

# ACTIVATE RESILIENCE OF THE MIYAGI COAST



**DIMI** Delft  
Infrastructures & Mobility  
Initiative

 **TU Delft**

**TU Delft** Department  
of Urbanism  
**BK** Bouwkunde

GRADUATION PRESENTATION | NASIEM VAFA | 4112636

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**SENDAI**

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**35 MUNICIPALITIES**

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**2.347.600 INH.**

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**7200 KM<sup>2</sup>**



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**TOHOKU**

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**66900 KM<sup>2</sup>**

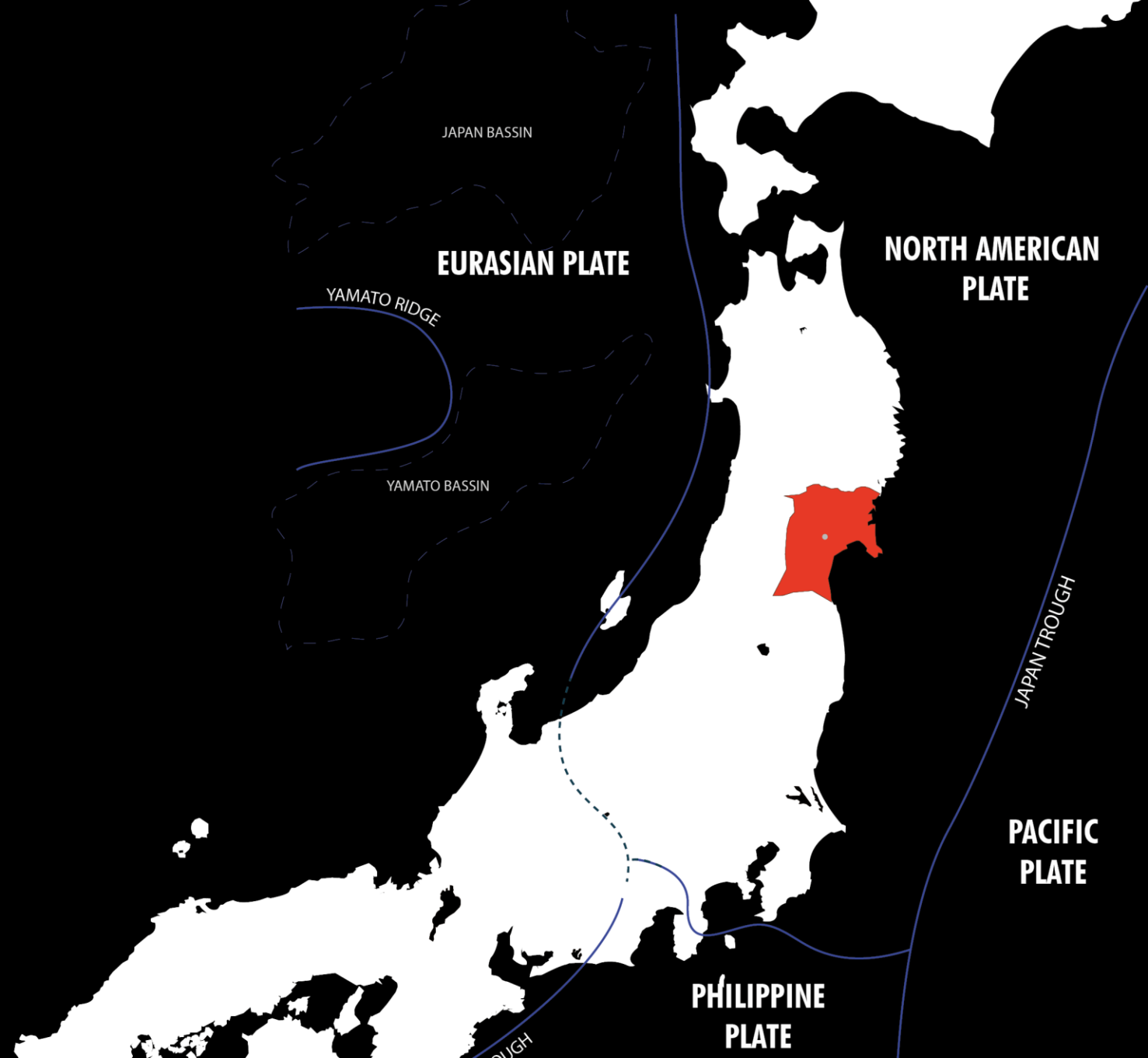
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**THE NETHERLANDS**

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**41500 KM<sup>2</sup>**



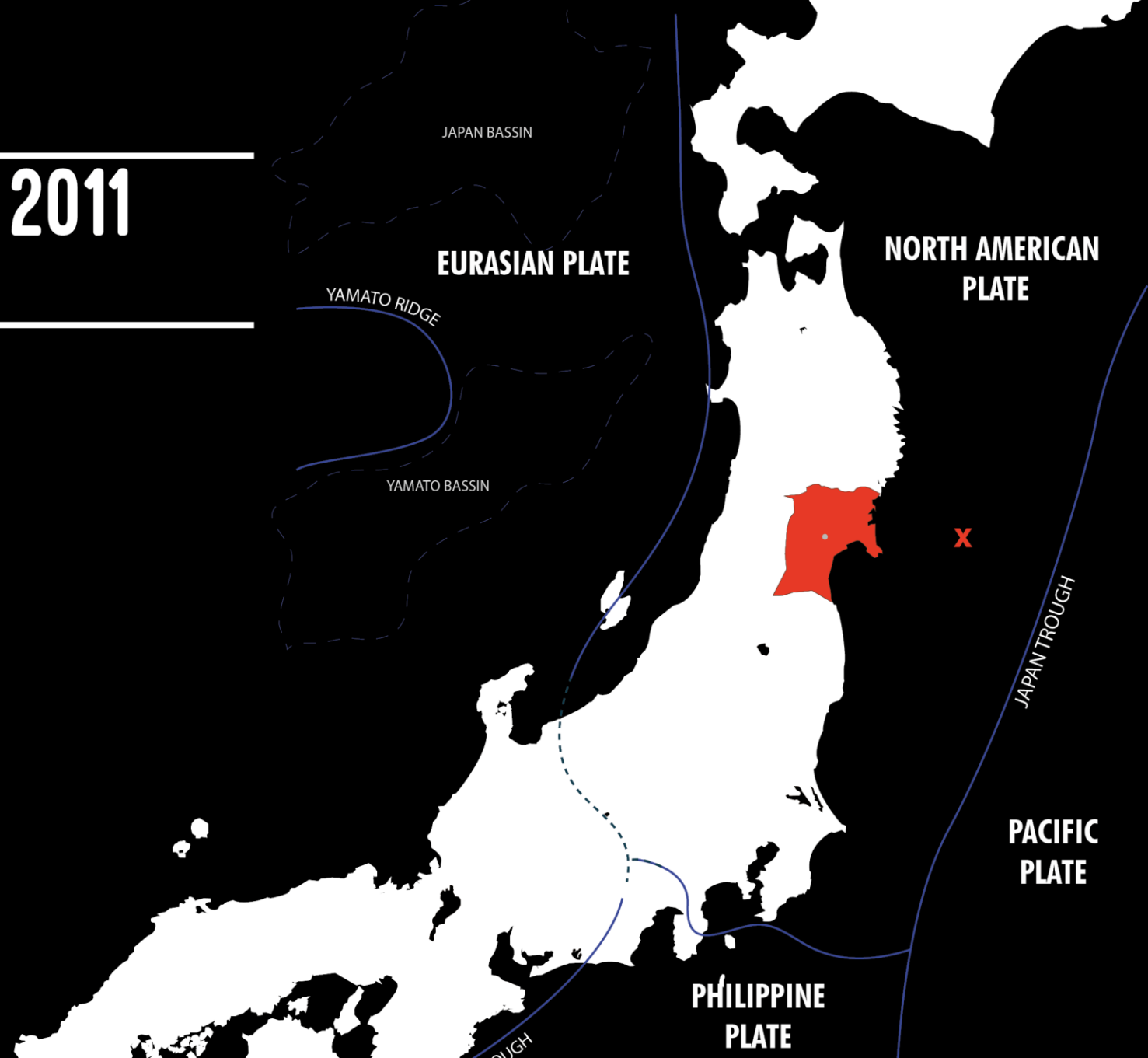


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# 11 MARCH 2011

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# 9.0 MMS







**\$183,000,000,000**

IN ECONOMIC DAMAGES



**15.860**

LIVES LOST



**128.530**

DESTROYED HOUSES

Source: New York times (2012)





# EXISTING PROBLEMS

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## AGING POPULATION

34% WILL BE 65 AND ABOVE IN 2040

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## SINGULAR ECONOMY

TOP 10 RICE AND FISH PRODUCTION IN JAPAN

+

# EXISTING PROBLEMS

## AGING POPULATION

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## SINGULAR ECONOMY

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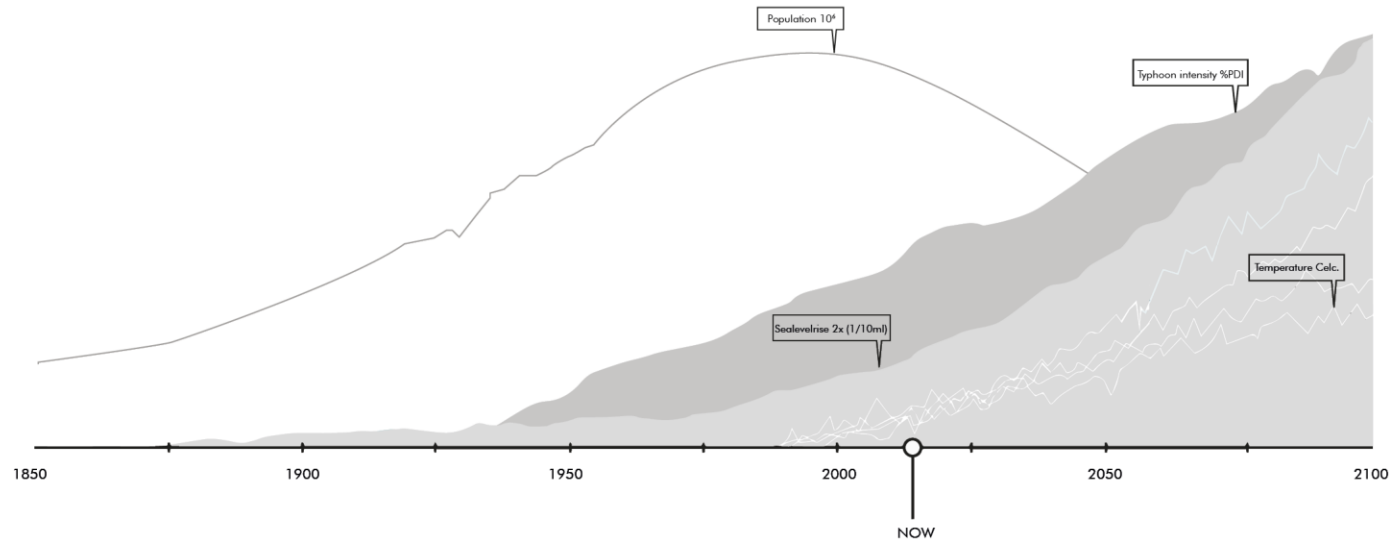
# FUTURE DEMANDS

## ENERGY DEPENDENCY

80% OF THE OIL USED IN IMPORTED

## CLIMATE CHANGE

STRONGER TYPHOONS, FLOODS AND RISING SEA LEVELS



# FIELDTRIP YURIAGE

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# GOVERNMENT

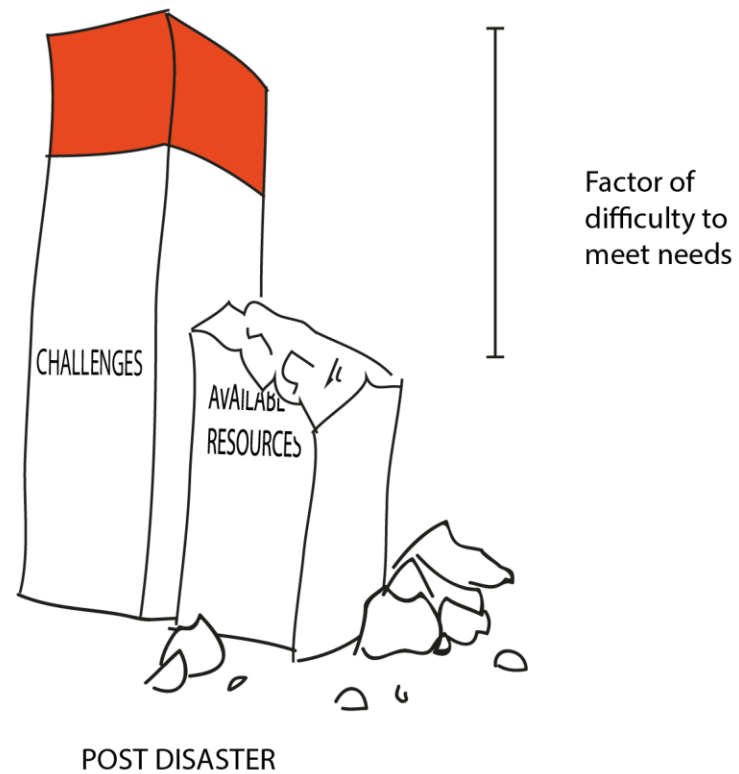
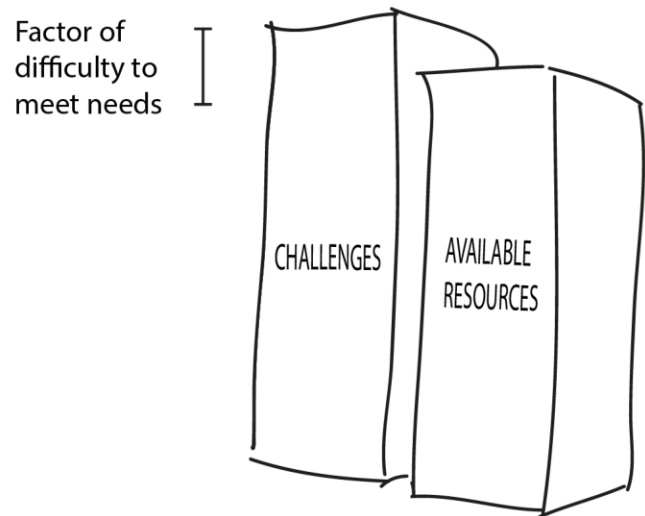
Affected Municipalities



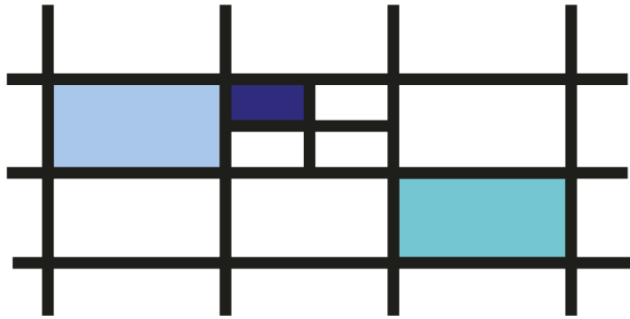
GOVERNMENT



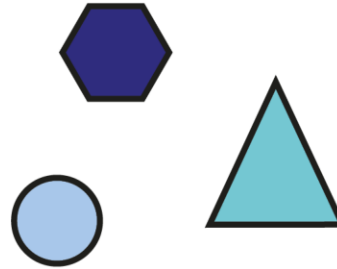
AFFECTED MUNICIPALITIES



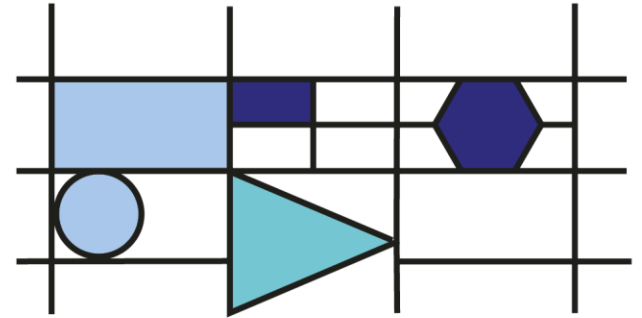
## Reconstruction framework



## Existing and Future Challenges



## Merging of Ambitions



GOVERNMENT



**REGIONAL DESIGN**



AFFECTED MUNICIPALITIES



GOVERNMENT



Can the introduction of a regional design in Japan lead to development that can increase the resilience of delta regions?



AFFECTED MUNICIPALITIES

CONTEXT

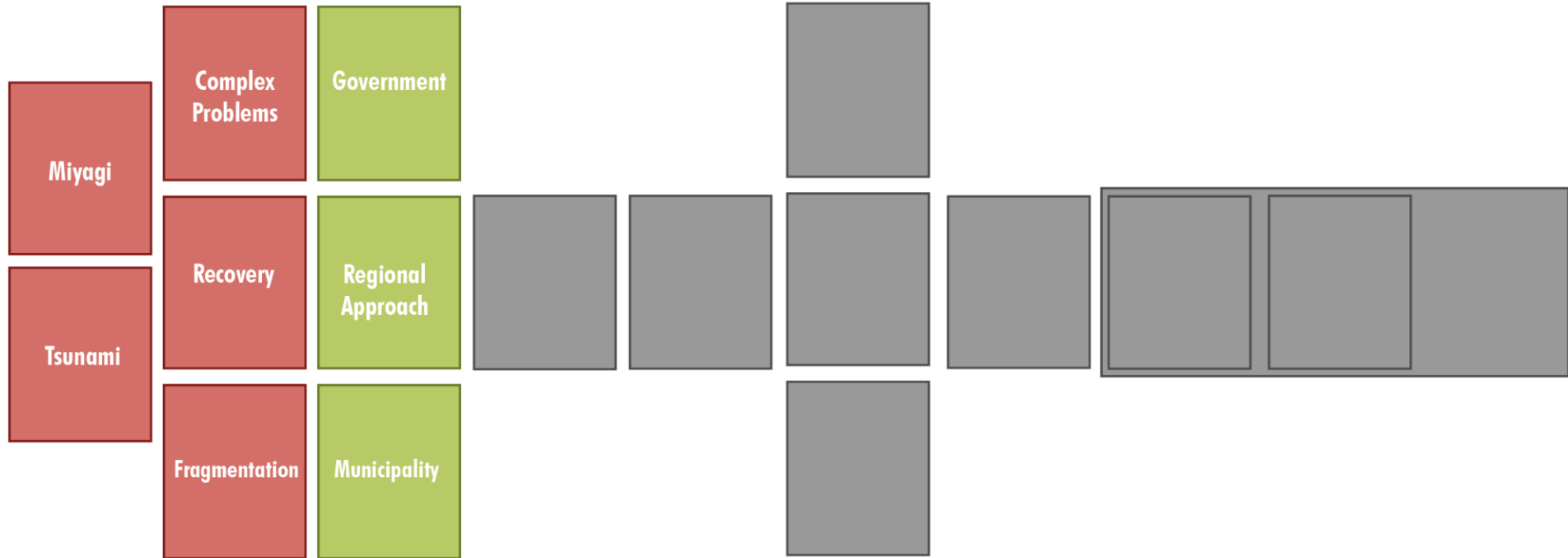
PROBLEM  
STATEMENT

APPROACH

STRATEGY

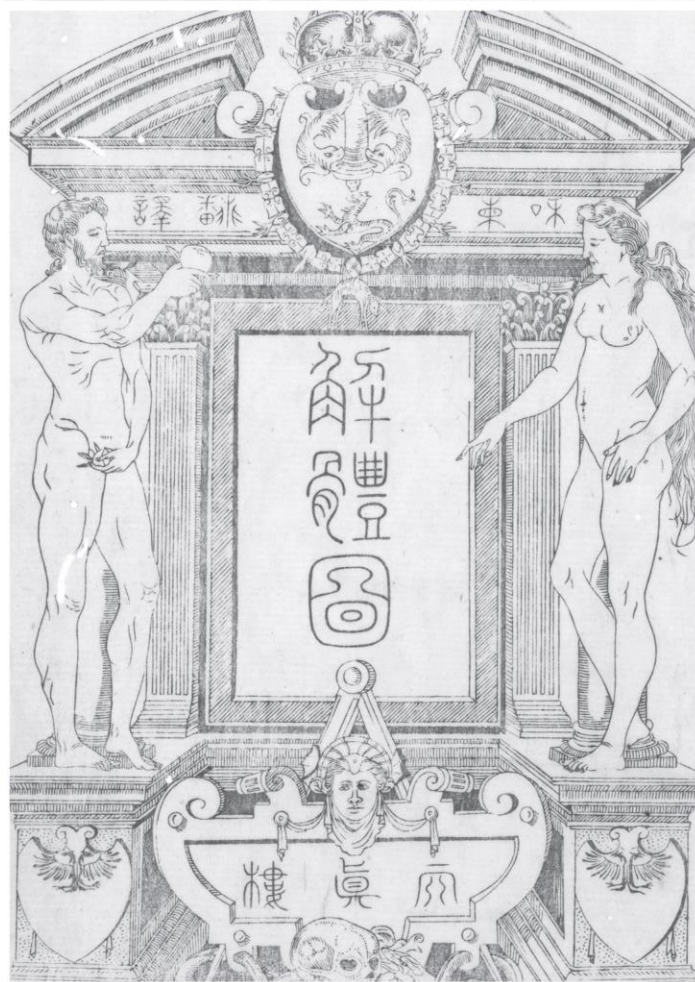
DESIGN

CONCLUSION



# DUTCH LEARNING

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Source: Siebold Memorial  
Museum

# DUTCH PLANNING

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- *Indicative framework*
- *Conceptual approach*
- *Open for interpretation*
- *Facilitating negotiation*

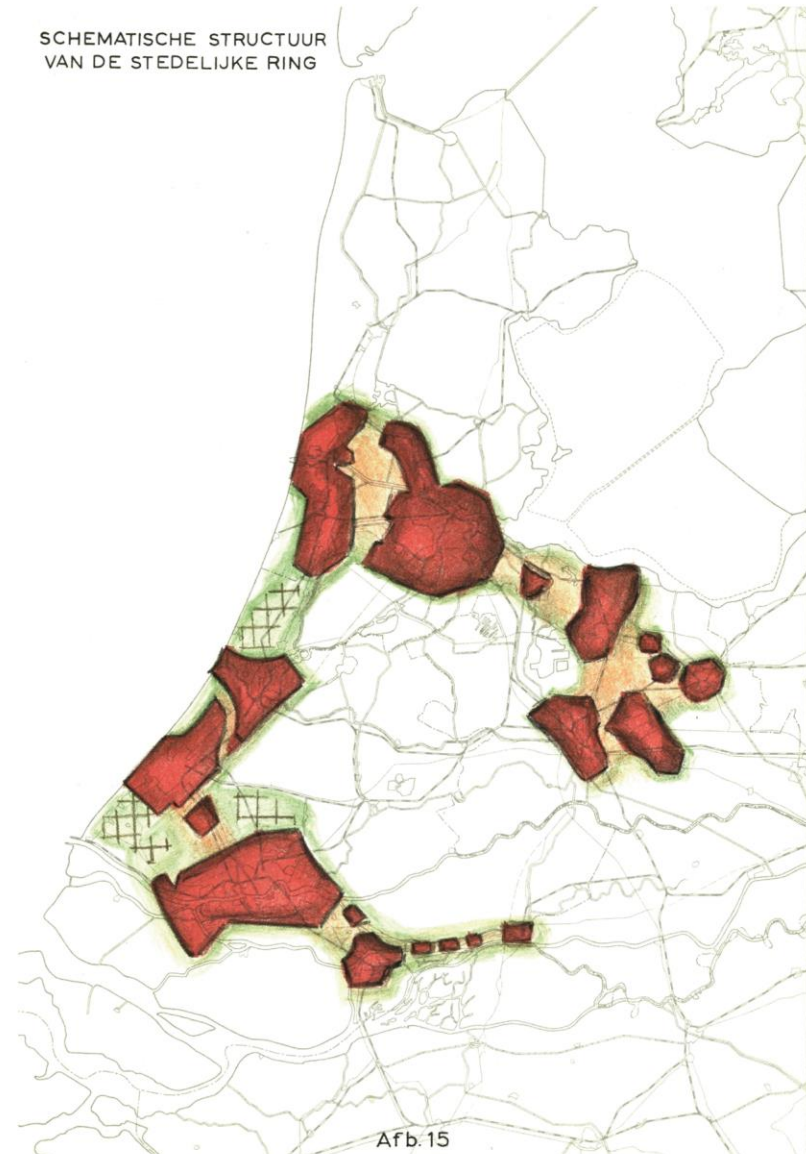


Source: des Lands, W. W. (1958). De ontwikkeling van het Westen des Lands. The Hague: Sdu Uitgevers.

# RANDSTAD

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- *Distribution post war housing*
- *Singular compact cities*
- *Urbanized vs. Rural land*
- *Red and Green regulation*



Source: des Lands, W. W. (1958). De ontwikkeling van het Westen des Lands. The Hague: Sdu Uitgevers.

# RANDSTAD

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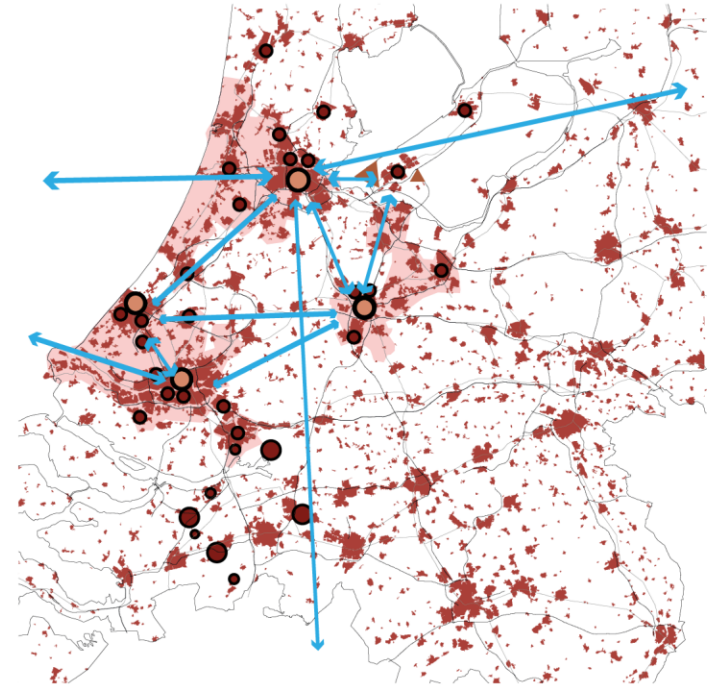
- *International competitiveness*
- *Complex transition*
- *Strategic approach*
- *Plan performance as goal*



# RANDSTAD

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- *National and International positioning*
- *Cooperating and engaging*
- *Elements of a Metropolis*
- *Economic 'powerhouse'*



# REGIONAL PLANNING

## Making use of spatial representations



### ORGANIZATIONAL DIMENSION

Territories and effects of political and economic choices

Goal:

- Regional development
- Positioning and interaction between actors
- Effects of policy measures

### ANALITICAL DIMENSION

Regional issues based on an empirical foundation

Goal:

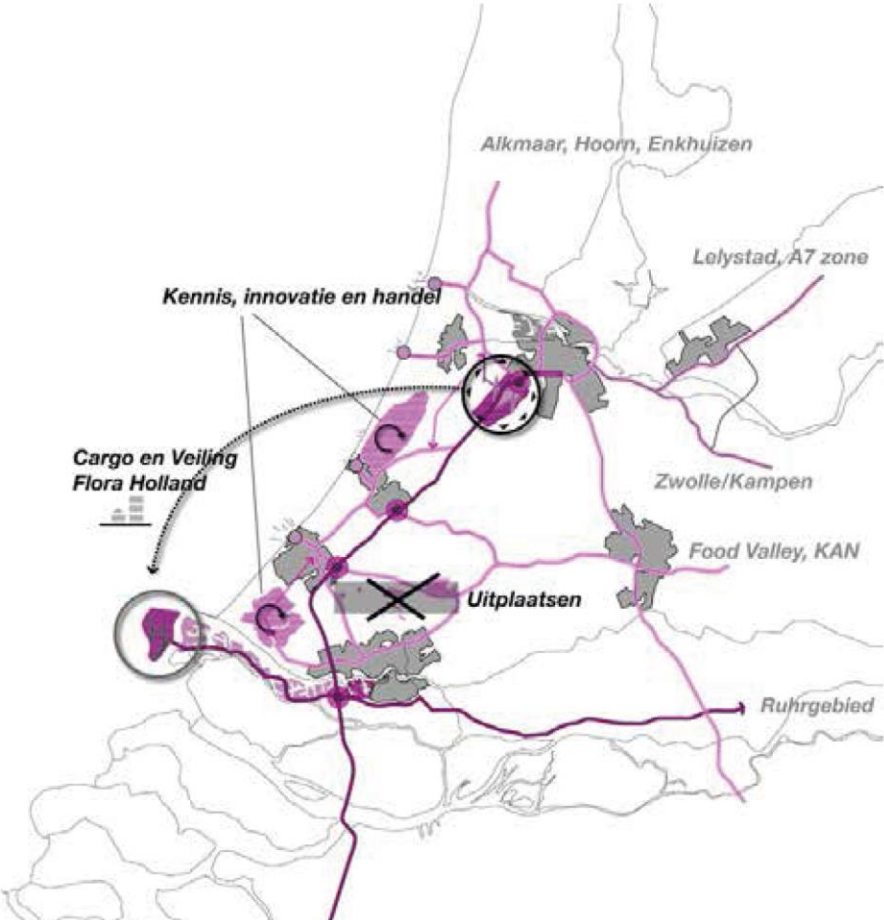
- Base of knowledge
- Collection of regional themes between actors
- Allocating regional resources

### NORMATIVE DIMENSION

Imagination of spatial development

Goal:

- Interpretation of development
- Grasping the spatial layout
- Highlighting regional fields of action



Source: VROM. (2007). Strategische toekomstagenda Randstad 2040: Naar een duurzame en concurrerende Europese topregio.



# REGIONAL PLANNING

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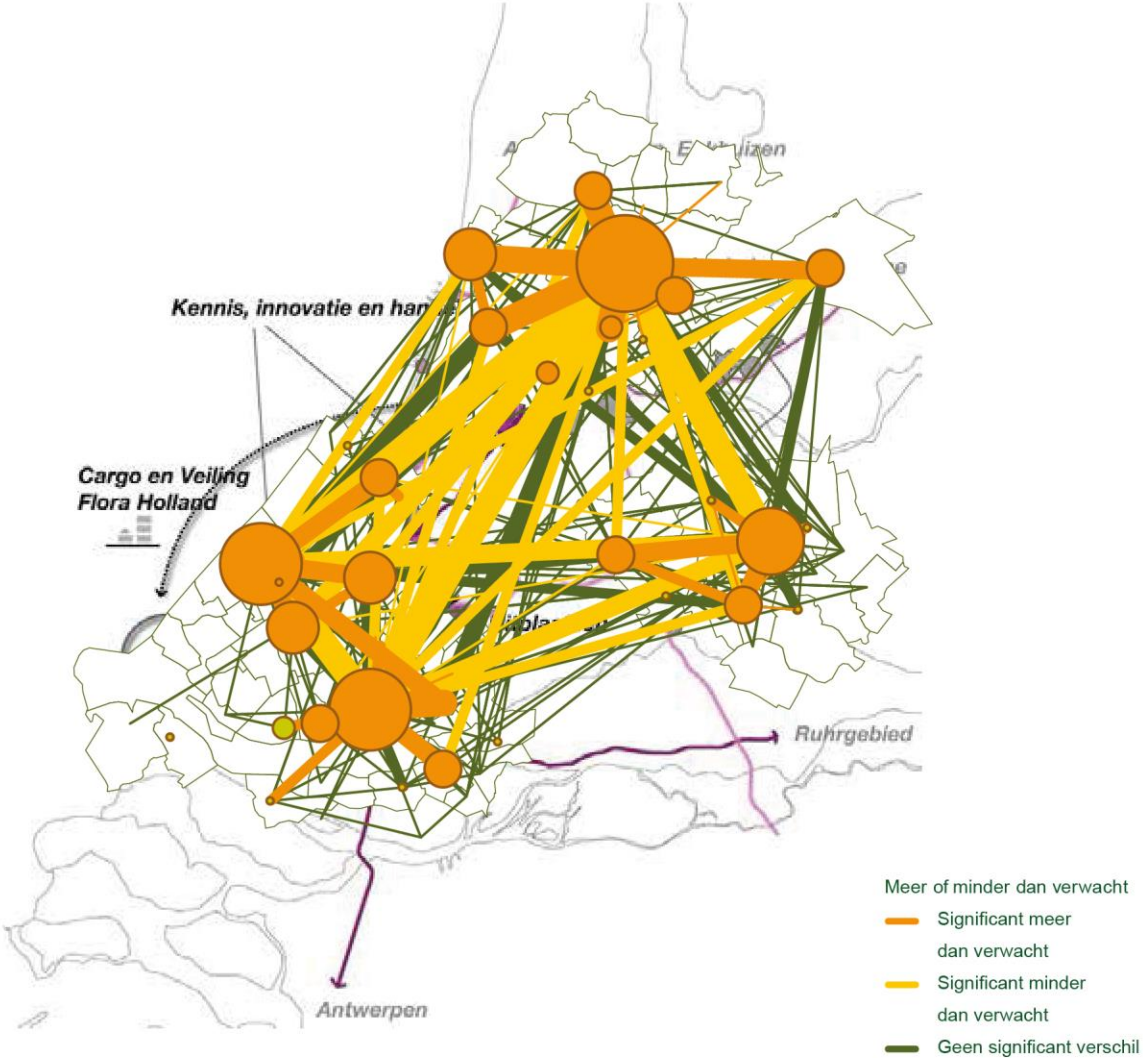
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Source: Ritsema van Eck, J., Van Oort, F., Raspe, O., Daalhuizen, F., & van Brussel, J. (2006). Vele steden maken nog geen Randstad. Netherlands: NAI Publishers.

CONTEXT

PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION

# REGIONAL PLANNING

## Making use of spatial representations



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Territories and effects of political and economic choices

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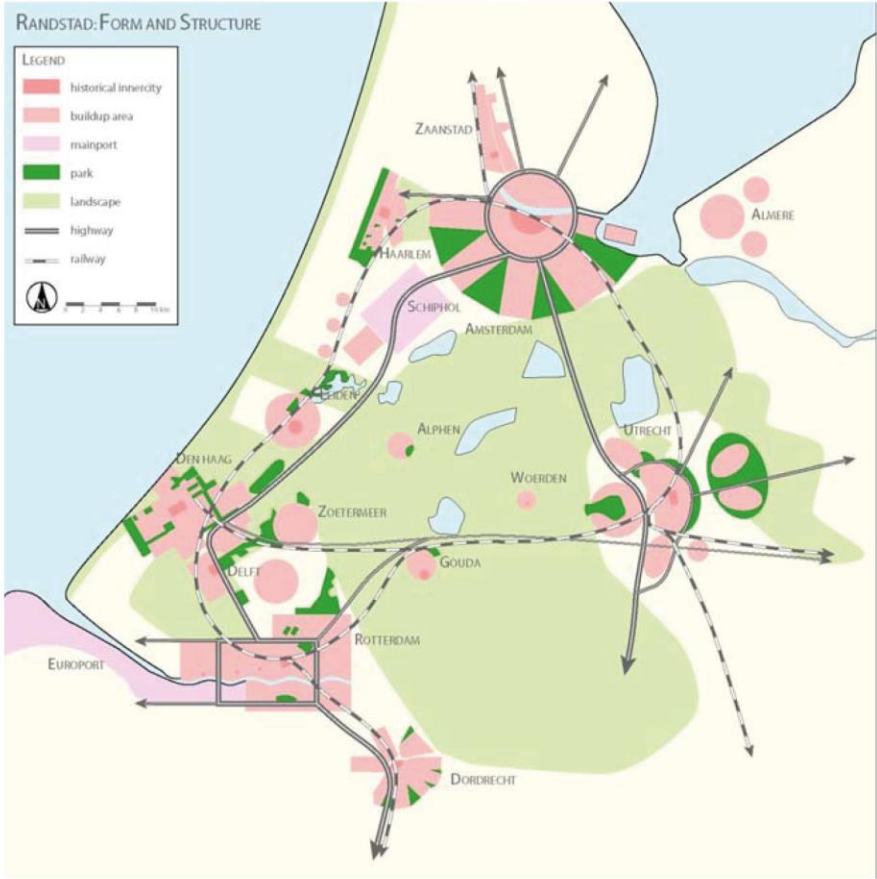
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Source: Priemus, H., & Van der Wusten, H. (1993). Bestuurlijke en ruimtelijke inrichting van de Randstad.

CONTEXT

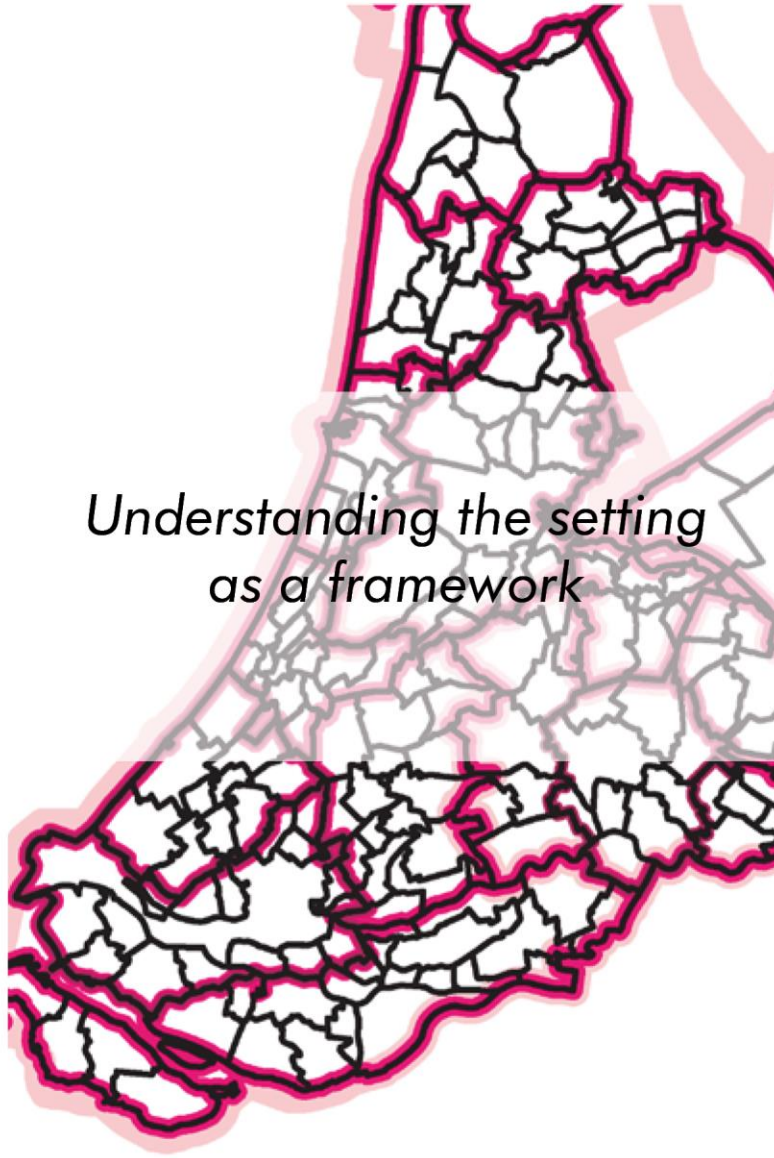
PROBLEM STATEMENT

APPROACH

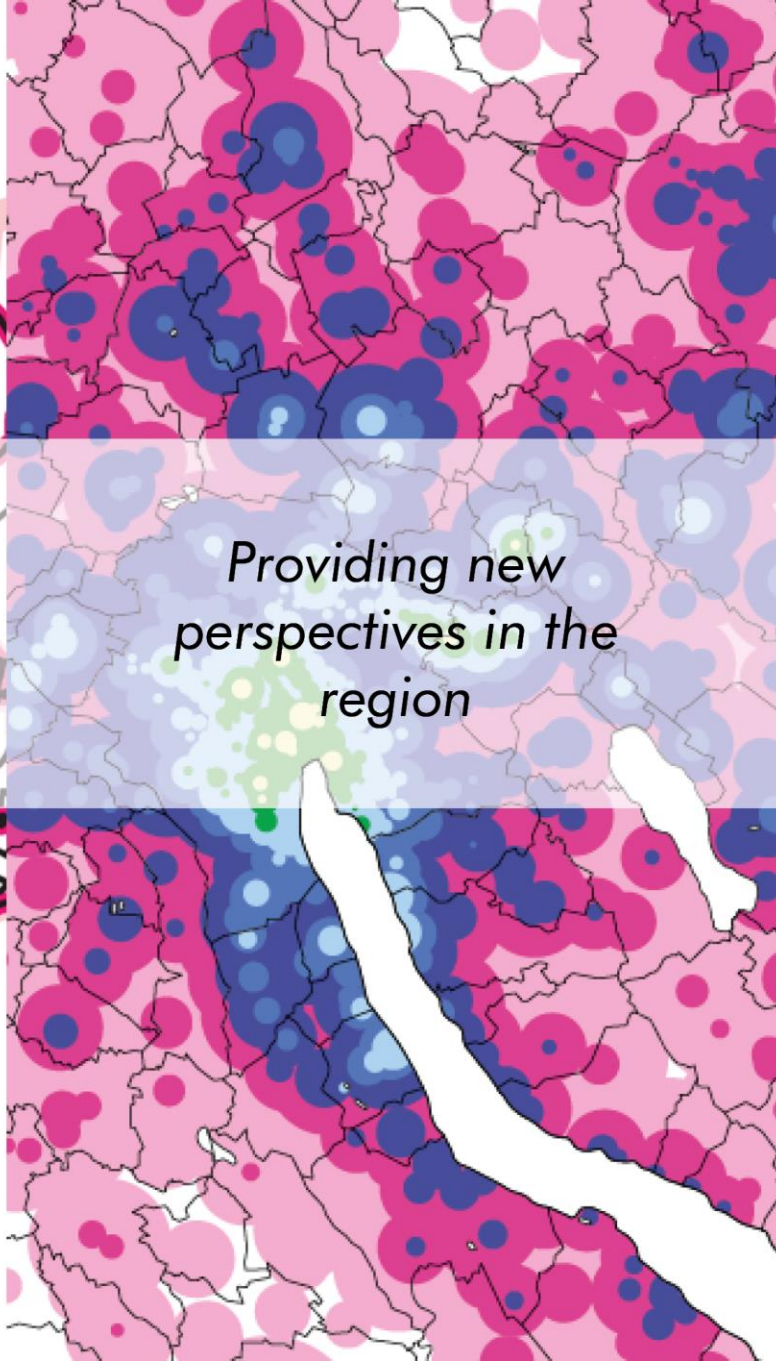
STRATEGY

DESIGN

CONCLUSION



*Understanding the setting  
as a framework*



*Providing new  
perspectives in the  
region*



*Explore in  
spatial and functional  
organisation*

Source: Verena Baltz „Regional design Conceptual framework

# TRANSFER TO PROJECT

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- *Diversity in city size*
- *Diversity in business*
- *Main ports*
- *Horticulture*



# ADAPTATION TO PROJECT

CONTEXT

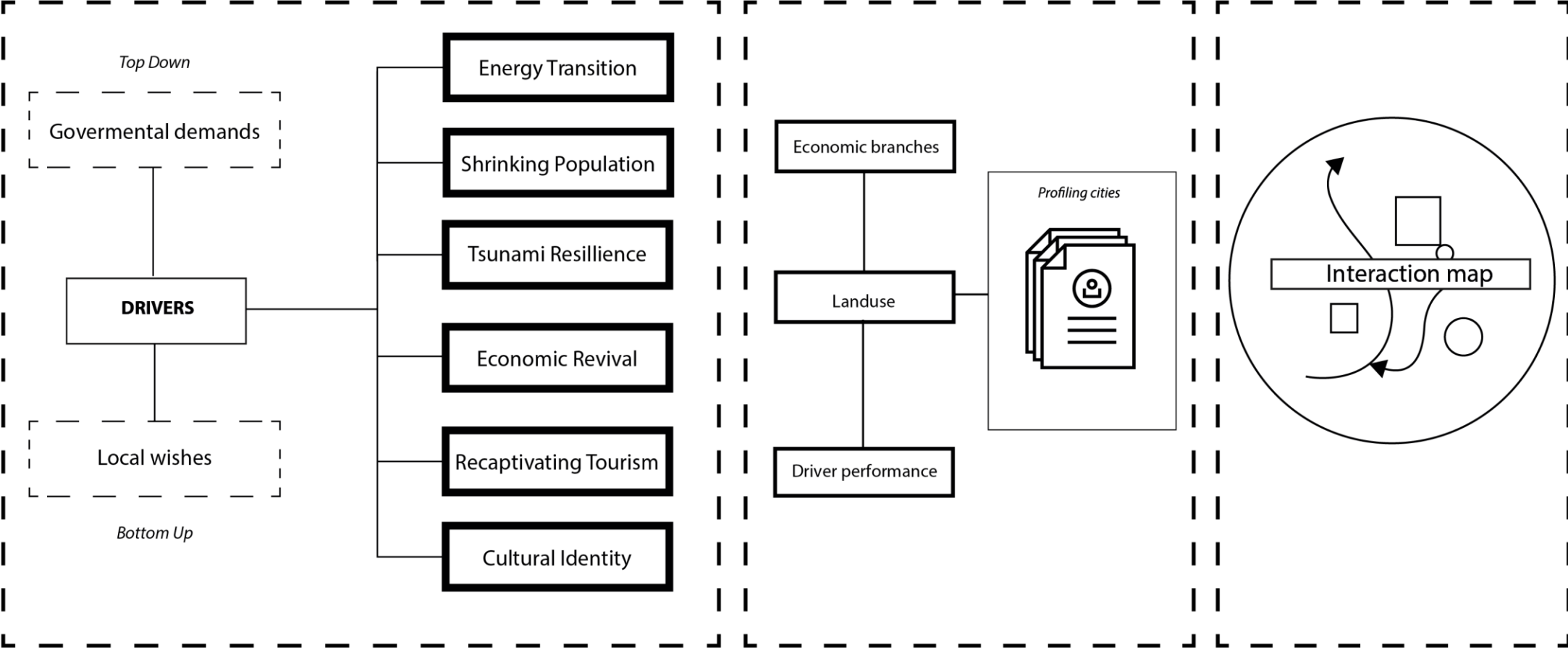
PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION



Analytical dimension

Organisational dimension

Normative dimension

CONTEXT

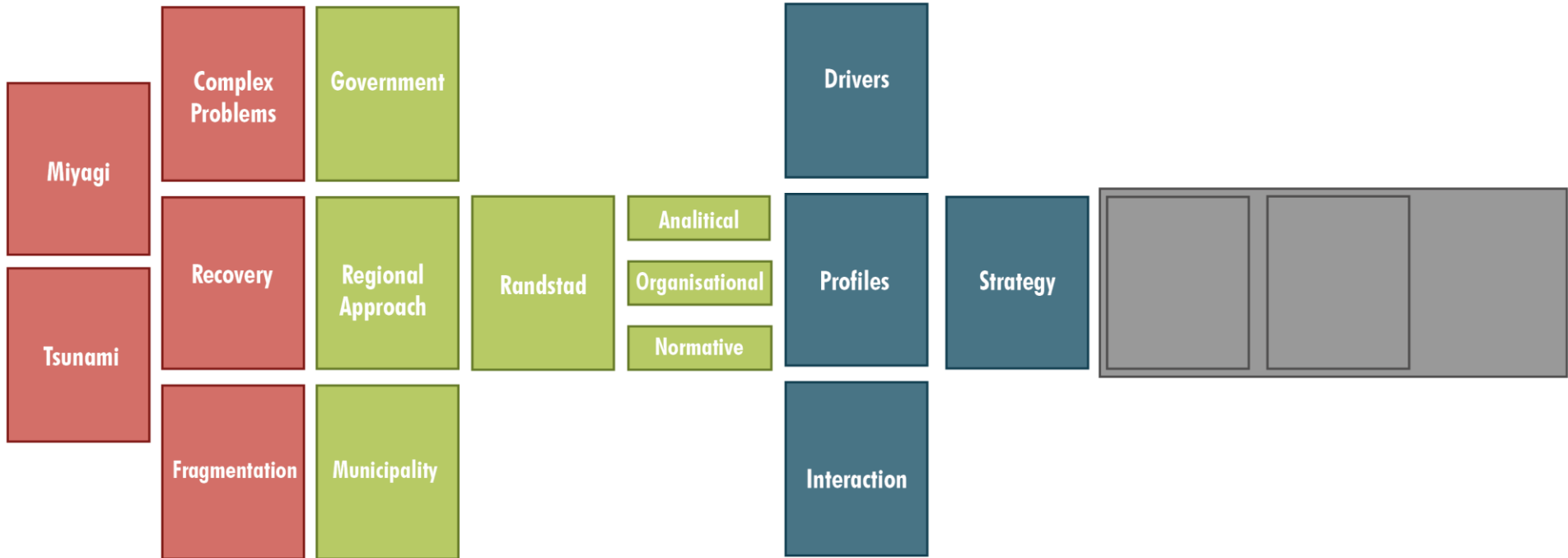
PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION



# DRIVERS

CONTEXT

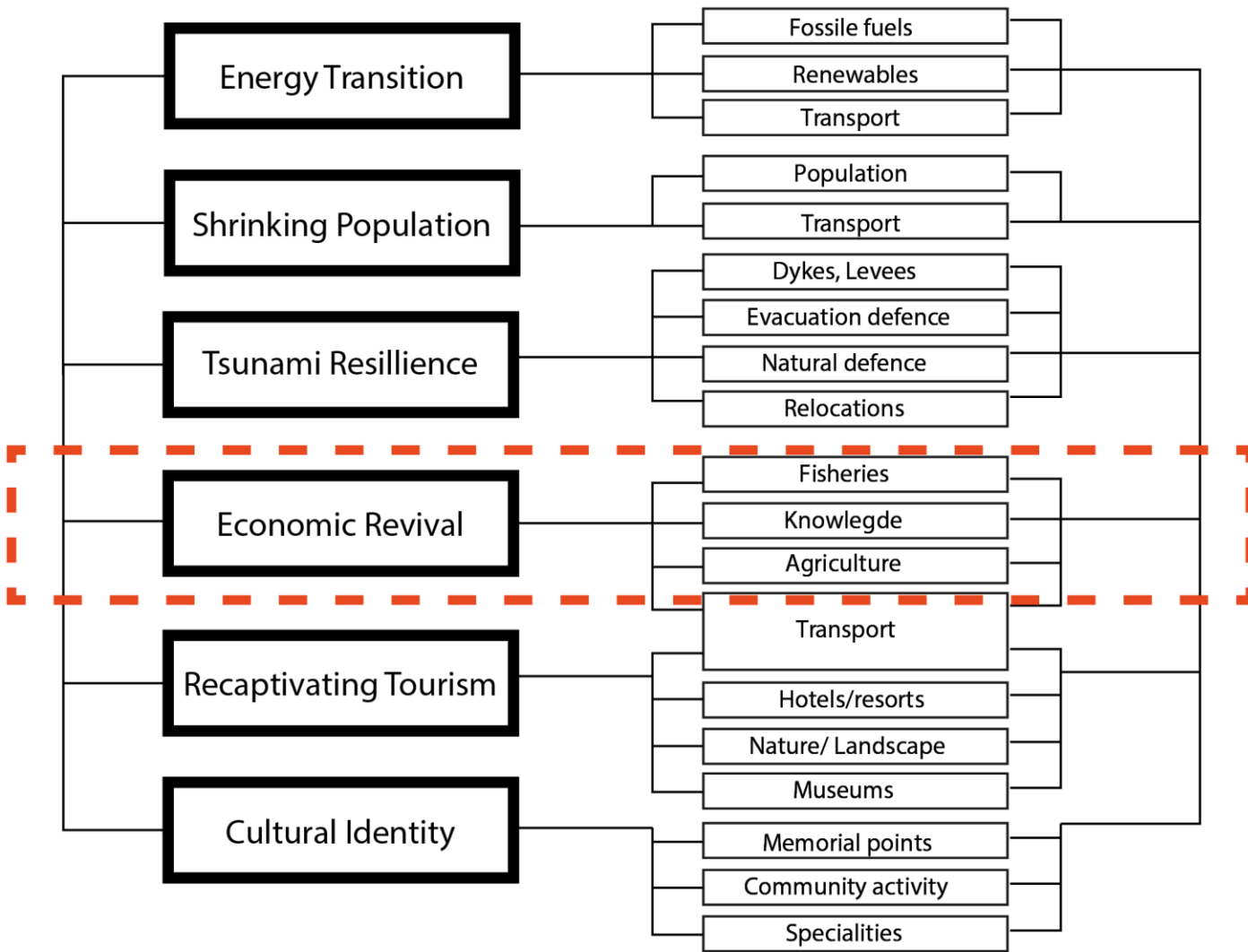
PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION



CONTEXT

# ECONOMIC REVIVAL

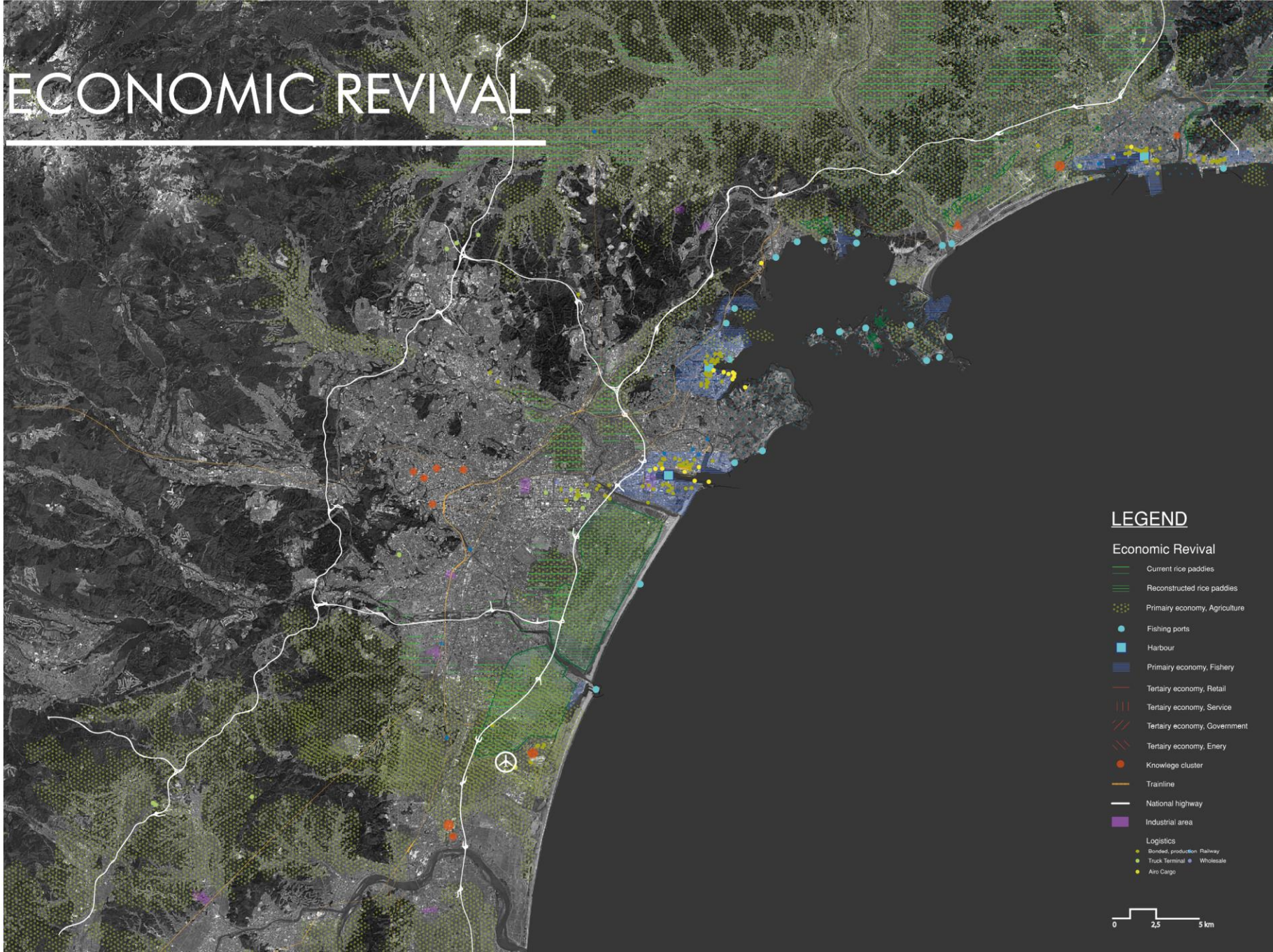
PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION



## LEGEND

### Economic Revival

- Current rice paddies
- Reconstructed rice paddies
- Primary economy, Agriculture
- Fishing ports
- Harbour
- Primary economy, Fishery
- Tertiary economy, Retail
- Tertiary economy, Service
- Tertiary economy, Government
- Tertiary economy, Energy
- Knowledge cluster
- Trainline
- National highway
- Industrial area
- Logistics
  - Bonded, production
  - Railway
  - Truck Terminal
  - Wholesale
  - Air Cargo

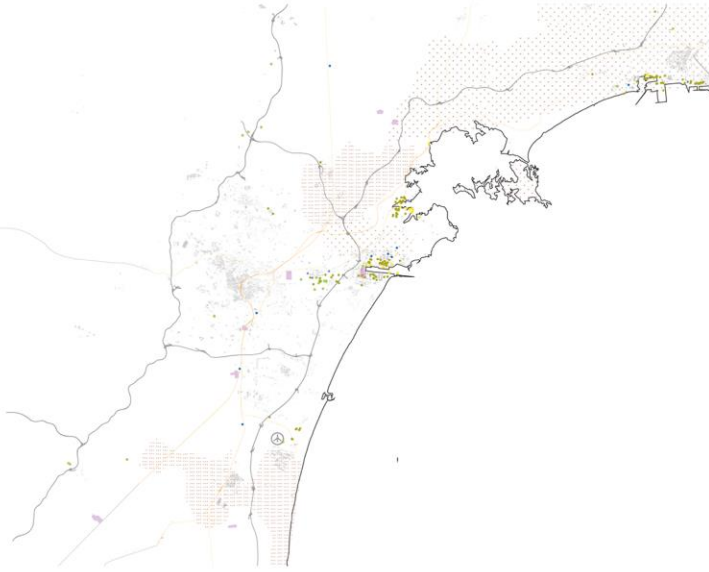




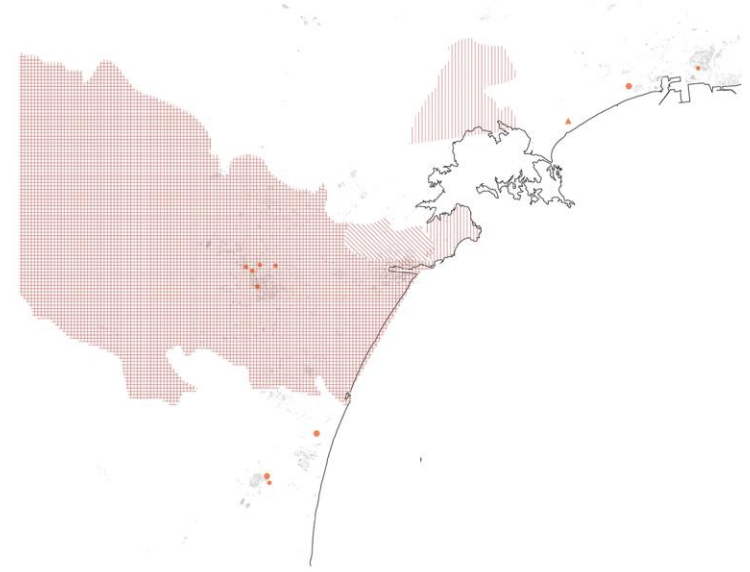
### Primary sector



### Secondary



### Tertiary sector



# PROFILES

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CONTEXT

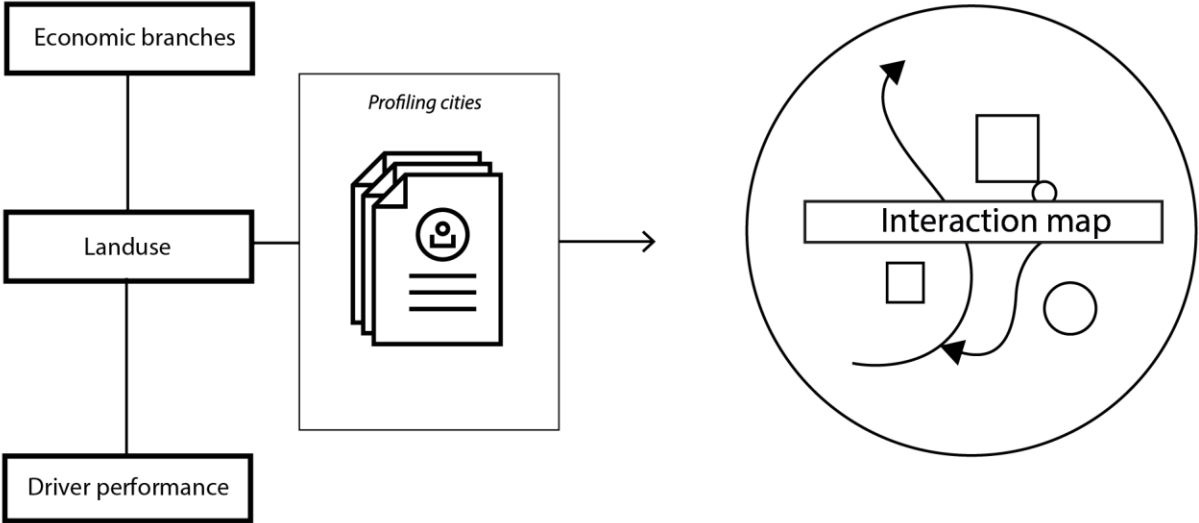
PROBLEM STATEMENT

APPROACH

STRATEGY





















DESIGN

CONCLUSION









# BRANCHES

- *Distribution of main sector and sub sector.*

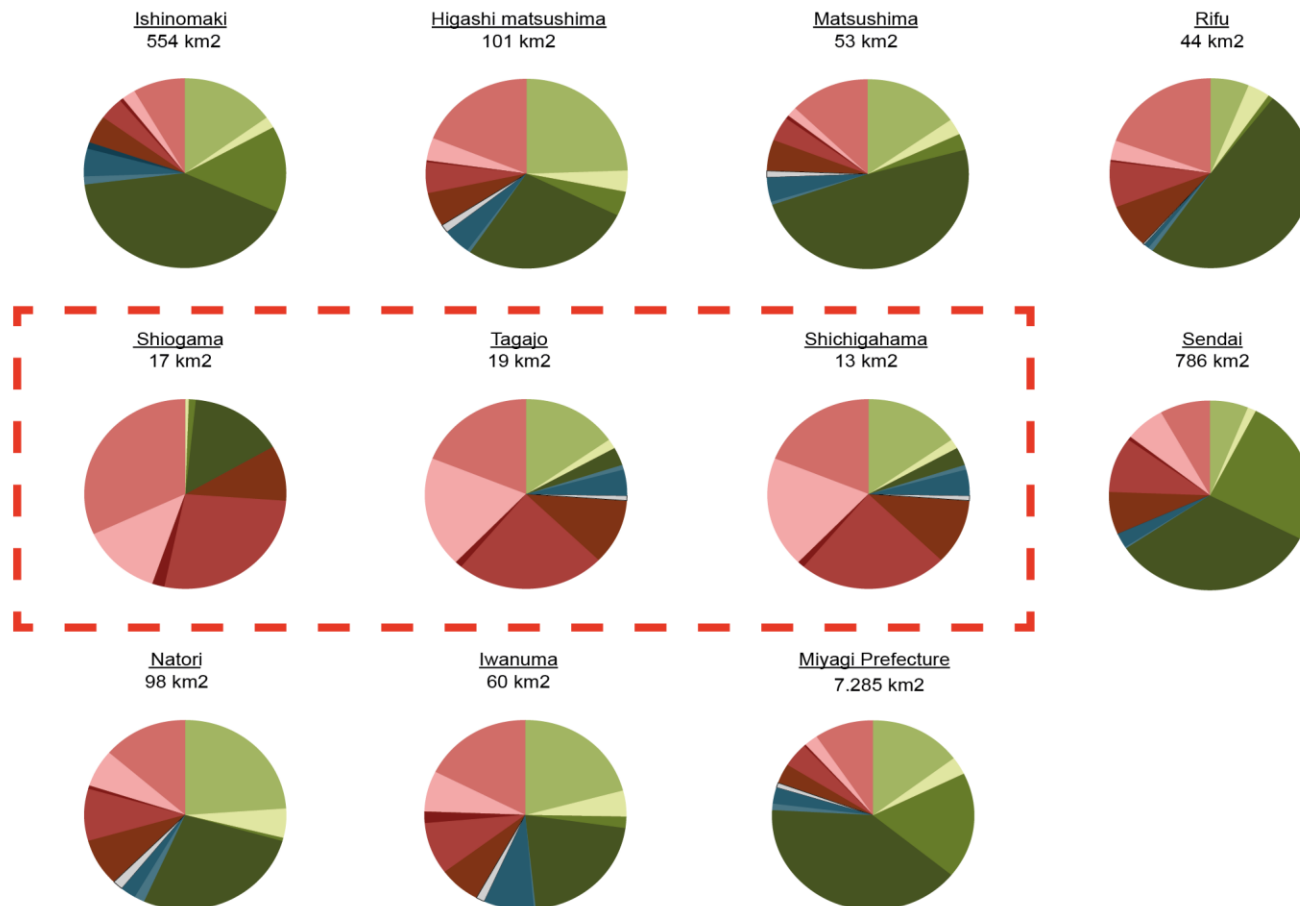
	Economic sector	Gross production (¥)	Population
ISHINOMAKI	 	636.105	148.238
HIGASHI-MATSUSHIMA	 	224.003	40.199
MATSUSHIMA	 	57.127	14.817
RIFU	 	43.810	36.330
SHIOGAMA	 	187.265	55.247
TAGAJO	 	176.807	62.177
SHICHIGAHAMA	 	41.957	19.623
SENDAI	 	5.057.680	1.053.304
NATORI	 	281.326	77.023
IWANUMA	 	209.488	44.242

## Legend

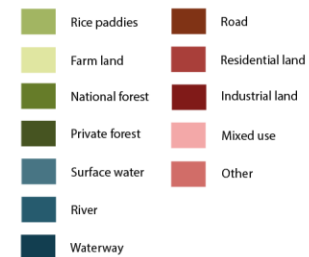
-  Knowledge
-  Ports and Fishery
-  Argiculture
-  Transport network
-  Energy network
-  Tourism

# LANDUSE

- *Location and land distribution*

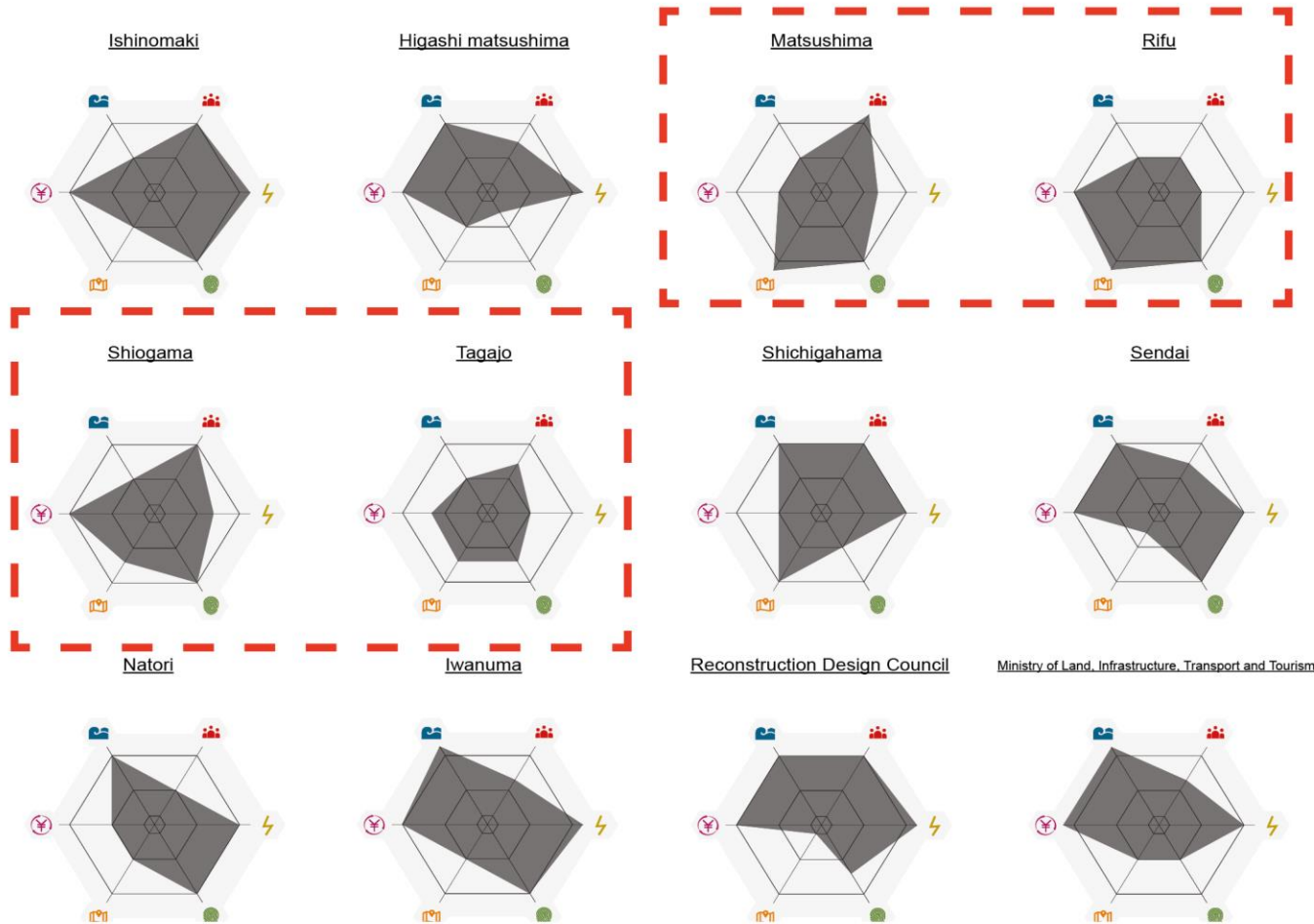


## Legend



# PERFORMANCE

- Investments of implemented policies.

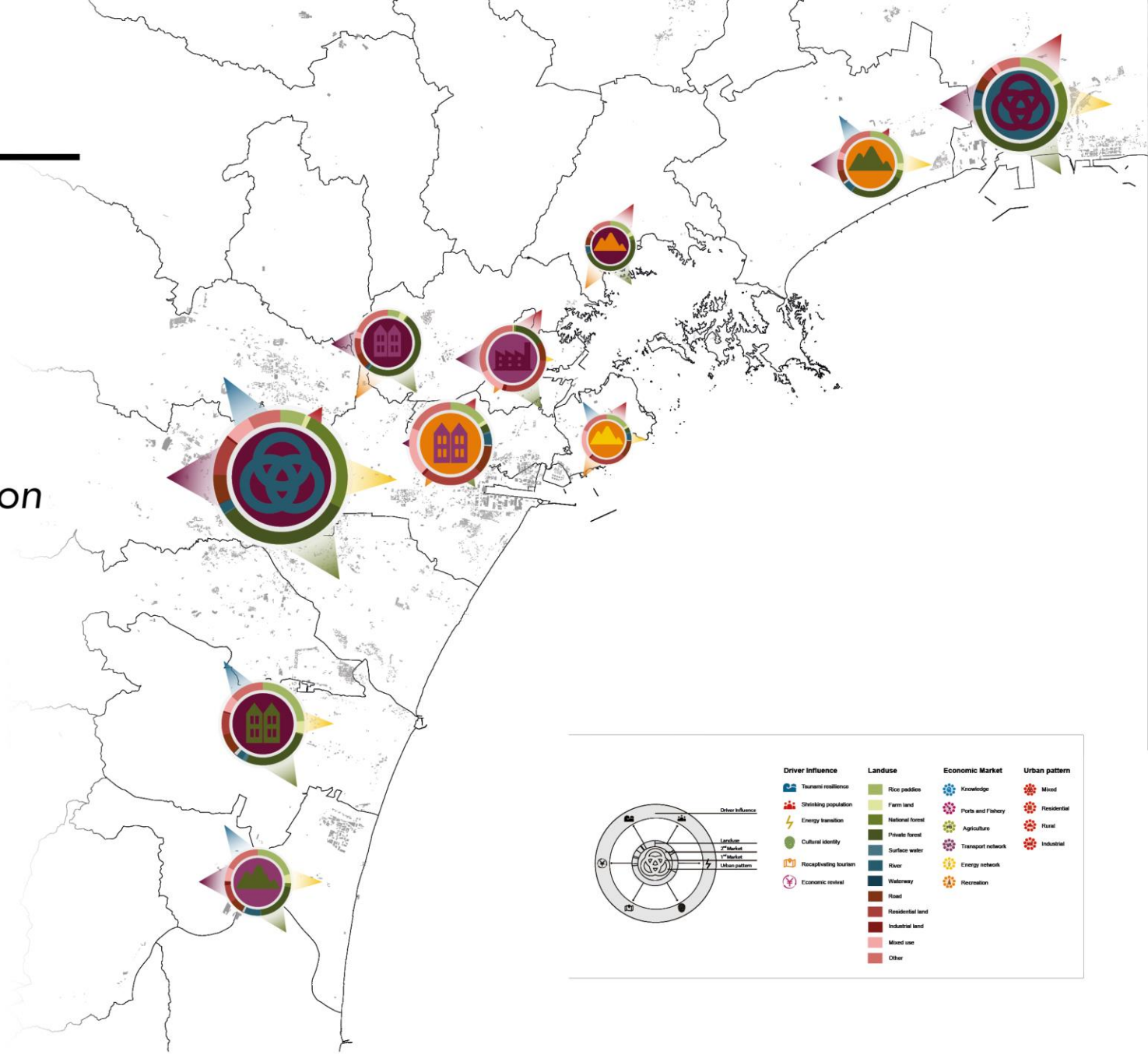


## Legend

-  Tsunami resilience
-  Shrinking population
-  Energy transition
-  Cultural identity
-  Recaptivating tourism
-  Economic revival

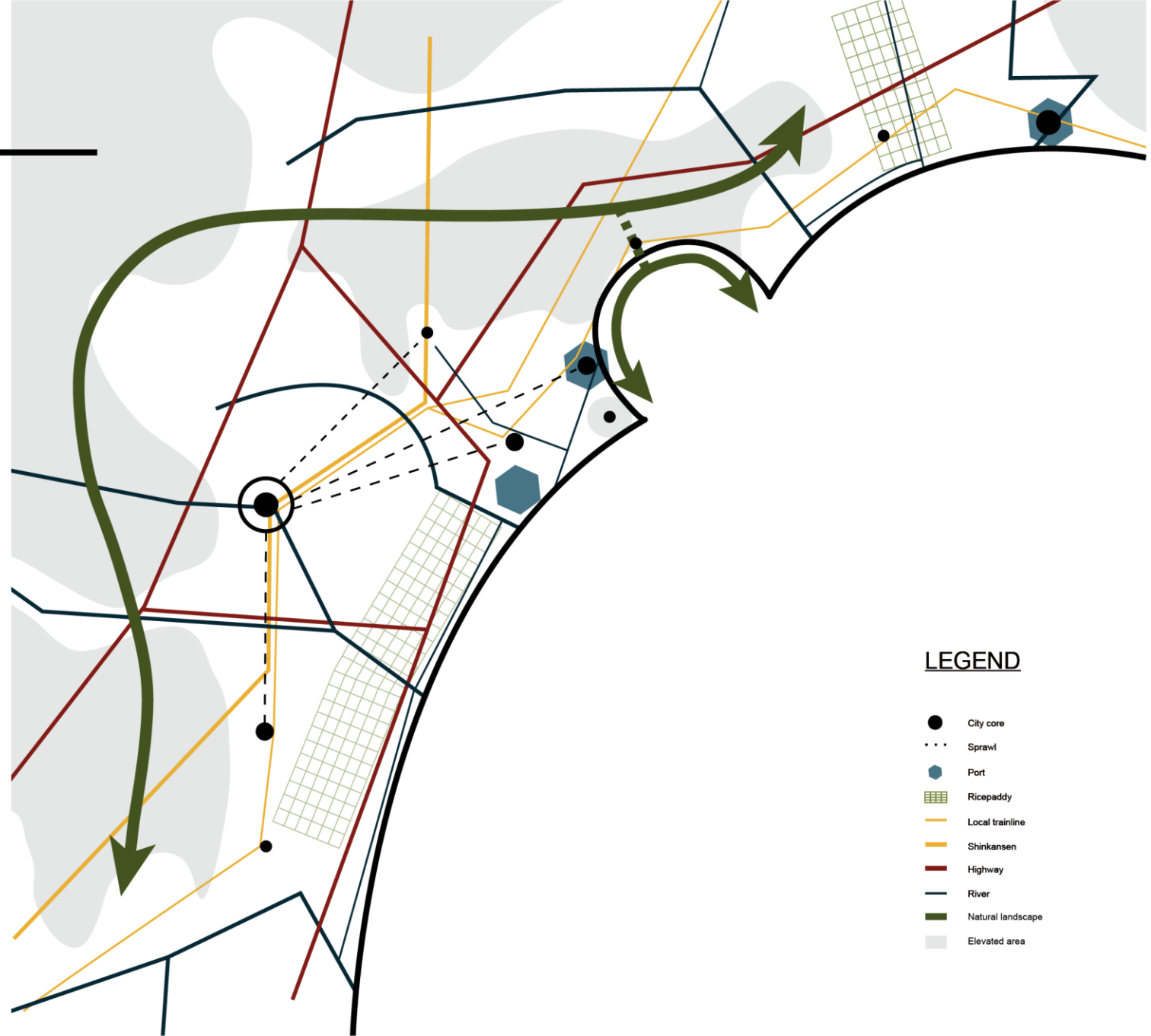
# PROFILES

- Competition clusters
- Land pressure north of Sendai
- Disparity in policy execution



# INTERACTION

- *Natural enclosure*
- *Industrial sites*
- *Bottle neck infrastructure*
- *20th century expansions*



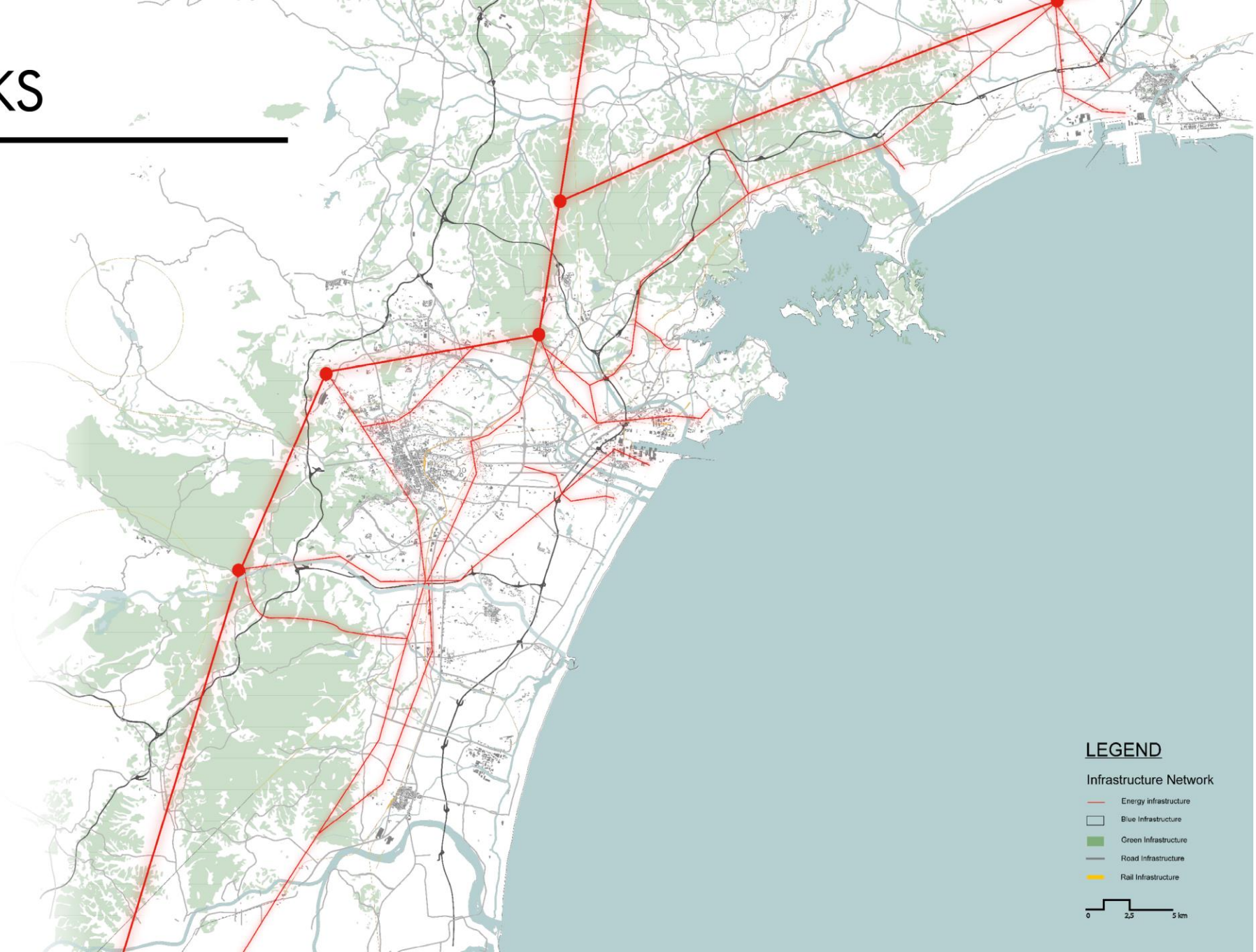
## LEGEND

- City core
- ⋯ Sprawl
- ⬢ Port
- ▧ Ricepaddy
- Local trainline
- Shinkansen
- Highway
- River
- Natural landscape
- Elevated area

# NETWORKS

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- *Overlap*
- *Pinpoint*
- *Expanding*





CONTEXT

# GREEN AND BLUE

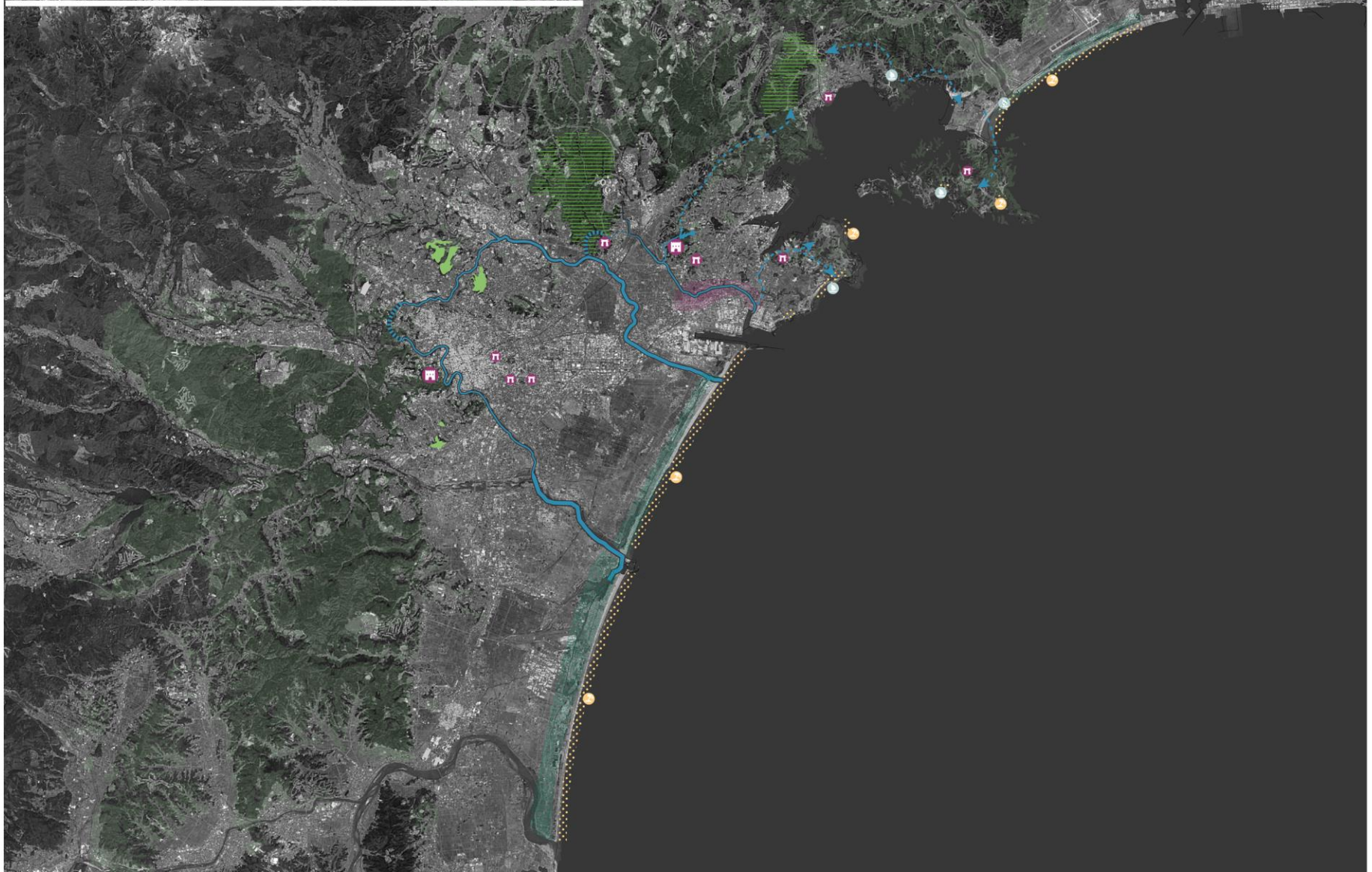
PROBLEM STATEMENT

APPROACH

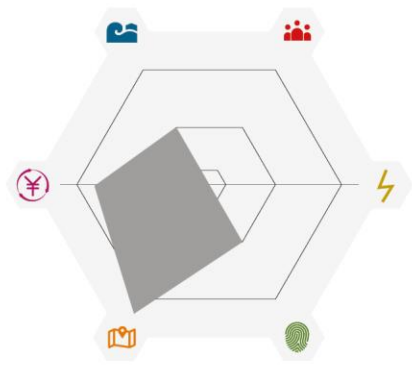
STRATEGY

DESIGN

CONCLUSION



- *East-West*
- *Strengthening ecosystem*
- *Natural and Cultural*



CONTEXT

PROBLEM STATEMENT

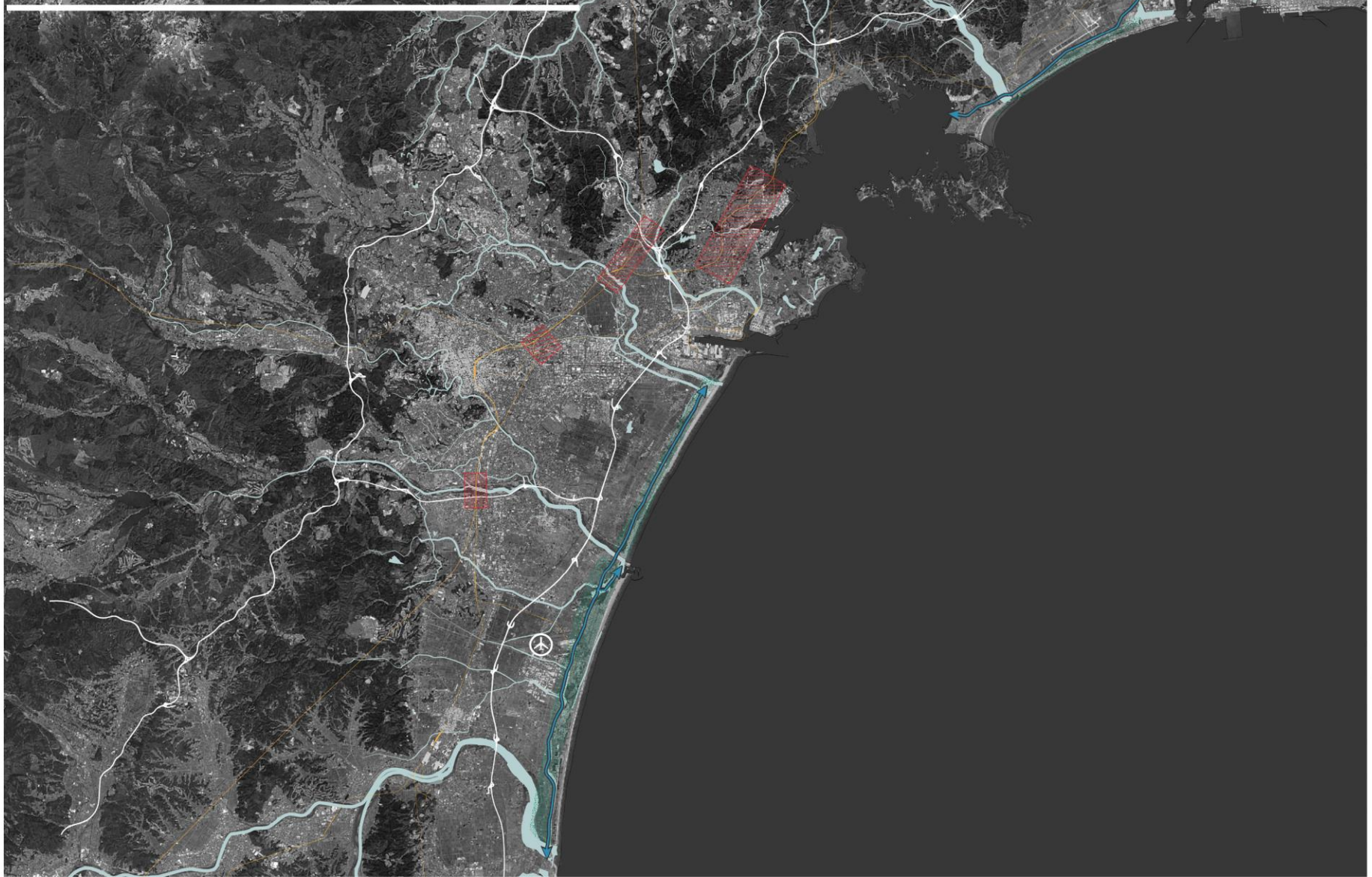
APPROACH

STRATEGY

DESIGN

CONCLUSION

# TRANSPORT RECONSIDERED



- *New modes of transport*
- *Increasing density around PT nodes.*
- *Polycentric development*



CONTEXT

# ENERGY DISPERSION

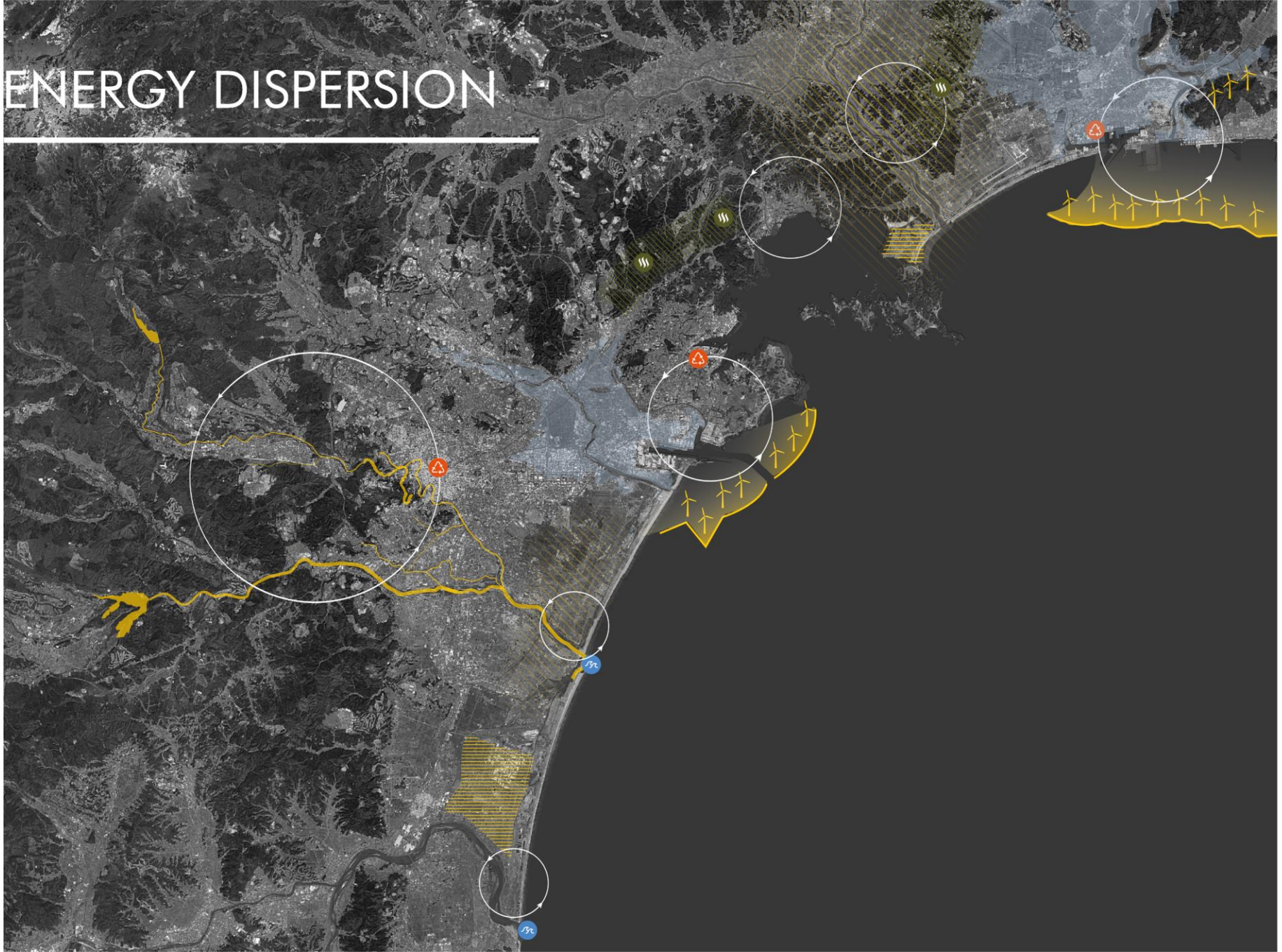
PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION



- *Optimizing local sources*
- *Introducing a new economy*
- *High and low resources*



CONTEXT

# STRATEGY

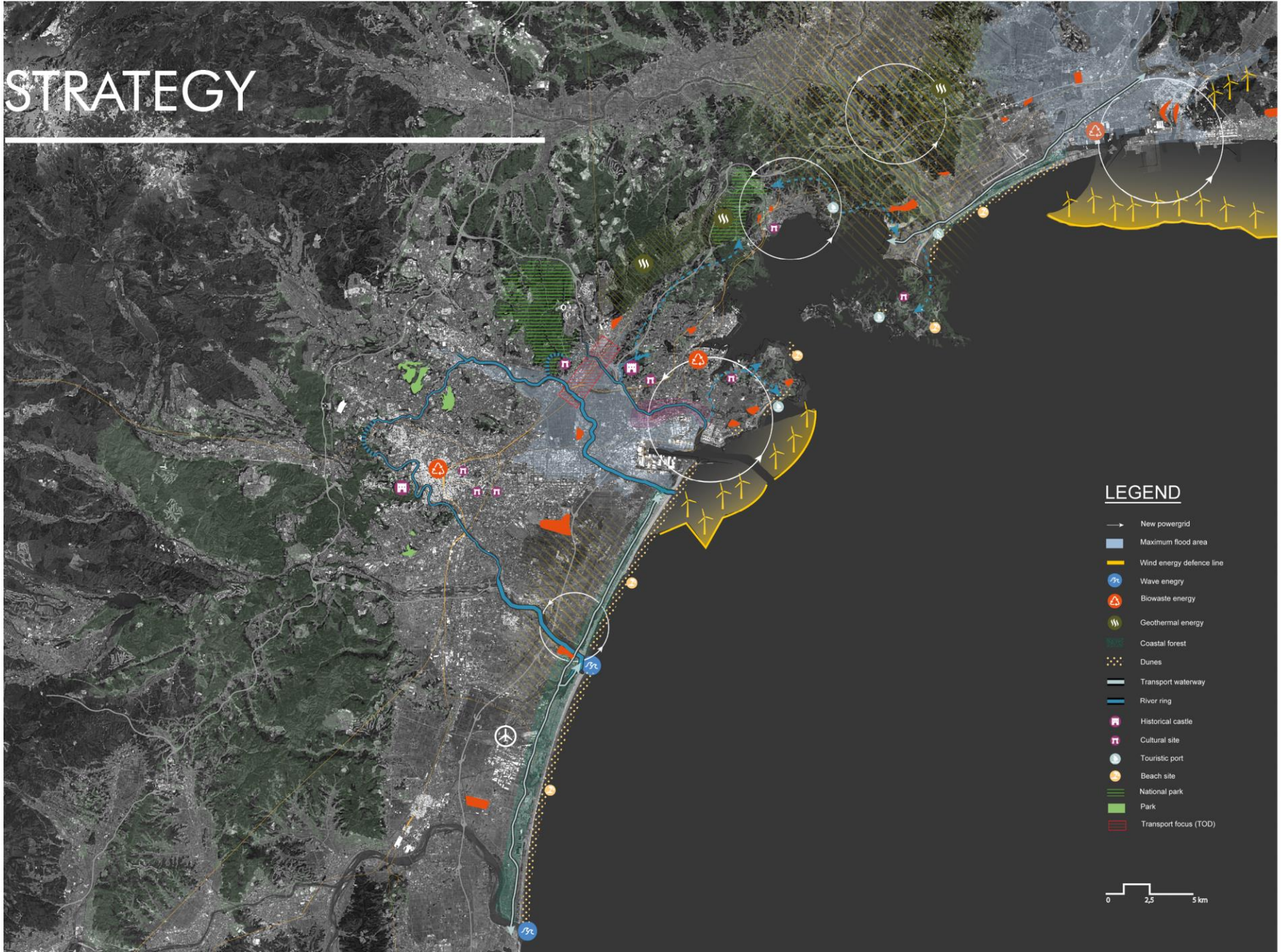
PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION



## LEGEND

- New powergrid
- Maximum flood area
- Wind energy defence line
- Wave energy
- Blowwaste energy
- Geothermal energy
- Coastal forest
- Dunes
- Transport waterway
- River ring
- Historical castle
- Cultural site
- Touristic port
- Beach site
- National park
- Park
- Transport focus (TOD)



CONTEXT

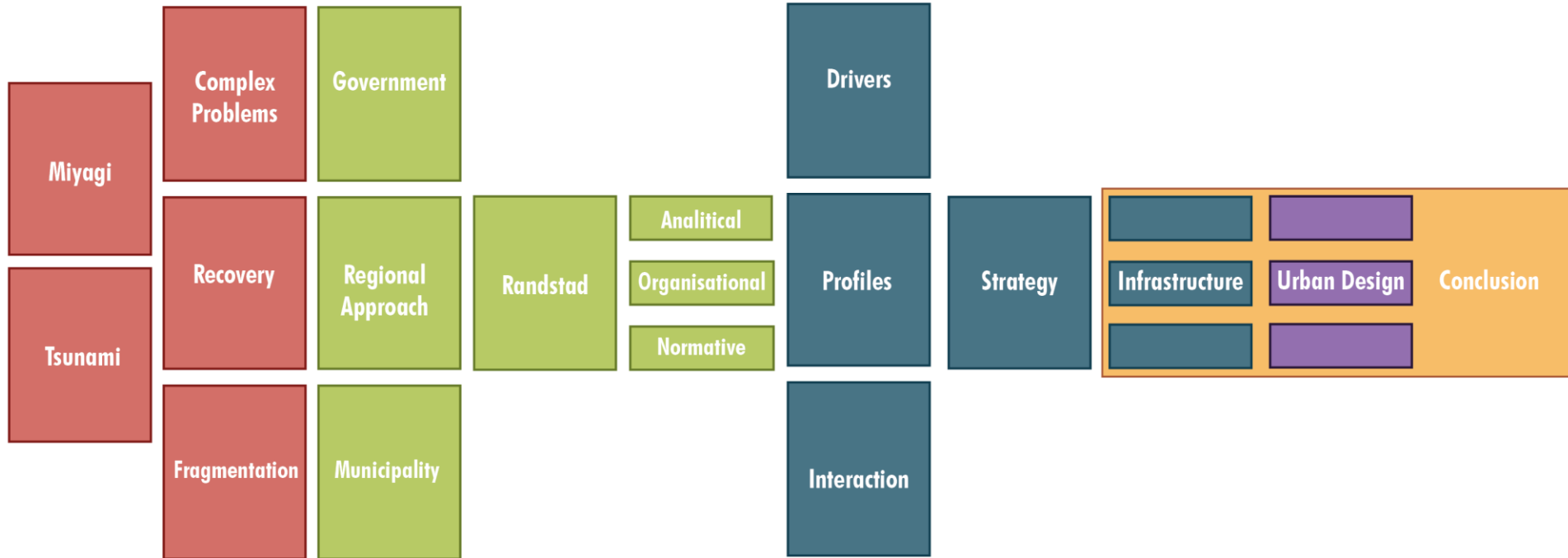
PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION



# FOCUS

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CONTEXT

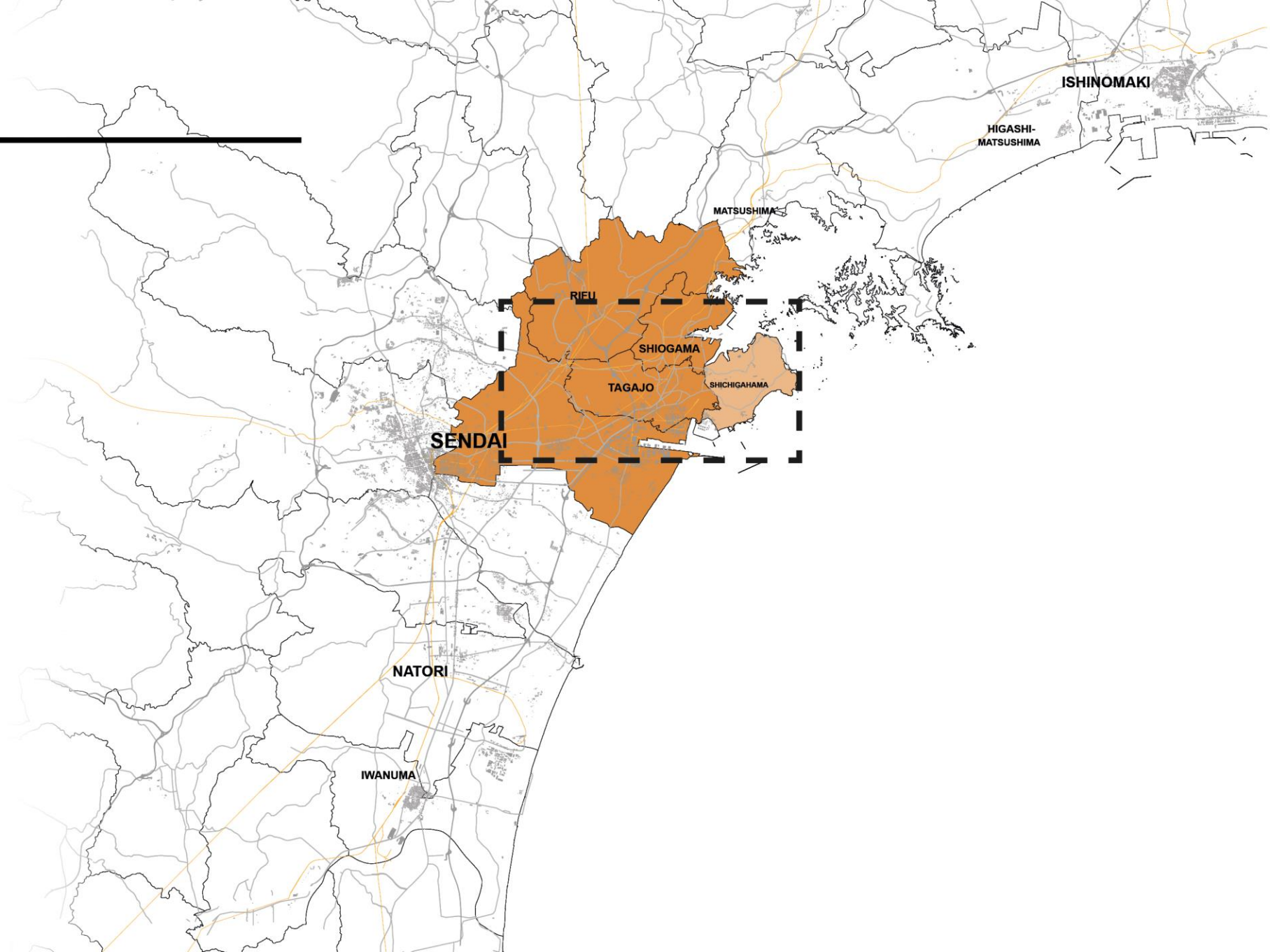
PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION



CONTEXT

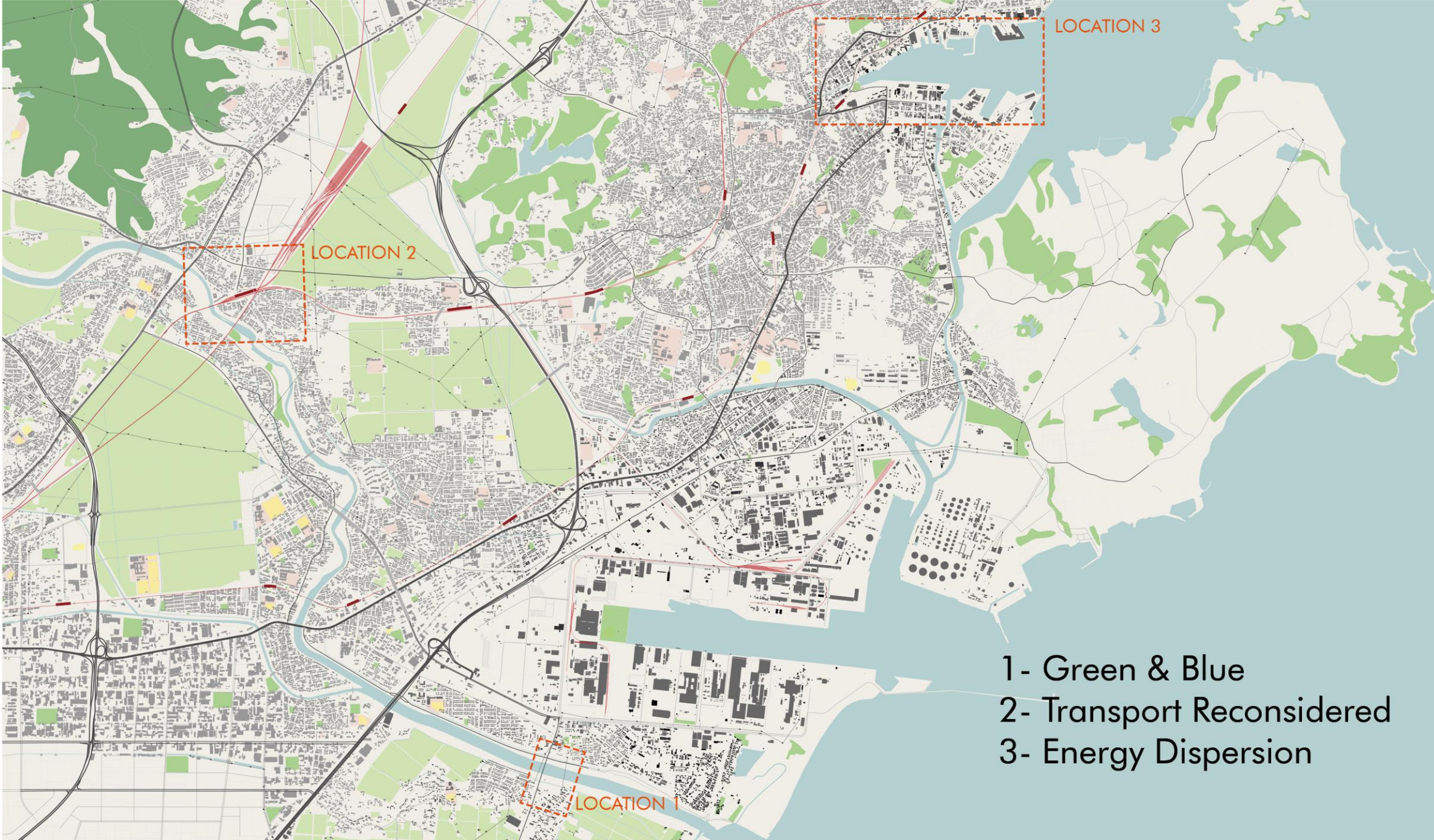
PROBLEM STATEMENT

APPROACH

STRATEGY

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CONCLUSION



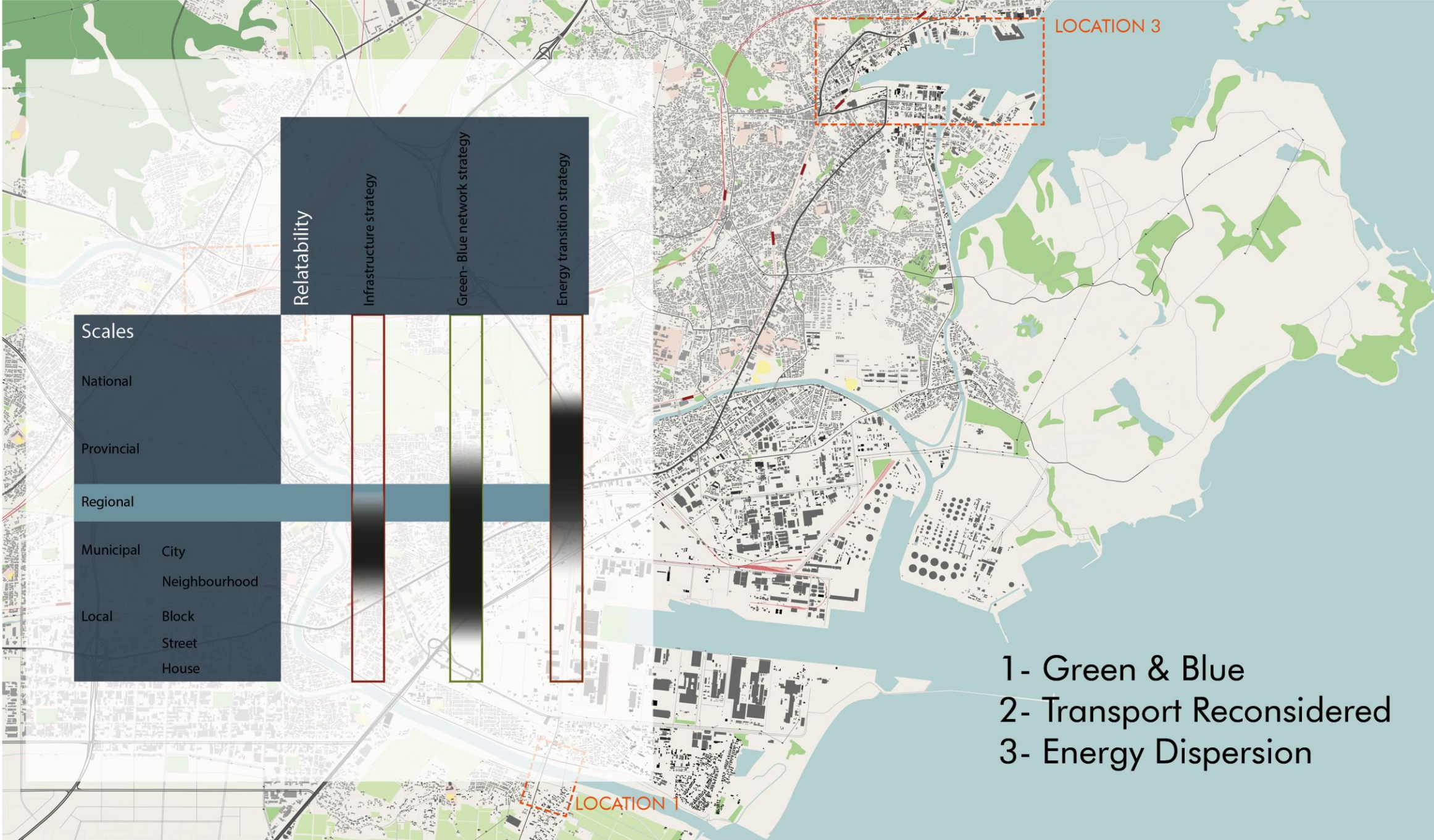
LOCATION 3

LOCATION 2

LOCATION 1

- 1- Green & Blue
- 2- Transport Reconsidered
- 3- Energy Dispersion

CONTEXT  
PROBLEM STATEMENT  
APPROACH  
STRATEGY  
DESIGN  
CONCLUSION



Reliability  
Infrastructure strategy  
Green-Blue network strategy  
Energy transition strategy

Scales  
National  
Provincial  
Regional  
Municipal City  
Neighbourhood  
Local Block  
Street  
House

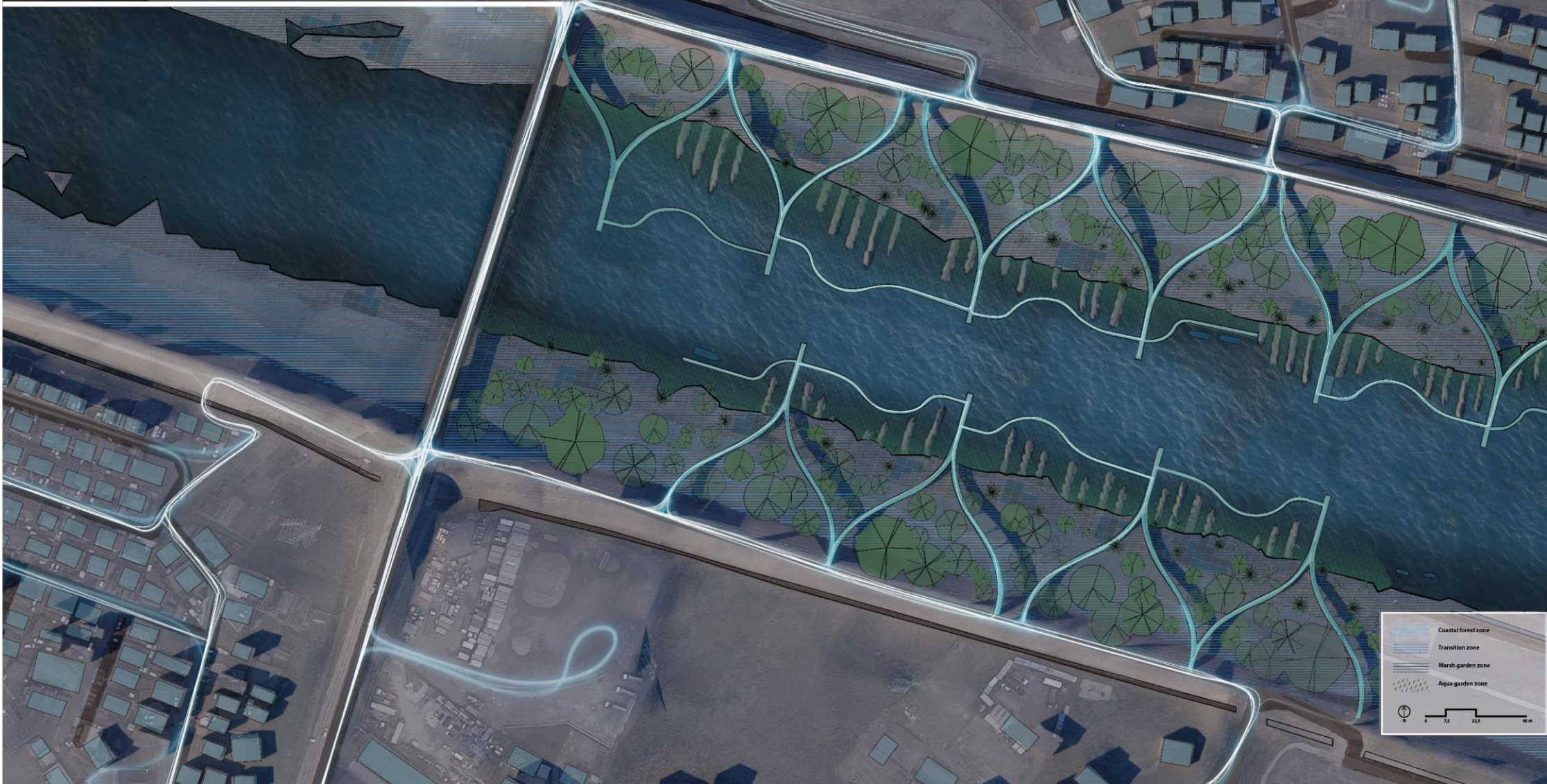
- 1- Green & Blue
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LOCATION 1

LOCATION 3



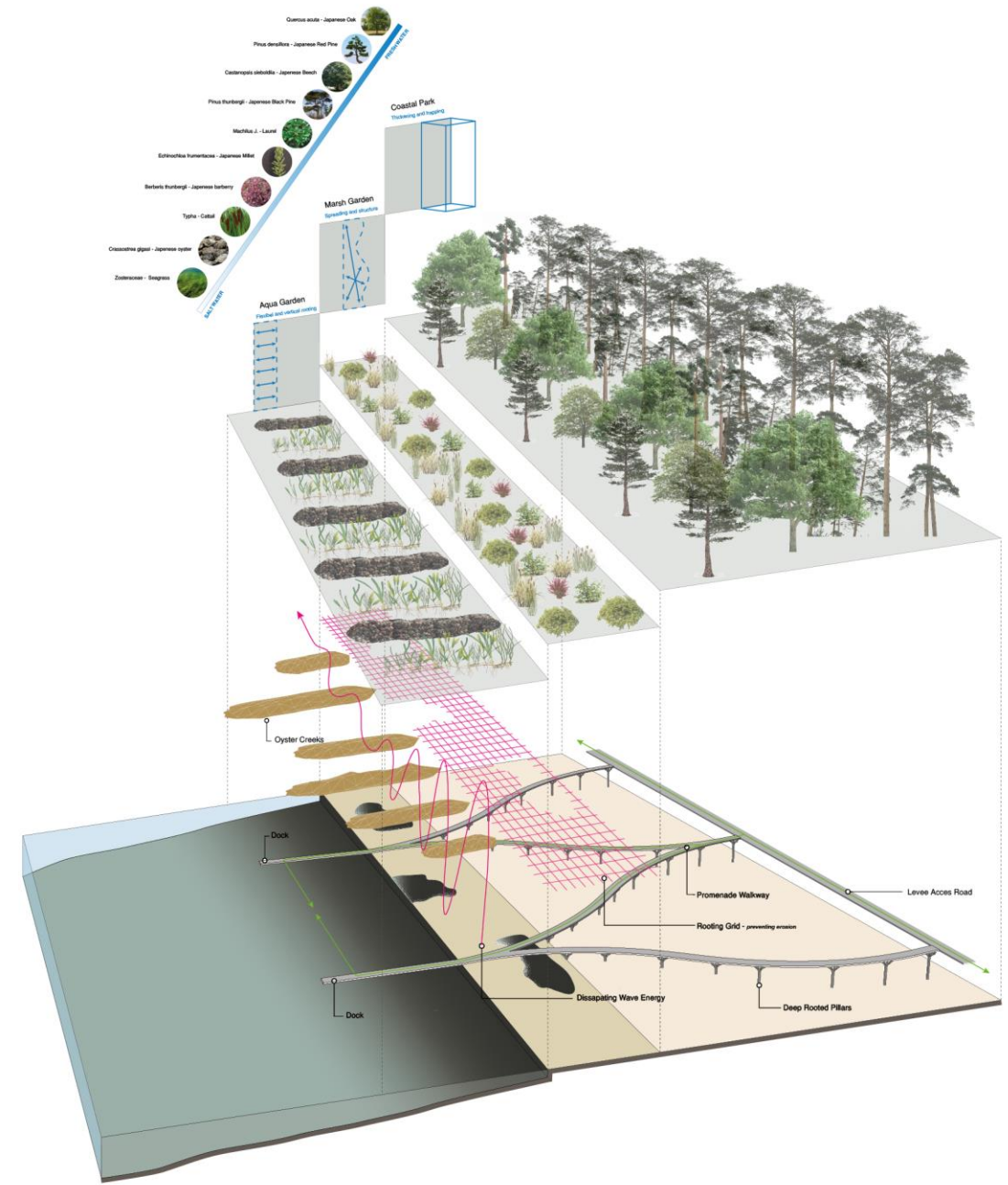
# LOCATION 1-ECO JETTY



	Coastal forest zone
	Transition zone
	Marsh garden zone
	Aqua garden zone

# FUNCTIONS

- *Connecting*
- *Cultural*
- *Erosion*
- *Mitigating and trapping*



CONTEXT

PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION

CONTEXT

PROBLEM STATEMENT

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CONCLUSION



CONTEXT

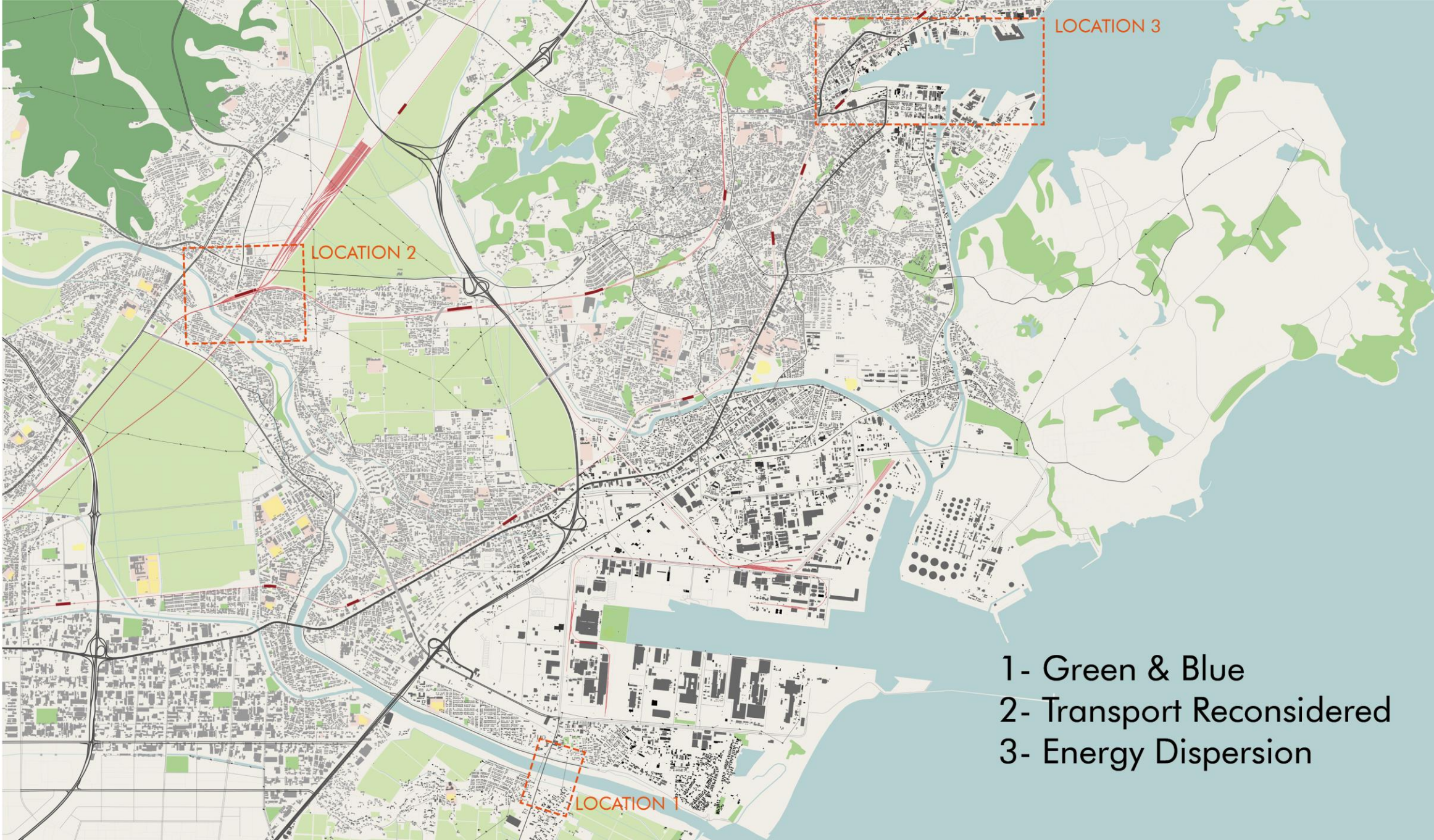
PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION



LOCATION 3








LOCATION 2


LOCATION 1

- 1 - Green & Blue
- 2 - Transport Reconsidered
- 3 - Energy Dispersion

# LOCATION 2- TRANSIT ORIENTED DEVELOPMENT



	<b>Paddy zone</b>		<b>PADDY</b> can be applied to outlet of irrigation channel, where flooding danger is high
	<b>Store zone</b>		<b>STORE</b> can be applied to areas where densification is required.
	<b>Intercept zone</b>		<b>INTERCEPT</b> can be applied to areas with wide flood plain along the river.
	<b>Industrial zone</b>		

 N  
 0m    25m    75m    150m

# TOD

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- Improving walking infrastructure
- Improving cycling infrastructure
- Optimal coverage and service of public transportation
- Minimal car oriented road design
- Better functional mix of living, leisure, recreation, retail and soft industries.
- Reduction of occupied urban space.



## Legend

- Station / Bus Stop
- Shinkansen
- Miyagi Express Rail
- Bus Line
- ⋯ Catchment Area - Bus
- ⋯ Catchment Area - Railway Line
- Local Commercial & Business
- ↔ Potential walk & cycle connection

Source: Robert Mohring, Transport system design considering trends of urbanization and aging society, 2018

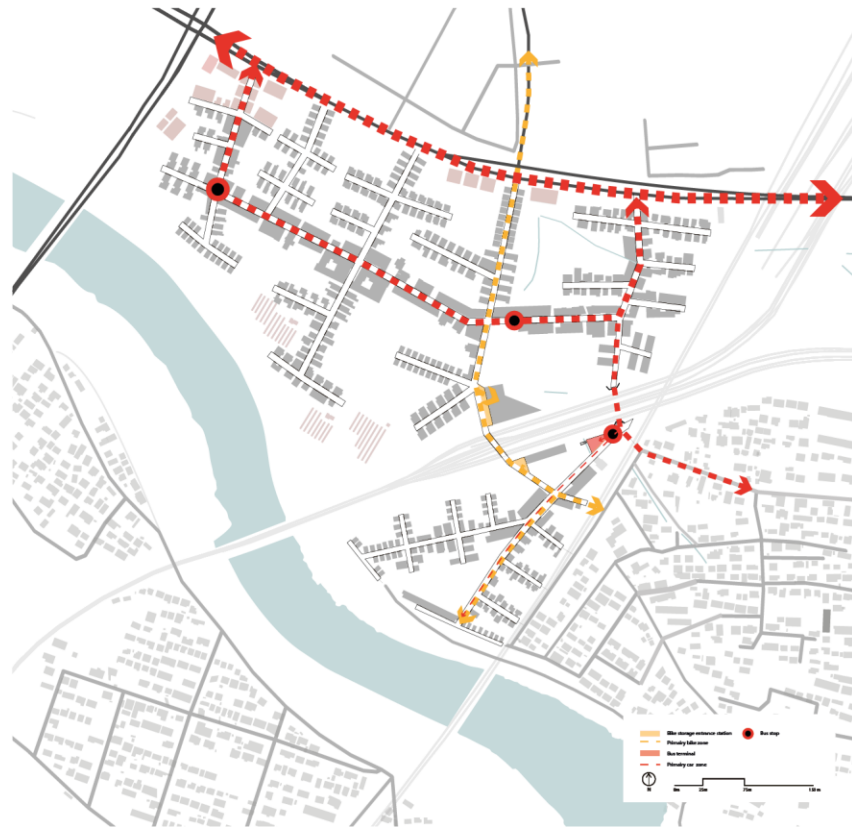
# INTERDISCIPLINARY

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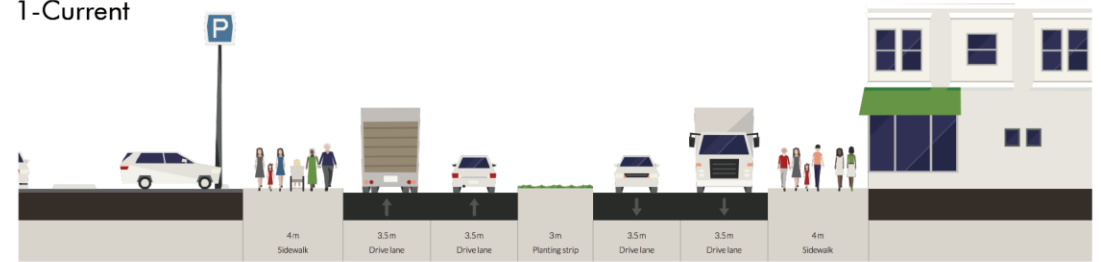
1. <i>Increase walkability</i>	<i>(TS)</i>	<i>Road Design</i>		<i>Design of Build Environment</i>
2. <i>Increase bikeability</i>	<i>(TS)</i>	<i>Road Design</i>		
3. <i>Increase connectivity</i>	<i>(TS+LU)</i>	<i>Network Design</i>		
4. <i>Increase PT</i>	<i>(TS)</i>	<i>Network Design</i>		
5. <i>Support Transport Shift</i>	<i>(TS+LU)</i>	<i>Public Places</i>		
6. <i>Densify</i>	<i>(LU)</i>	<i>Urban Design</i>		
7. <i>Increase Mix</i>	<i>(LU)</i>	<i>Urban Design</i>		
8. <i>Build compact settlements</i>	<i>(LU)</i>	<i>Urban Design</i>		

# TOD

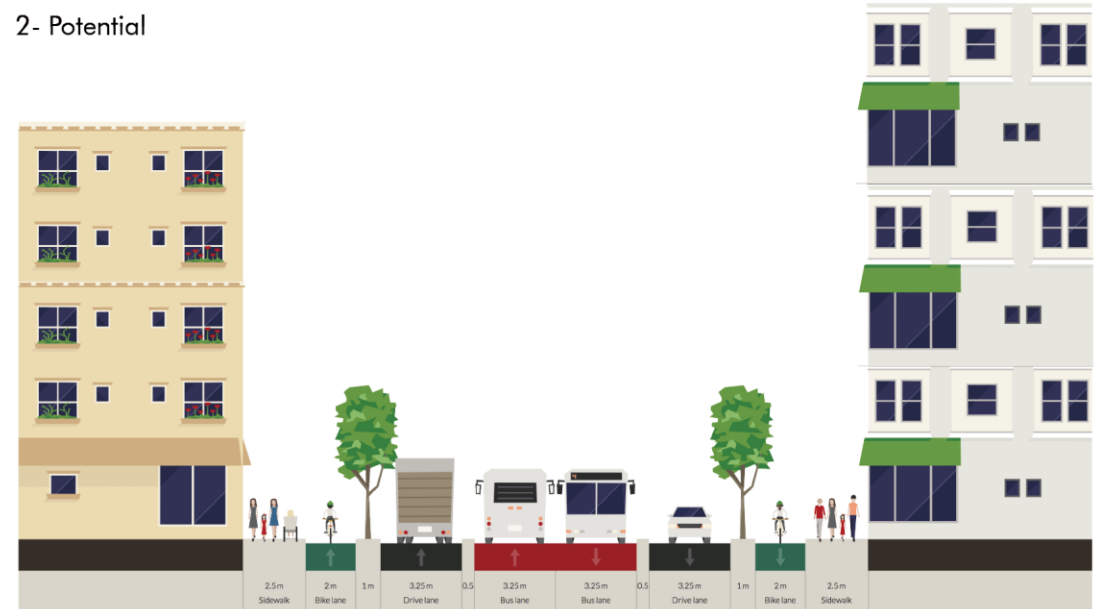
## Road Design



1-Current



2- Potential



Source: Robert Mohring, Transport system design considering trends of urbanization and aging society, 2018



# TOD

## Urban design



## Allocate



## Multifunctional



CONTEXT

# NETWORK DESIGN

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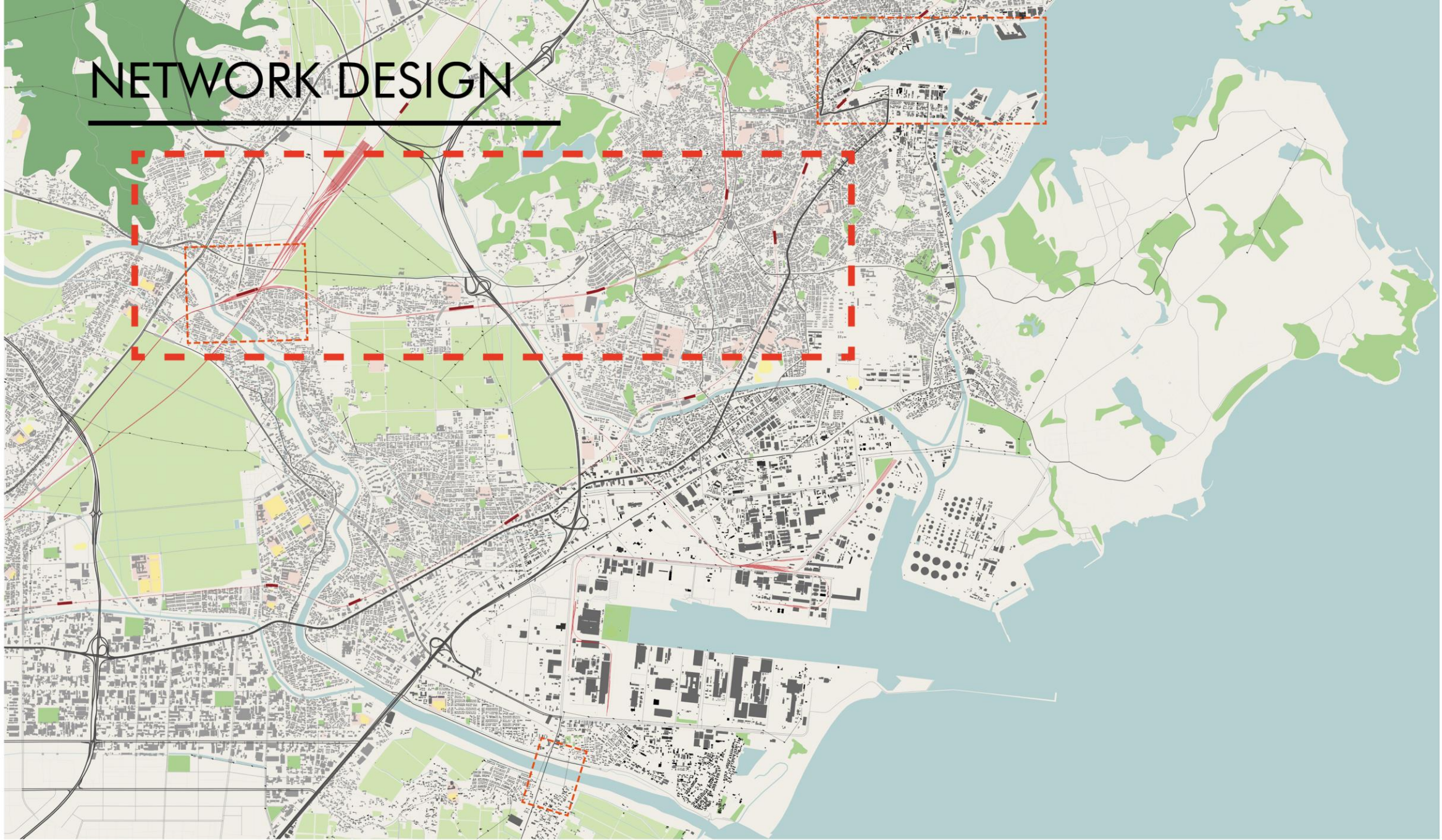
PROBLEM STATEMENT

APPROACH

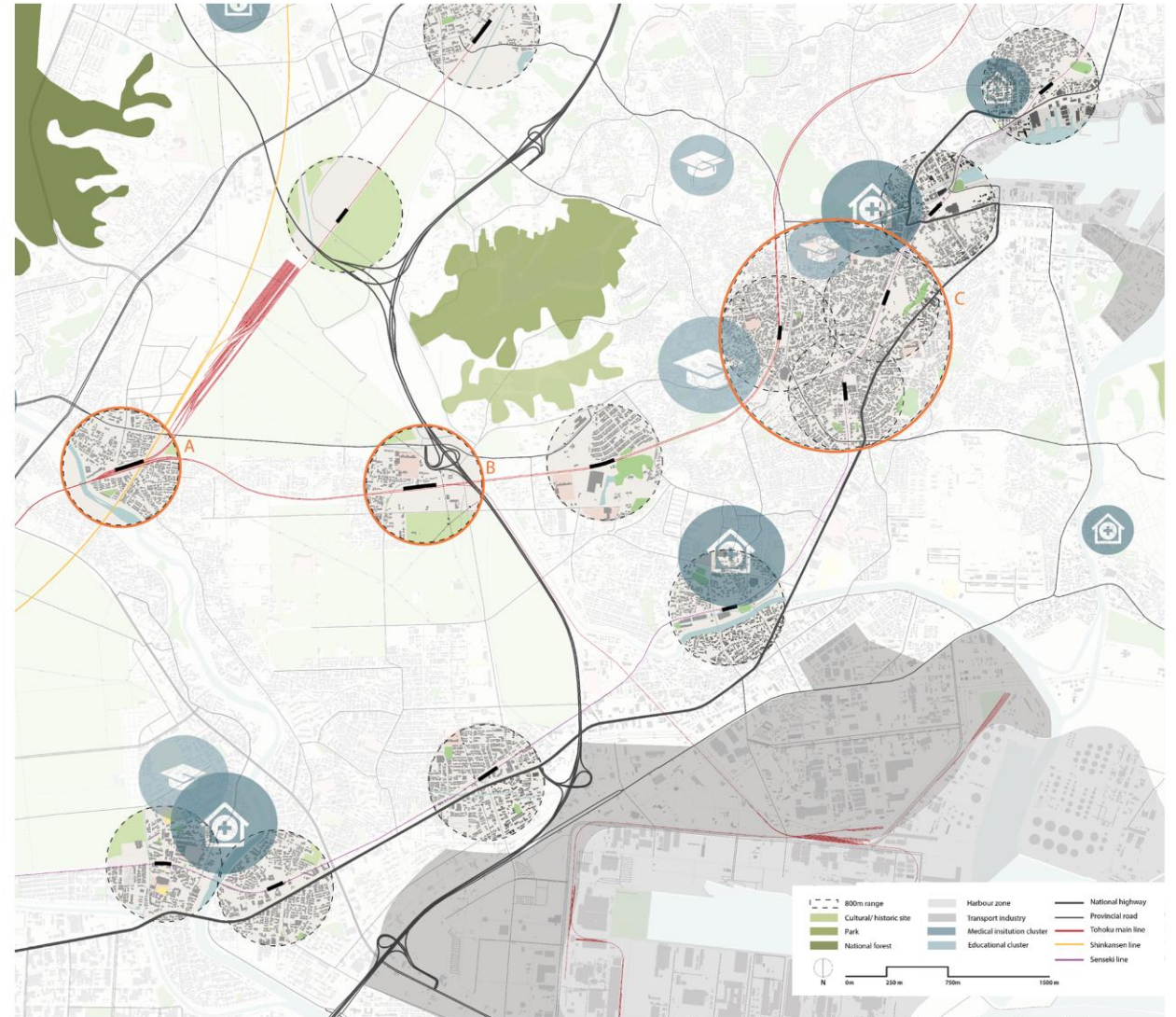
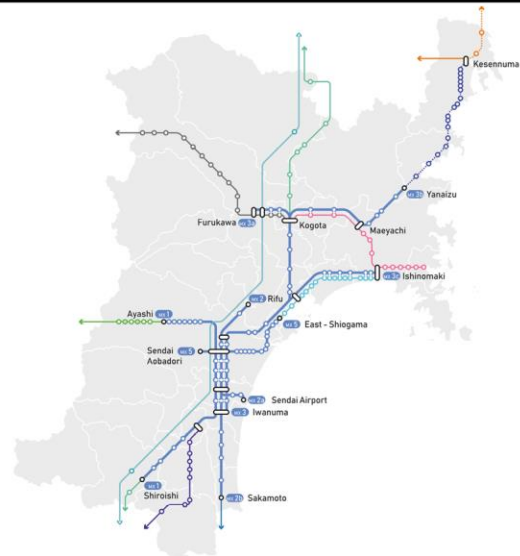
STRATEGY

DESIGN

CONCLUSION



# NETWORK DESIGN



Source: Robert Mohring, Transport system design considering trends of urbanization and aging society, 2018

CONTEXT

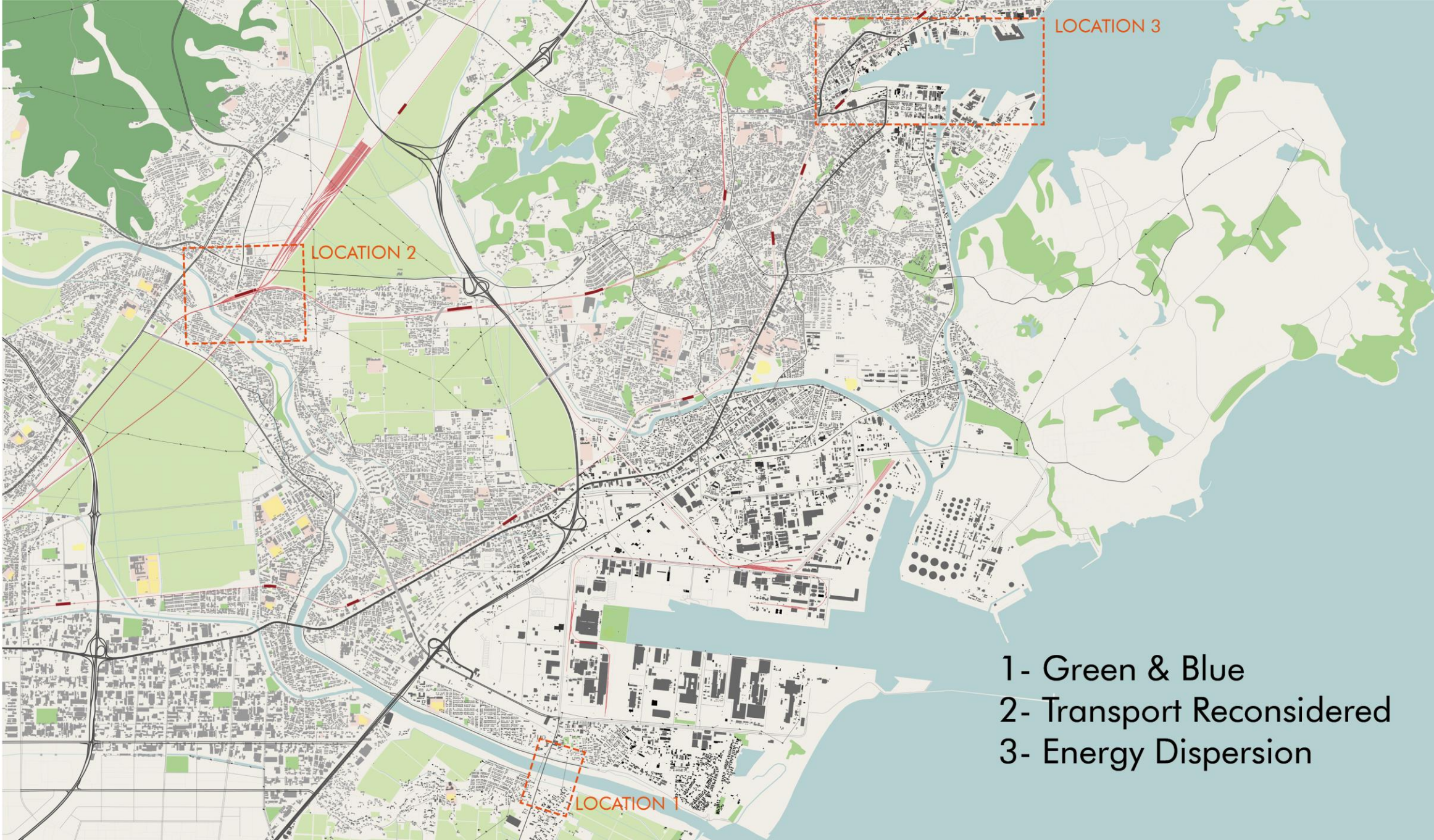
PROBLEM STATEMENT

APPROACH

STRATEGY

DESIGN

CONCLUSION



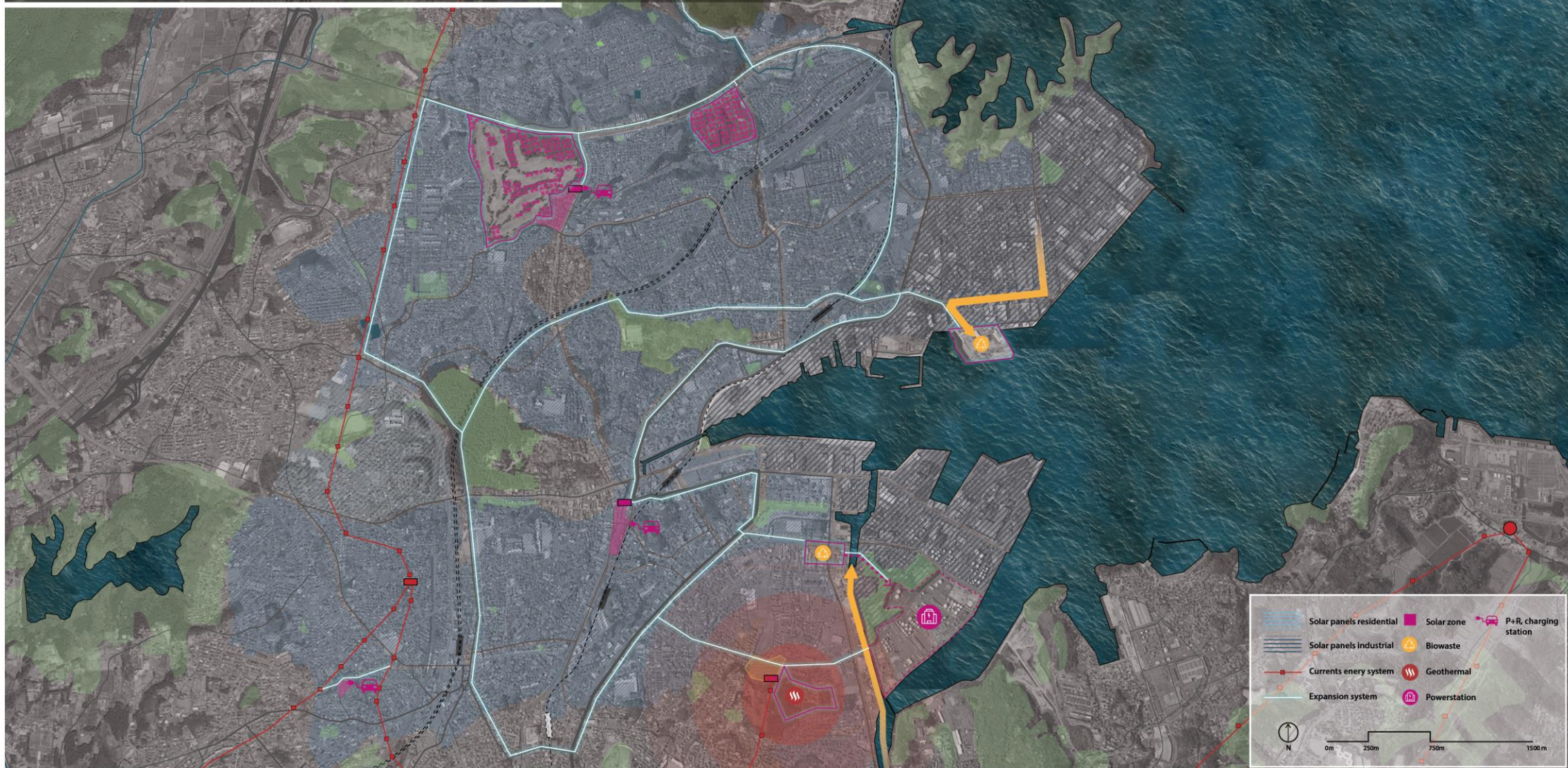
LOCATION 3

LOCATION 2

LOCATION 1

- 1- Green & Blue
- 2- Transport Reconsidered
- 3- Energy Dispersion

# LOCATION 3- ENERGY HARBOUR

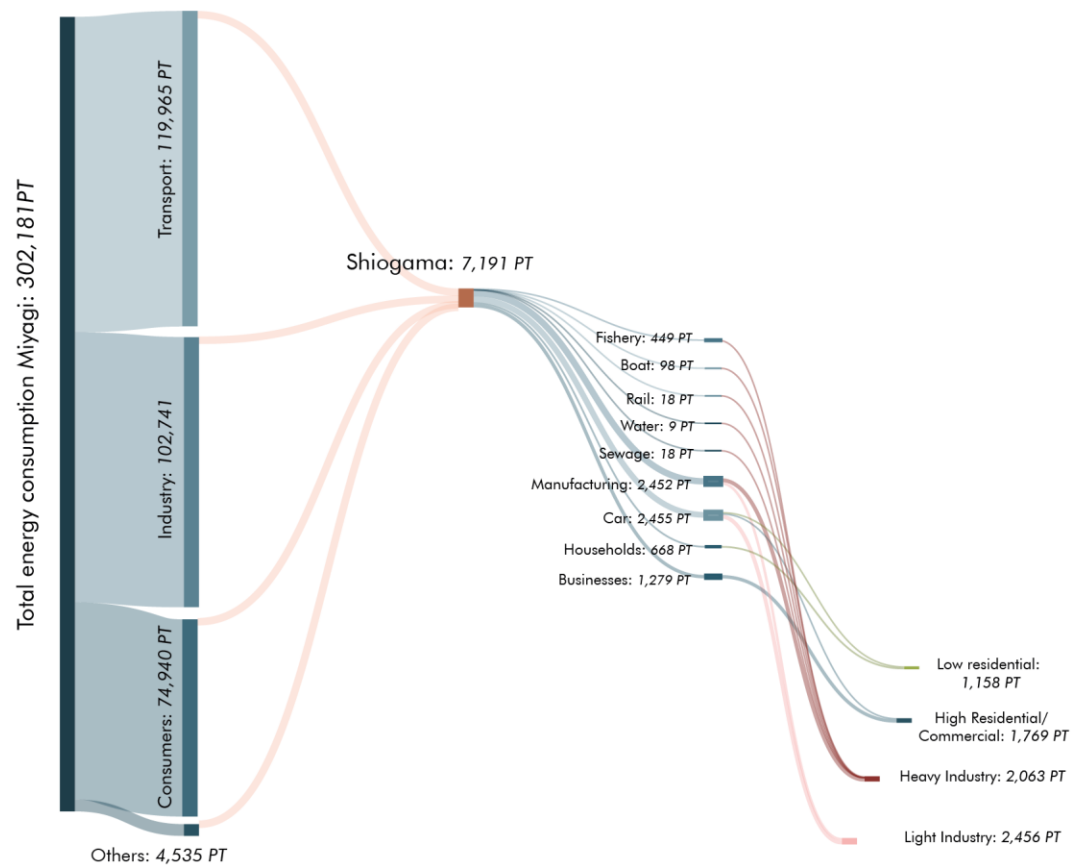


	Solar panels residential		Solar zone		P+R, charging station
	Solar panels industrial		Biowaste		Geothermal
	Currents energy system		Powerstation		
	Expansion system				

0m 250m 750m 1500m

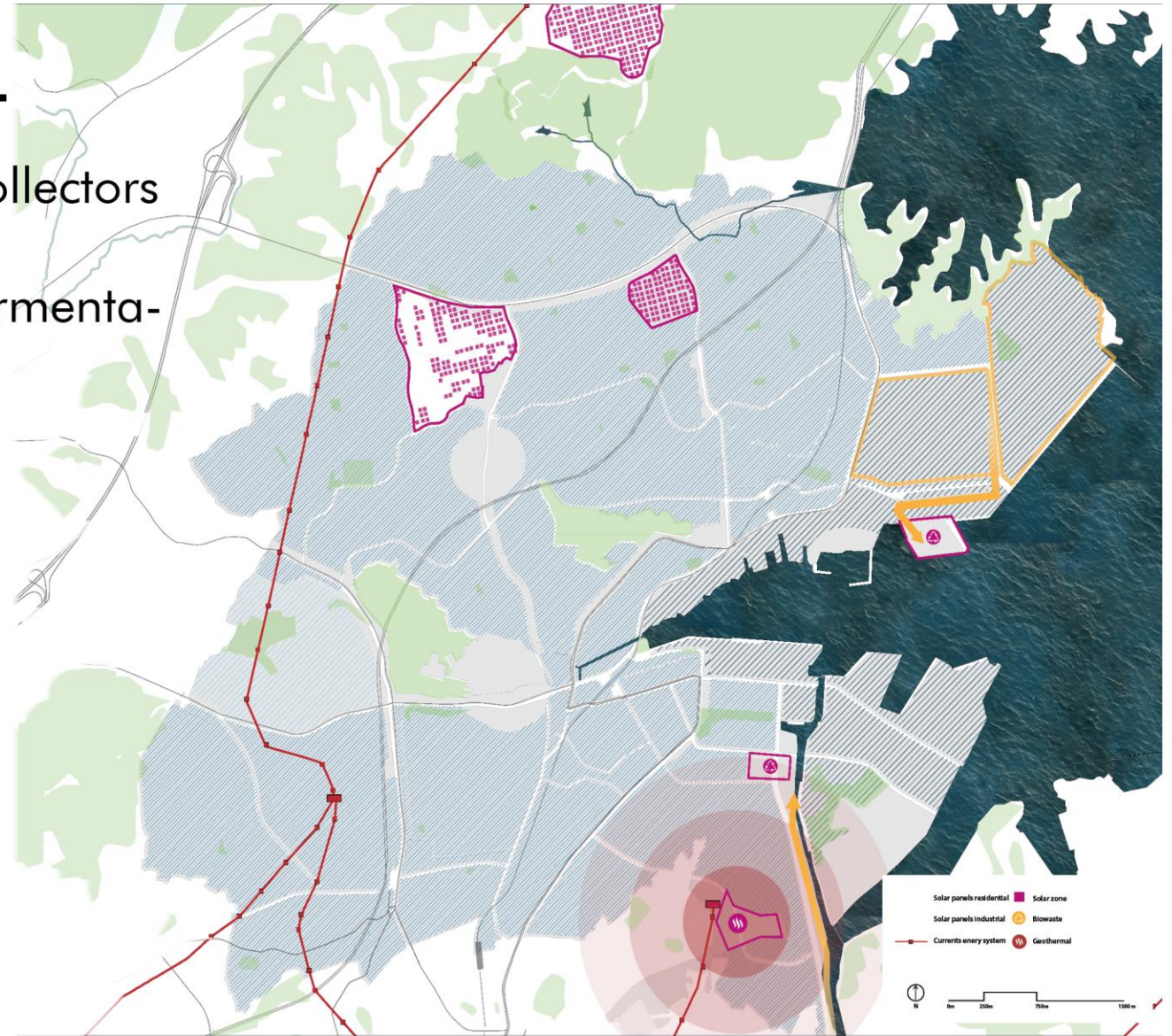
# ENERGY TRANSITION

- Using local and regional elements
- New energy as a structuring measure for the city
- Safety and stability
- Possibilities for buffer capacity



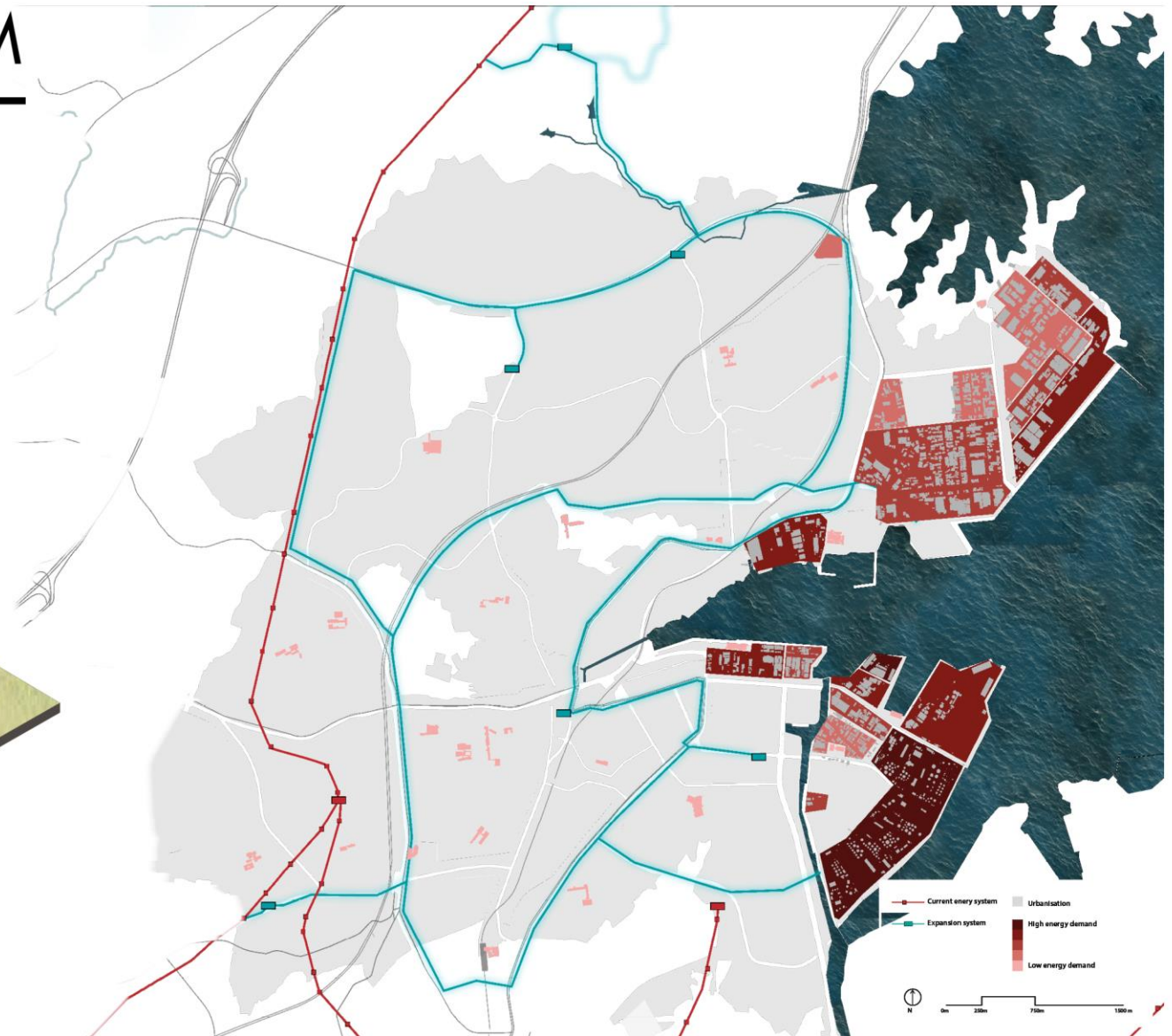
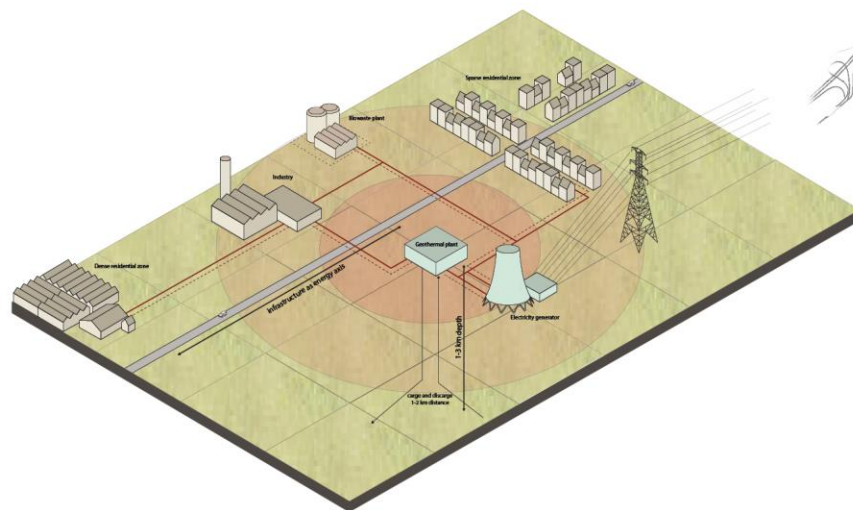
# RENEWABLES

- Solar: Photovoltaic & Solar collectors
- Biomass: Incineration & Fermentation (Gas)
- Geothermal



# CASCADING SYSTEM

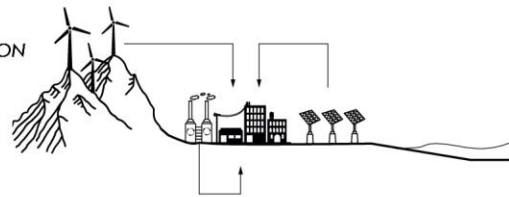
- Efficient use of exergy



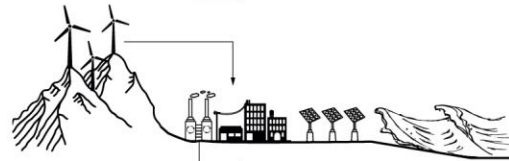


# SAFETY

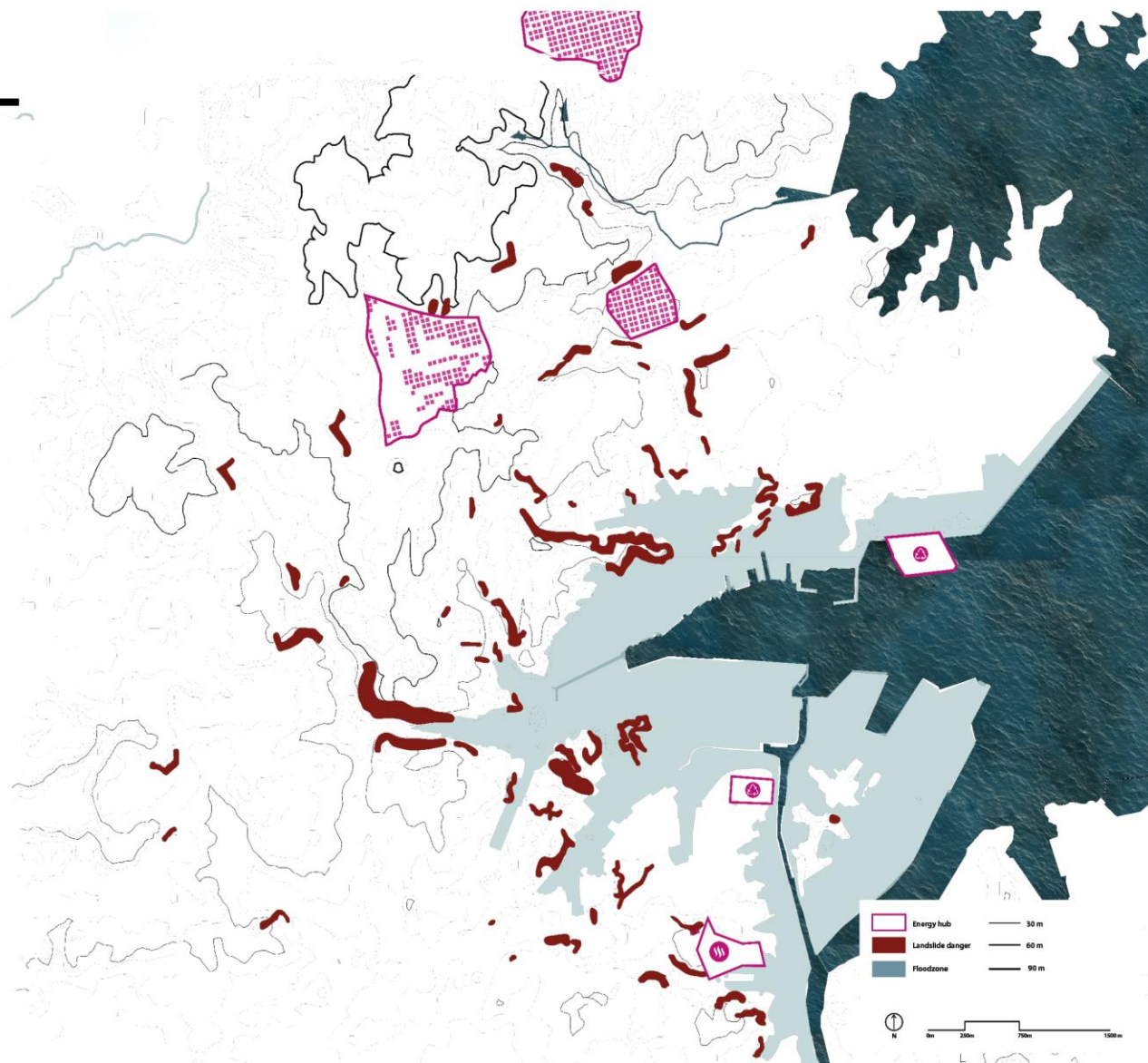
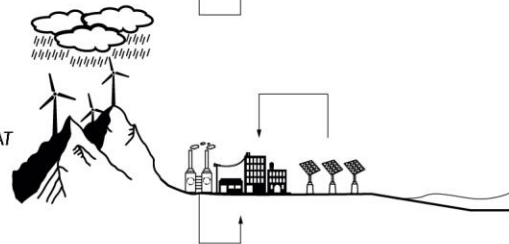
NORMAL SITUATION



TSUNAMI THREAT



TYPHOON/  
LANDSLIDE THREAT



# BUFFER

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- Transition zone in the harbour
- Short term solution



**Previous situation**7,191 × 10<sup>9</sup> Megajoules a year**New situation**

Solar:

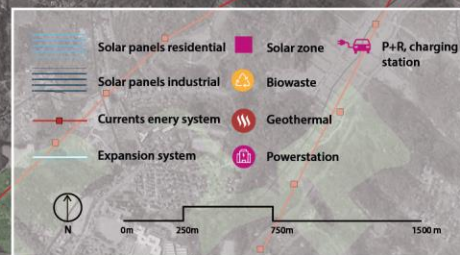
Residential =	397.082.500 kWh
The industrial zone =	181.678.620 kWh
Solar parks =	194.668.160 kWh

Biomass

Northern plant =	37.500.000 kWh
Southern plant =	126.111.111 kWh

Geothermal =

155.000.000 kWh

**Total:****3,393 × 10<sup>9</sup> MJ****47%** renewable energy replacing fossil fuel use.

CONTEXT

PROBLEM  
STATEMENT

APPROACH

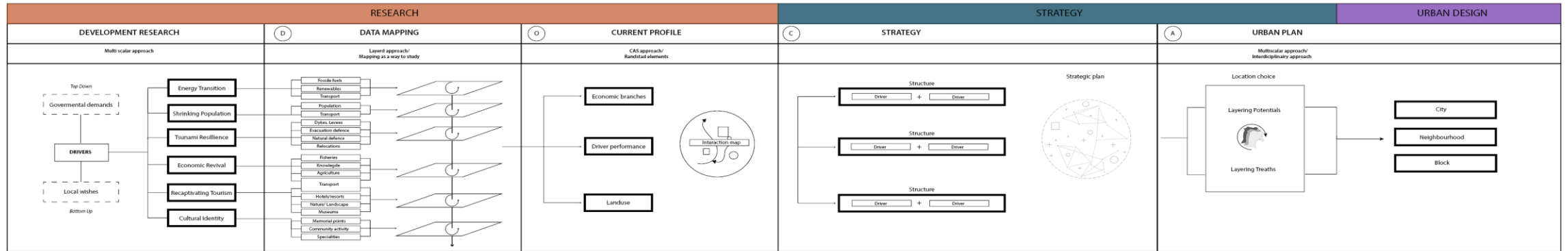
STRATEGY

DESIGN

CONCLUSION



# CONCLUSION

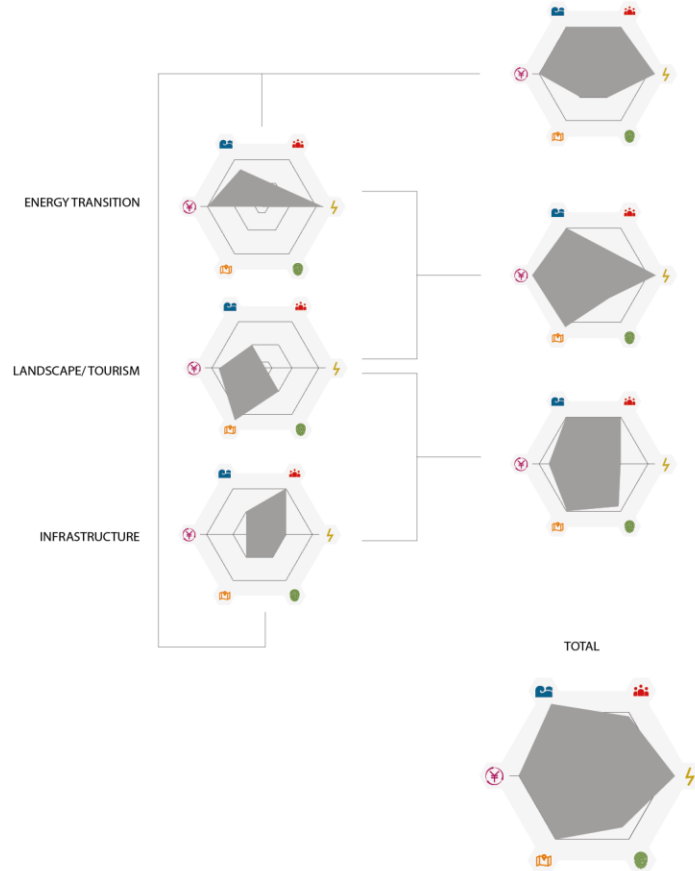


Regional research approach

Indicative strategy

Impact on scale

# IMPACT



- Dependent on actions of the government.



- Costly investment with no clear time frame on return of investments.

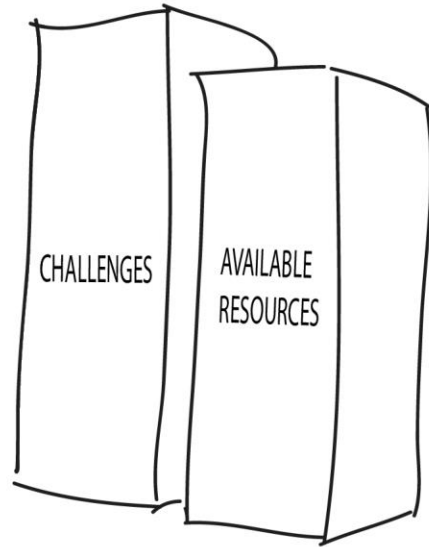


- Complicated system of land readjustment

# CONCLUSION

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Factor of difficulty to meet needs



PRE DISASTER



Factor of difficulty to meet needs

POST DISASTER

# CONCLUSION

---

CONTEXT

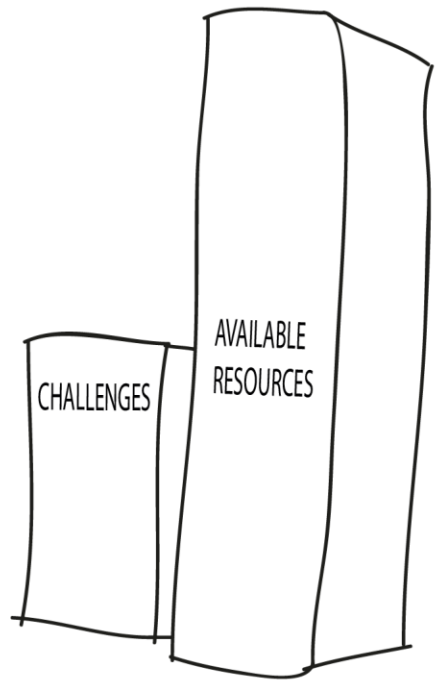
PROBLEM STATEMENT

APPROACH

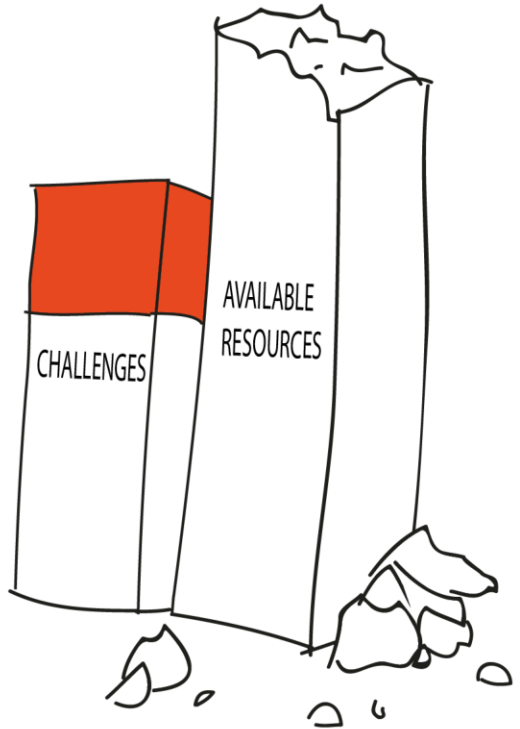
STRATEGY

DESIGN

CONCLUSION



PRE DISASTER



POST DISASTER



# THE NEXT BIG ONE

---

**\$183,000,000,000**

IN ECONOMIC DAMAGES

---

**15.860**

LIVES LOST

---

**4.400.000**

HOUSEHOLDS WITHOUT POWER

---

**1.500.000**

HOUSEHOLDS WITHOUT WATER

# THE NEXT BIG ONE

---

**\$18.300.000**

IN ECONOMIC DAMAGES

---

**0**

LIVES LOST

---

**40.000**

HOUSEHOLDS WITHOUT POWER

---

**15.000**

HOUSEHOLDS WITHOUT WATER

# ACTIVATE RESILIENCE OF THE MIYAGI COAST

GRADUATION PRESENTATION | NASIEM VAFA | 4112636





