INTEGRATED MOVEMENT

The reintegration of the marine establishment into the public space of Amsterdam
PRESENTATION CONTENT

1. Introduction & Function
   - Introduction to the marine area

2. Research
   - Thematic research
   - Research program
   - Site analysis

3. Design
   - Site intervention
   - Building design
PRESENTATION CONTENT

1. Introduction & Function
   *Introduction to the marine area*

2. Research
   *Thematic research*
   *Research program*
   *Site analysis*

3. Design
   *Site intervention*
   *Building design*
**MARINE AREA - HISTORY**

1655: Used for building Navy ships

1790: Outer ring of the Marine Establishment Amsterdam is built

1796

1875

1915 No longer suitable as shipyard. Storage of military equipment and training of personnel

1950

1968 Central water body in the area is reclaimed

2015 Parts of the area disclosed to Rijksvastgoedbedrijf to start the gradual development of entire area
MARINE AREA

Military area

Public area

Transition period 2018 - ?

Future -?
INVENTORISATION
VISION

The reintegration of the marine area into the public space of Amsterdam.
VISION

The reintegration of the marine area into the public space of Amsterdam.
Transition area unites current and future users taking into account the identity and vision of the area
INTEGRATED FUNCTION

Marine area since 1655

Transition period

Future
EXISTING POOLS
PRESENTATION CONTENT

1. Introduction & Function
   Introduction to the marine area

2. Research
   Thematic research
   Research program
   Site analysis

3. Design
   Site intervention
   Building design
Main research question
How can a swimming pool with a sustainable energy design bring the vitality of the city into the marine area?
Main research question
How can a swimming pool with a sustainable energy design bring the vitality of the city into the marine area?
Main research question
How can a swimming pool with a sustainable energy design bring the vitality of the city into the marine area?
Main research question
How can a swimming pool with a sustainable energy design bring the vitality of the city into the marine area?
Main research question
How can a swimming pool with a sustainable energy design bring the vitality of the city into the marine area?
Main research question
How can a swimming pool with a sustainable energy design bring the vitality of the city into the marine area?
ENERGY CONSUMPTION

High gas consumption

Netherlands 700 pools = Total of 1.6 million MWh energy ~ 90.500 households

Mainly natural gas

≥ 27 °C
What interventions can be applied to a(n) (existing) swimming pool to eliminate natural gas consumption and reduce the overall energy consumption?
II. REFERENCE SWIMMING POOL

The influence of interventions on the gas and electricity consumption of swimming pools is highly dependent on the current situation. In other words, depending on the context, some interventions may yield different quantitative results. To be able to compare different type of interventions with each other a reference pool is introduced. The gas and electricity consumption of swimming pools is often based on the surface area of the swimming pool. Hence, an estimation of the energy consumption can be made by multiplying the surface area with the benchmark energy consumption of swimming pools. At this moment, swimming pools consume around 51 m³/m² gas and 136 kWh/m² (Sipma, 2016). This paper provides insights in the gas and electricity consumption of a small – middle sized swimming pool (~2500 m²). Water consumption that is related to the energy consumption is included as well.

A reference pool is introduced with a surface area of 2500 m². This pool is still largely dependent on gas, and as such falls in the category of older, still to be renovated, swimming pools. The reference pool will help to understand the different flows within the pool and to become more numerate with the flows. More information on the reference pool can be found in Appendix 10.1. Based on the data that is provided by Meijer and Verweij (2009) and the aforementioned gas-electricity ratio, a Sankey diagram can be constructed (Figure 2.1, left). This Sankey diagram shows the yearly energy requirements in terms of natural gas and electricity. Most noticeable is that gas is predominantly used for the purpose of space heating. Next to this diagram a Sankey diagram (Figure 2.1, right) the future (goal) scenario is shown, which shows that the swimming pool is no longer dependent on natural gas for its energy requirements.
INTERVENTIONS

Trias Energetica

1. Reduce energy consumption
   - Orientation and organisation of the building
   - Improved Insulation
   - Pool covers
   - LED Light
   - Frequency pool water pumping system

2. Reuse waste energy streams
   - Heat exchangers and heat pumps for ventilation
   - Heat recovery and heat pump for shower water
   - Heat recovery and heat pump for pool water

3. Use renewable energy sources
   - Geothermal heat
   - Sewer heat recovery
   - PV Panels
   - Solar collectors
   - PVT Panels
COMBINING INTERVENTIONS

Most effective interventions to eliminate natural gas

<table>
<thead>
<tr>
<th>Status Quo</th>
<th>Insulated + Heat recovery</th>
<th>Air heat pump + Heat recovery</th>
<th>Shower and pool water heat pump + heat recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saving natural gas: 32%</td>
<td>Saving natural gas: 80%</td>
<td>Saving natural gas: 100%</td>
<td></td>
</tr>
<tr>
<td>Saving total: 24%</td>
<td>Saving total: 60%</td>
<td>Saving total: 73%</td>
<td></td>
</tr>
</tbody>
</table>
Figure 2.2. Detailed flow diagram of the reference swimming pool in the current situation. On the left hand side of the figure different flows enter the system boundary of the swimming pool. The right-hand shows how the flows leave the system, either to the sewage system in the form of hot water, or to the outside environment in the form of hot air.

Figure 8.2. Detailed flow diagram containing a combination of interventions. This combination of interventions has resulted in the elimination of natural gas consumption.

Status Quo  

With sustainable energy interventions
CONCLUSION RESEARCH

What interventions can be applied to a(n) (existing) swimming pool to eliminate natural gas consumption and reduce the overall energy consumption?

Orientations and organisation should be considered initially as this can, through energy collection and absorption greatly reduce energy consumption.

Technical interventions can completely eliminate gas consumption.

Insulation is a key aspect in energy reduction.

Quick wins like a pool cover, led light and frequency pump systems should always be applied.
DESIGN CONSIDERATIONS

Initial design considerations

- Orientation and organisation of the building
- Insulation

Both newly build pools from the case study have used the organisation of their spaces to reduce heat loss. The pool area has the highest temperature of approximately 28-30 [°C]. Other spaces like dressing rooms, technical spaces, storage, etc. have lower temperatures. These spaces can be used as an extra insulation layer around the swimming pool area (Menerga, 2017). Especially within the Noorderparkbad in Amsterdam this is clearly visible. In the Noorderparkbad the pool area is orientated to the south, the other sides of the pool area are enclosed by the other functions to increase insulation. From the facades, most of the heat is lost through the north façade, where the Sun cannot heat up the surface. In general, the north side is the coldest side, followed by the east side, and then the west side. This is depicted in Figure 4.1.2.

Due to the complex nature of quantifying the solar heat gain through radiation this intervention has not been quantified. These calculations are difficult to perform without dedicated simulations since heat transfer through radiation depends on the time of day/year, incoming incident angle of the Sun, the geometry of the building and the temperature and radiative properties of the different materials inside the building. However, from the earlier discussed references it can be concluded that for swimming pools in particular skylight may provide a beneficial increase in solar heat, which can reduce the required energy consumption.

4.2. Insulation

Insulation of the building will help to keep heat insight. Almost all pools from the case study did use high insulation to prevent the heat from escaping. This intervention can be applied to both existing and new buildings. A high insulation value ensures that a minimal amount of heat is able to escape. For new buildings there are standards set by the national government. Conservation of energy in buildings starts with good insulation. Especially poor insulation values of glass lead to a large heat loss in existing buildings. Table 4.2.1 shows what kind of interventions are useful to apply based the construction year.
**DESIGN CONSIDERATIONS**

Further considerations

- Heat exchangers and heat pumps:
  - ventilation
  - shower water
  - pool water
  - Geothermal heat
  - Sewer heat recovery

- PV(T) Panels, Solar Collectors

- Pool covers

- Prevent overheating
Main research question

How can a swimming pool with a sustainable energy design bring the vitality of the city into the marine area?
CONCLUSIONS

Double height pool area

Standard order of spaces
Not always on same level

Basement usually used for technical spaces

Small pools < 3100m³

Small pools > 5500m³

Large pools have a raised audience stand
SWIMMING POOL

Minimal program - indoor pool

- Entrance
- changing rooms + locker area
- Toilets
- Showers
- Pool(s)
  - Staff room
  - Audience stand

[technical space]

Usual
- Cafe

Additional
- Sauna
- Tanning facilities
- Training facilities
- Recreation facilities (slides, waves etc)

Sport
25 meter pool
15 meter pool

2000 - 3000 m²
Main research question
How can a swimming pool with a sustainable energy design bring the vitality of the city into the marine area?
ACCESS

Current access to the marine area
ACCESS

Current access to the marine area, no clear entry
PRESENTATION CONTENT

1. Introduction & Function
   Introduction to the marine area

2. Research
   Thematic research
   Research program
   Site analysis

3. Design
   Site intervention
   Building design
SITE INTERVENTION

Creating a central route through the marine area
SITE INTERVENTION

The buildings open to the route to create vitality
CLOSED VS OPEN

Transparency
Walking in the city is enhanced for pedestrians if they can see goods on display and what is going on inside buildings. And that works both ways.

- Jan Gehl, Cities for people-
CLOSED VS OPEN

The buildings will opened towards the new main route
BUILDING POSITION

Building added as vital part of the main route
BUILDING POSITION

Building added as vital part of the main route
BUILDING POSITION

Orientation of the building - maximize solar gain south facade -
EXISTING STORAGE BUILDING
BUILDING POSITION

Development of the complete strip to create vitality towards both sides and to define the green area
BUILDING FUNCTIONS

Opportunity to include an additional function to the program

~1500 m²
~500 m²
~1200 m²

additional function
**ADDITIONAL FUNCTION**

A place to escape the busy city, and experience peace and quiet

**Minimal program** - indoor pool

- Entrance
- Changing rooms + locker area
- Toilets
- Showers
- *Pool(s)*
- Staff room
- Audience stand

[Technical space]

**Usual**

- Cafe

**Additional**

- Sauna / Spa
- Tanning facilities
- Training facilities
- Recreation facilities (slides, waves etc)
PROGRAM ORDER

Existing building
PROGRAM ORDER

Structure existing building
PROGRAM ORDER

Most public function connected to main route
PROGRAM ORDER
ENERGY CONCEPT
Using the large south facade to gain solar energy
THERMAL MASS

Using thermal mass to capture and store the solar energy
THERMAL MASS

Using thermal mass to capture and store the solar energy
THERMAL MASS

Using thermal mass to capture and store the solar energy
THERMAL MASS

Using thermal mass to capture and store the solar energy
THERMAL MASS

Using thermal mass to capture and store the solar energy - adding a water body -
THERMAL MASS

Using thermal mass to capture and store the solar energy

effectively regulate humidity
HUMIDITY

General ventilation requirement
RAMMED EARTH

Rammed earth stores a large amount of moisture

![Graph showing humidity levels during day and night, with ventilation requirement and max comfortable humidity levels marked.]
NATURAL HUMIDITY & HEAT CONTROL

Thermal mass and moist absorption reduce the energy consumption
INFRASTRUCTURE CONCEPT

Overview of the infrastructure that can be solved within the rammed earth wall

Heat

Humidity
INFRASTRUCTURE CONCEPT

Overview of the infrastructure that can be solved within the rammed earth wall

Air (ventilation)  Stormwater  People
WALL
Building with wall
PUBLIC BUILDING ZONE
Front facade area as serre for the park

between building and park, a public part of the building as part of the park
TRANSPARENCY

Interaction between in and outside
BUILDING CONSTRUCTION

Making use of and extending the existing structure
EXISTING BUILDING

Using facade elements to create a new floor throughout the entire building

Facade elements

Ingredients new floor

Terrazzo floor (Studio Volop)
DIVISION OF SPACE

CLT panels divide the building in three parts
BUILDING LAYOUT
BUILDING LAYOUT

Within each main function a special intervention takes place
BUILDING LAYOUT

Within each main function a special intervention takes place
FACADE

Facade elements that are able to block the Sun on the south facade and collect energy
ROOF CONCEPT

Concept for the roof to include all

Walking
Relaxing
privacy
Solar energy
Natural Daylight
Green roof
Insulation
ROOF CONCEPT

Integrated layers in a new roofscape
PLAN ROOFSCAPE

The roofscape consists of a garden with a path, and private areas
ADAPTIVE SUSTAINABLE DESIGN

Conventional swimming pool

Pool with sustainable energy measures

Pool with sustainable adaptive design

Energy use

Gas

Heat Loss

Fresh air

Exhaust air (lost heat)

Boiler

++ Insulation

Thermal mass / humidity control
HEAT TRANSFER

Heat can be transported through the building
HEAT TRANSFER

Additional help from heat pump
VENTILATION

Natural ventilation through wall from serre
VENTILATION

Natural ventilation through adjustable openings
VENTILATION

Air unit for extra ventilation, situated in wall
STORM WATER COLLECTION

Storm water collection through the wall into the swimming pond / helophyte filter
POOL WATER SYSTEM

Water flows from hot to lower temperature pools. Additional water from swimming pond.
IDENTITY

Navy since 1655, still present
Closed off and peaceful area
VISION OF THE AREA

A search for buildings that can both be used by the military and the public

- Statement from the ministry-

Ambition - municipality

Detailed analysis by urban dynamics
Verkenning marineterrein

INNOVATION

SPORT

Flexible workspace

RECREATION

HOUSING

GREENERY

Sport

Movement

Playing
Innovation: Companies & education
HoReCa
Other visitors

Current users

Marine area

Future users

Innovation: Companies & education
HoReCa
Other visitors

Neighborhood

Users Marine establishment

Inhabitants

Age Oostelijke Eilanden/Kadijken

0-22 23-24 25-49 50-64 65+

Users Marine establishment