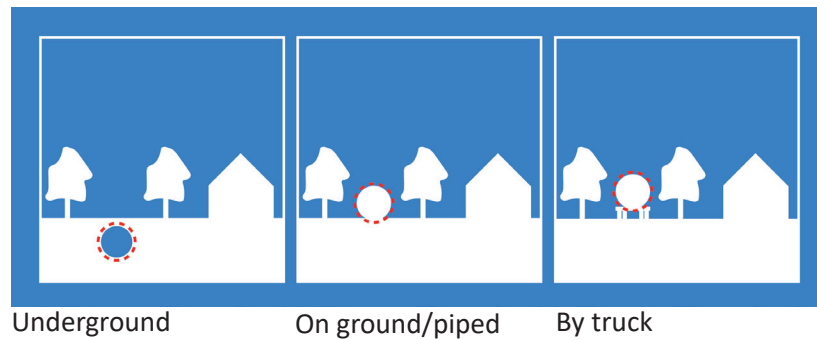
- Prepare thorough analyzes of context.
- Have an ambitious landscape approach: "Add more than you subtract"
- Map public interests as a function of local interests.



Context

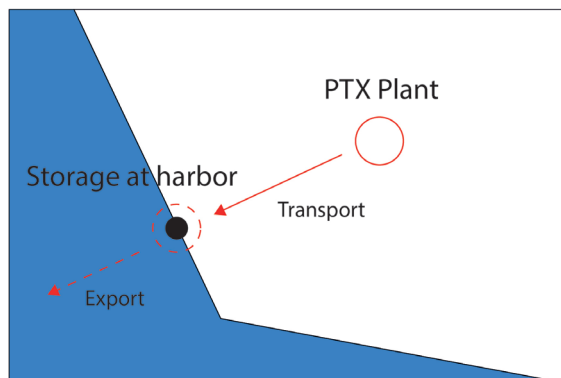
TRANSPORT OF PRODUCT FROM POWER-TO-X PLANT

The product has to be transported in a safe matter to an existing or new port for export or to another industry. We can address the challenges for transport with the following three scenarios:



1) Plant placed in land and storage placed at an existing harbor

Context



Transport of product:

By truck:

- Is not a sustainable solution if the product is in large amounts.

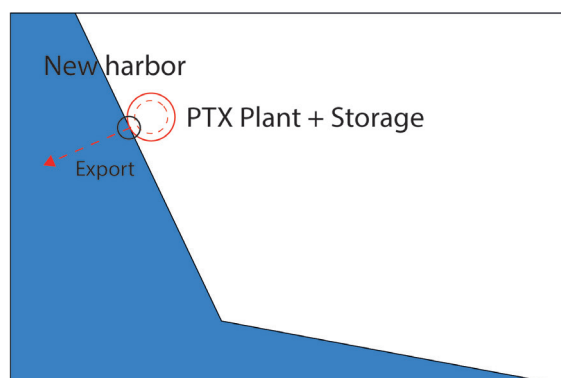
Underground pipes:

- Does not require municipal planning, but includes risk assessment, environmental permits and multiple legal cadastral agreements.

On ground/piped:

- Requires municipal planning and is only possible in areas with low population density.

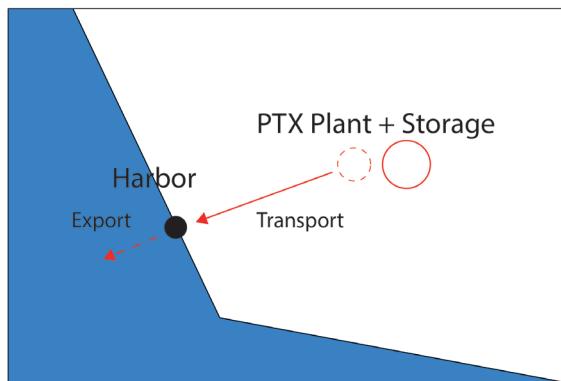
2) Plant and storage placed at a new harbor



Transport of product:

- A location of both PTX and storage close to the export point, would be an optimal scenario, hereby avoiding the transport.

3) Plan and storage placed in land



Transport of product:

By truck:

- Is not a sustainable solution if the product is in large amounts.

Underground pipes:

- Does not require planning, but includes risk assessments, environmental permits and multiple legal cadastral agreements.

On ground/piped:

- Requires municipal planning and is only possible in areas with low population density.

Recommendations - Transport of product

Transport of the PTX product is an important factor for localizing the future plant and storage facility.

- Avoid long transport times and traffic through areas with a high population density.

- Localize plant and storage facility as close to the "export point" as possible.



Context





KORTBILAG 3 - MILJØKLASSER

SIGNATURFORKLARING

- • • • Lokalplangrænse
- • • • • Delområdegænse
- 1-7 Delområdebetegnelse
- Miljøklasse 3-6
- Miljøklasse 4-7
- Støjbufferområde

Local Plan:

<https://bornholm.viewer.dkplan.niras.dk/plan/23#/>

STORAGE OF eFUELS IN PORT OF RØNNE

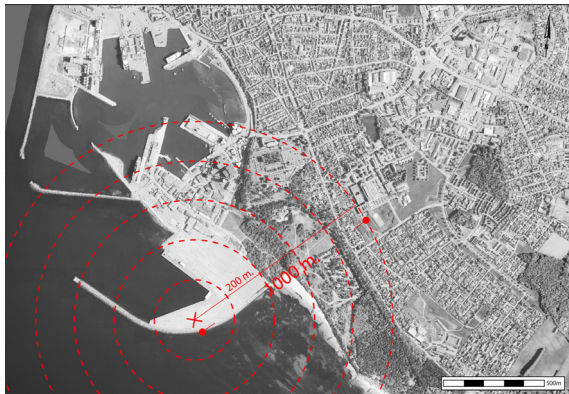
Storage of efuels at the port of Rønne:

The local plan, "lokalplan," for The Port of Roenne has the overall category "Port-related functions," and that includes heavy industry, such as tank and oil plants.

The area is divided into 7 sites, with the following building specifications:

- Site 1 and 2: The building height cannot exceed 30m. above ground level
- Site 3 and 6: The building height cannot exceed 20m. above ground level
- Site 4 and 5: The building height cannot exceed 40m. above ground level

There is no planning restrictions for storage of efuels as such, but it will require environmental screening, eventual environmental report(EIA Directive) and building permits.



The safety zone will be defined on the basis on the entire project: situation plan, the structure of the tank, safety procedures etc.

Authority: The Danish Environment Agency and Bornholms Regionskommune

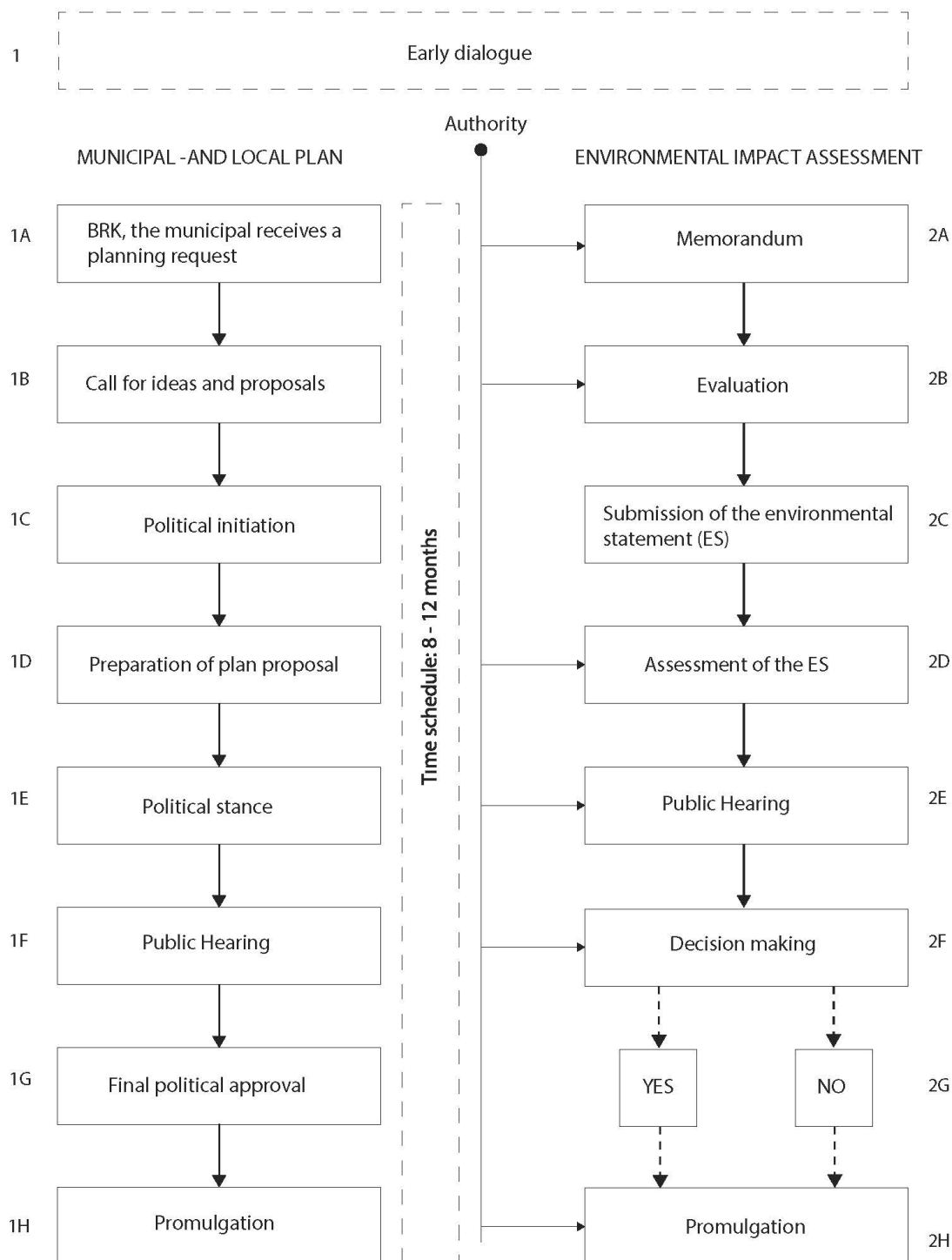


Red = Local plans
Dotted line = Restricted areas
(Recreational and architectural conservation)

Recommendations - Storage of efuels

- Storage of efuel at the Port of Roenne is a sensitive matter because it is close to a dense city. A public strategy and involvement is required.

FLOW CHART: MAPPING OF AUTHORITY PROCESS



Legal basis:

Planning Law: <https://www.retsinformation.dk/eli/lta/2020/1157>

Environmental Assessment Act: <https://www.retsinformation.dk/eli/lta/2021/1976>

APPROVAL PROCESS

The following flow chart maps out the process for applying for project approval from the planning and environmental authorities.

Flow Chart description:

1: Pre-project dialogue

We recommend that you engage in pre-project dialogue with the authorities in order to establish a chain of command for the further process.

Municipal and local plan

1A: Planning application

A planning application contains a statement of intention and a project proposal. The proposal should spell out all of the details of the project. It is addressed to the municipal planning department.

1B: Call for ideas and proposals

First, the project site is screened by all relevant municipal departments in order to map potential conflicts with e.g. planned usage, vulnerable habitats, infrastructure, etc. The municipal council also invites stakeholders to the first public meeting in order to ensure that the project is not in conflict with other potential projects.

1C: Initiation of the planning process

Based on point 1B, the county council initiates the official planning process.

1D: A draft of the county plan/amendment to the local plan is drawn up and sent to the county council to be approved as a basis for public hearing.

(This runs parallel with point 2C)

1E: Initial approval of plan drafts

The municipal council approves the drafts as a basis for public hearings.

1F: Public Hearing

A hearing period of 6-8 weeks, with at least one public meeting.

(This runs parallel with point 2E)

1G: Final approval

Qualified input from the public hearing is evaluated and the adjusted plans are approved by the county council.

1H: Promulgation

The planning authority promulgates the plans.

Environmental Impact Assessment

2A: Memorandum

The environmental department screens the projects and formulates a memo on each project.

2B: Evaluation

The county decides whether an environmental impact assessment is required.
(A PTX project will most likely require an environmental impact assessment)
2C: Submission of the environmental statement
The project owner prepares an environmental statement (ES).
(This runs parallel with point 1D)

2D: Assessment of the ES
The environmental department evaluates the report.

2E: Public Hearing
Public hearing of the ES.
(This runs parallel with point 1F)

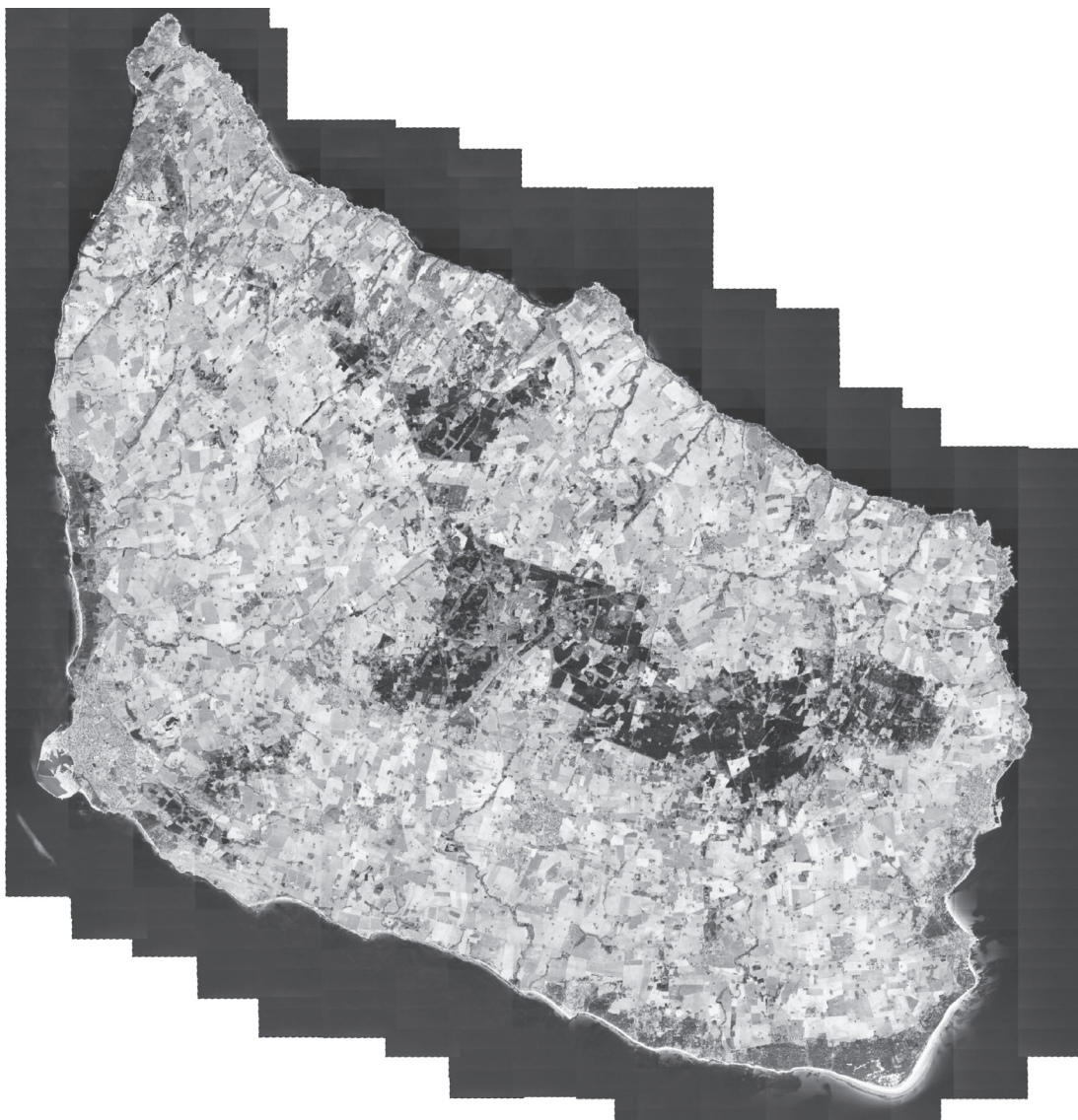
2F: Decision-making
The environmental report is presented to the county council.

2G: Yes or No
The project is either approved or disapproved.

2H: Promulgation
The ES is publicly announced

Recommendation - Authority process

- Early dialogue and cooperation with authorities. Bornholms Regionskommune / Miljøstyrelsen.
- Work with transparent processes.



Context

ARKITEKTURPOLITIK FOR BORNHOLM

Arkitektonisk kvalitet

opleves, når form, funktion og byggeteknik sammentænkes og udmøntes i en helstøbt kunstnerisk idé. Det er vanskeligt entydigt at definere begrebet. Arkitektur af høj kvalitet forholder sig til omgivelserne i et kvalificeret med- eller modspil. Arkitekturen understreger, forstærker og fortolker omgivelsernes kulturhistoriske særkende og egenart. Arkitektur skabes såvel i planlægningsfasen som i udførelsesfasen og skal stå sin prøve i brugsfasen.

Forudsætningen for at fastholde og udvikle et samfunds arkitektoniske værdier over tid er, at både beslutningstagere, udførende og brugere har fokus på deres respektive ansvar for at sikre den arkitektoniske kvalitet.

Høj arkitektonisk kvalitet kan betale sig

Det gælder, når man ser på totaløkonomien, hvor anlægs- og vedligeholdelsesudgifter vurderes under ét.

Det gælder også, når bygningers langsigtede markedsværdi og brugsværdi tages i betragtning.

God arkitektonisk kvalitet er også

- ansvarlighed i forhold til signalværdi, identitet og kulturarv
- sunde bygninger, fx Svanemærket byggeri
- tilgængelighed for alle til bygninger, anlæg og pladser
- bæredygtighed, dvs tage hensyn til bl.a. energiforbrug ved materialer og konstruktioner
- reducere omkostninger til drift af bygninger og anlæg
- i sig selv en turistattraktion.

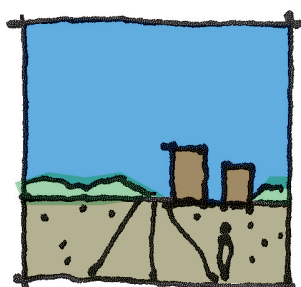


LANDSCAPE AND ARCHITECTURE

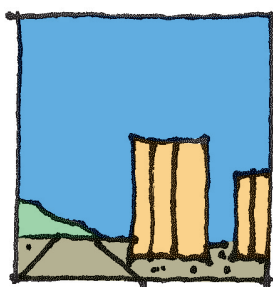
The municipal council has approved an architectural policy in order to secure and enhance the architectural quality and development on Bornholm. The policy has the following two goals:

1. Architectural quality should be promoted via professional and qualified dialogue, guidance and communication.
2. An understanding and appreciation of architectural quality should be implemented across all boundaries within the municipal organization.

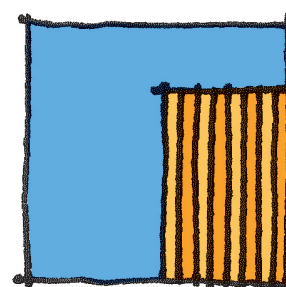
Bornholm is characterized by a varied landscape as well as by unique and diverse cultural environments. Therefore, when planning for new buildings and facilities in the countryside, the greatest possible consideration to the character of the surrounding landscape must be given.



From a far



From a distance



Up close

Recommendation - Landscape and Architecture

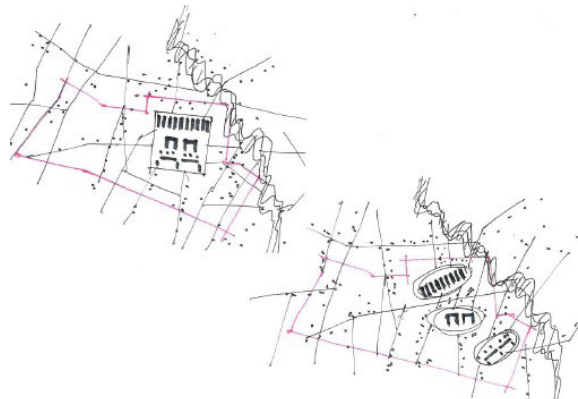
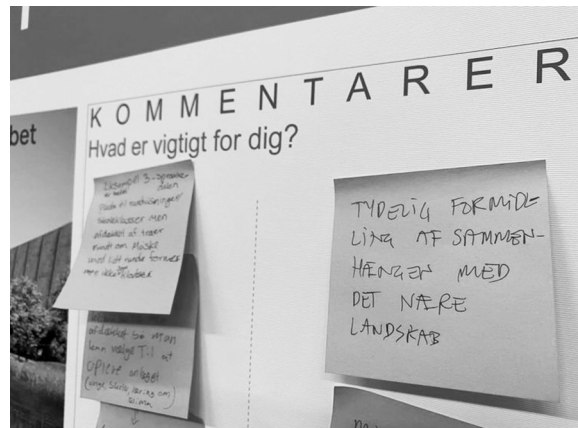
- Involve building and landscape architects early in the process.
- Involve citizens and interest groups.
- Be open to creating new recreational facilities or infrastructure or new nature in the landscape design.
- Adapt the plant's design to the natural surroundings.
- Create links to the existing natural elements, such as natural streams, paths etc.
- Design the safety fence as an architectural element.
- The size of the project defines the participatory process.
- Create architecture that is inspiring, both from afar and up close.

ENERGY ISLAND

A reference project:

Energinet is currently planning for a approx. 70 ha transformer station on Bornholm. Their approach to the context and architecture is a two-sided process. On the one hand, they are planning and detailing the technical aspects of the project. On the other hand, they have engaged architects to manage the participatory planning process in order to get input on the landscape design and the design on the buildings/structures.

At the first workshop, the public was invited to brainstorm on the landscape, buildings and such. At the second workshop, the architects presented 3 concepts for the landscape and architecture and citizens were invited to give their input. The architects are now developing their final concept and then it's up to Energinet on how they will use the input from the architects for the final landscape and structural design. Parallel with this, there is a municipal, local and environmental plan in the works.



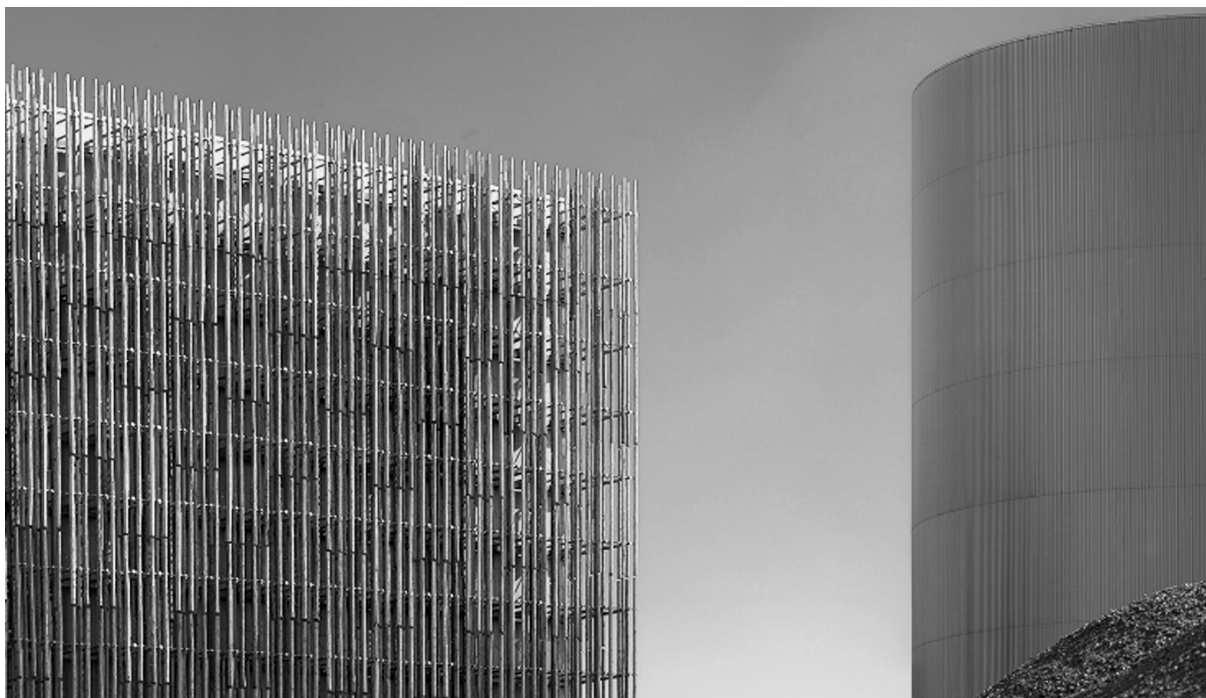
WP5 LOCATION OF POWER-TO-X PLANT AND STORAGE

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