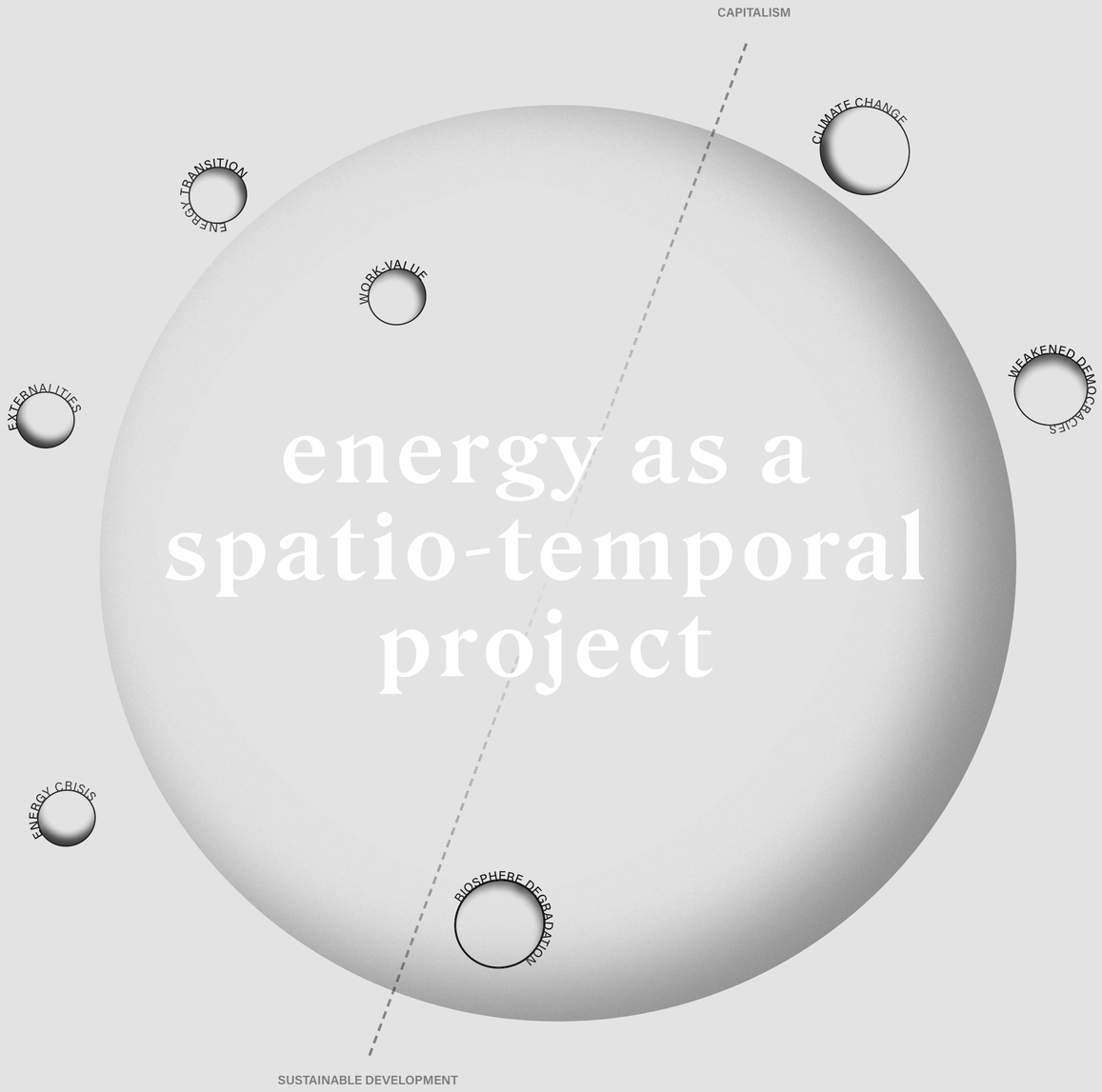
temporalities of energy landscapes in the Rhine basin

energy as a spatio-temporal project

hugo lopez
transitional territories studio

\

p5 presentation



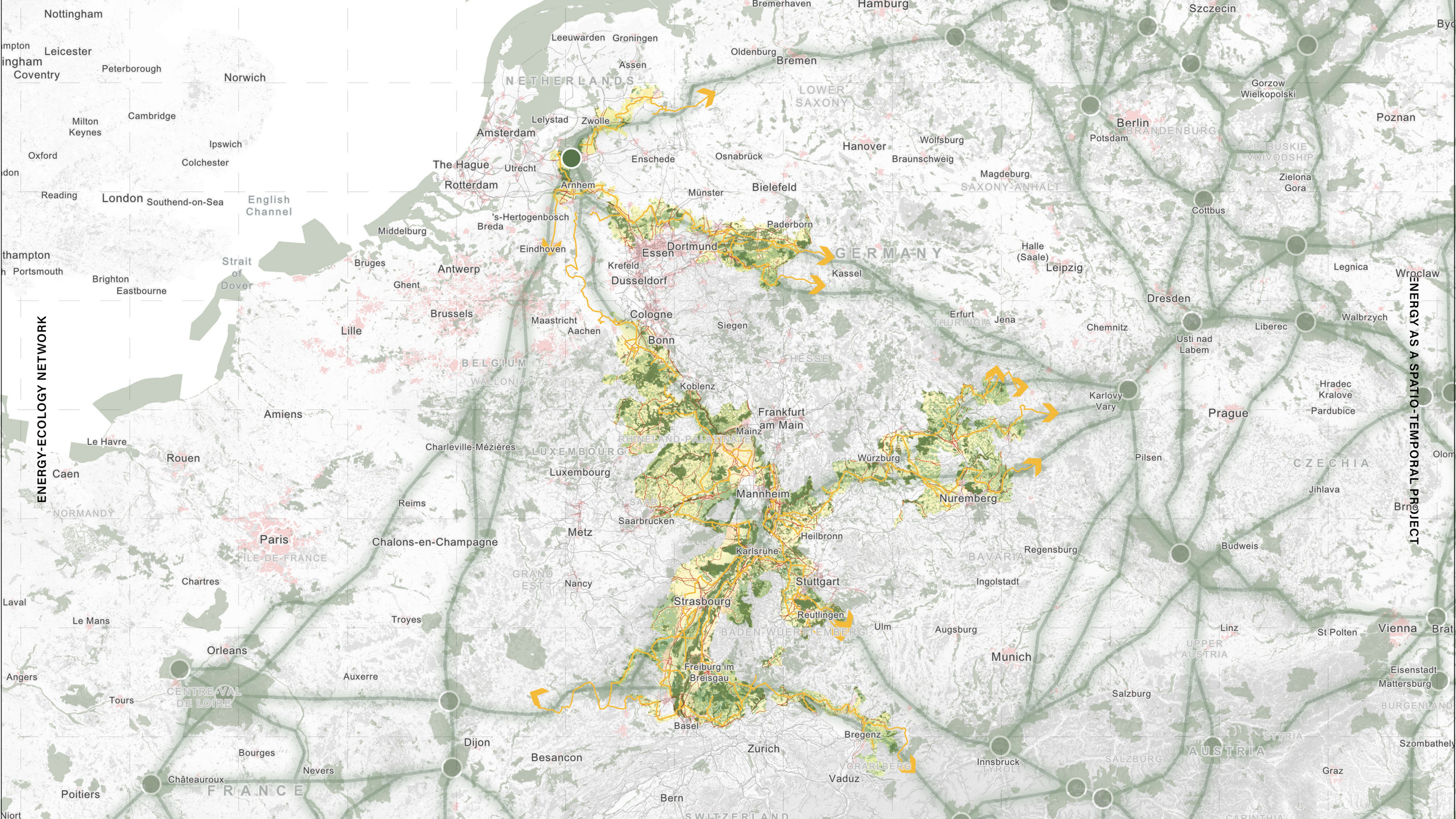
energy as a spatio-temporal project

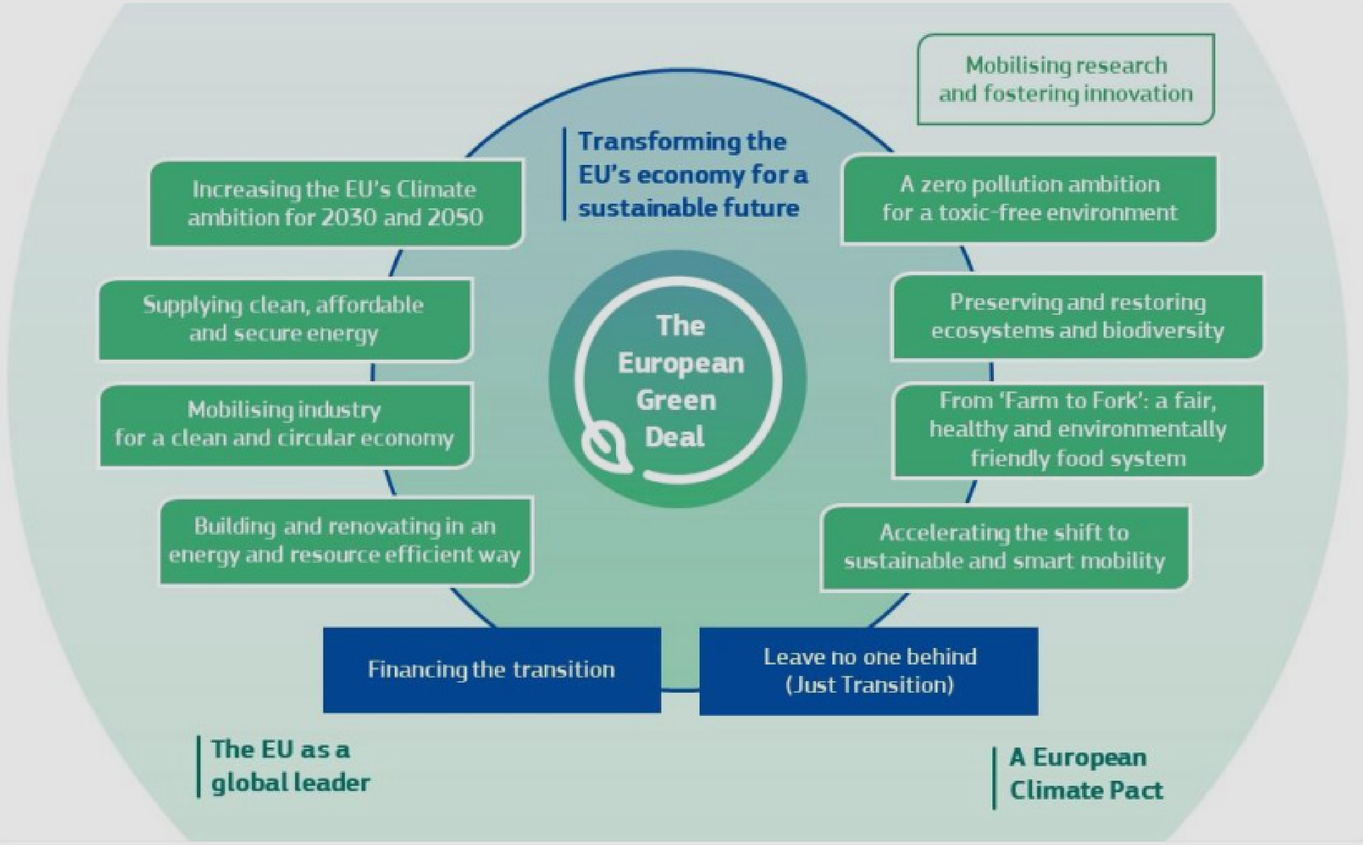
Summary

SUMMARY

ENERGY-ECOLOGY NETWORK

ENERGY AS A SPATIO-TEMPORAL PROJECT


ENERGY-ECOLOGY NETWORK
ENERGY AS A SPATIO-TEMPORAL PROJECT
Nottingham
Leicester
Coventry
Peterborough
Norwich
Cambridge
Milton Keynes
Ipswich
Oxford
Colchester
Reading
London
Southend-on-Sea
English Channel
Brighton
Eastbourne
Portsmouth
Strait of Dover
Middelburg
Bruges
Ghent
Antwerp
Brussels
Lille
Amiens
Le Havre
Rouen
Caen
NORMANDY
Paris
ÎLE-DE-FRANCE
Chartres
Laval
Le Mans
Troyes
Orleans
Angers
Tours
CENTRE-VAL DE LOIRE
Auxerre
Bourges
Nevers
Châteauroux
Poitiers
FRANCE
Dijon
Besancon
Bern
SWITZERLAND
Zurich
Basel
Freiburg im Breisgau
Vaduz
Bregenz
VORARLBERG
Innsbruck
TYROL
Salzburg
AUSTRIA
SALZBURG
STYRIA
Graz
Szombathely
Vienna
Brat
St Polten
Linz
UPPER AUSTRIA
BURGENLAND
Eisenstadt
Mattersburg
Munich
Augsburg
Ingolstadt
Regensburg
BAVARIA
Ulm
Reutlingen
Stuttgart
Karlsruhe
Heilbronn
Nancy
Metz
Saarbrucken
SAAR
Mannheim
Nuremberg
Würzburg
Frankfurt am Main
Mainz
RHINELAND-PALATINATE
Koblenz
Luxembourg
LUXEMBOURG
Charleville-Mézières
Reims
Chalons-en-Champagne
GRAND EST
BADEN-WUERTTEMBERG
Strasbourg
Pilsen
Prague
CZECHIA
Karlovy Vary
Hradec Kralove
Pardubice
Jihlava
Budweis
Olom
Brn
Chemnitz
Usti nad Labem
Liberec
Walbrzych
Legnica
Wroclaw
Dresden
Leipzig
Halle (Saale)
Cottbus
Zielona Gora
Gorzow Wielkopolski
Poznan
Szczecin
Berlin
Potsdam
BRANDENBURG
LUBUSKIE VOIVODSHIP
Magdeburg
SAXONY-ANHALT
Erfurt
THURINGIA
Jena
Kassel
GERMANY
Paderborn
Dortmund
Essen
Krefeld
Dusseldorf
Cologne
Bonn
Aachen
Maastricht
Siegen
HESSE
Eindhoven
's-Hertogenbosch
Breda
Münster
Bielefeld
Osnabrück
Enschede
Hanover
Wolfsburg
Braunschweig
Arnhem
Utrecht
The Hague
Rotterdam
Amsterdam
Lelystad
Zwolle
Assen
Leeuwarden
Groningen
NETHERLANDS
LOWER SAXONY
Oldenburg
Bremen
Bremerhaven
Hamburg
WALLONIA
BELGIUM

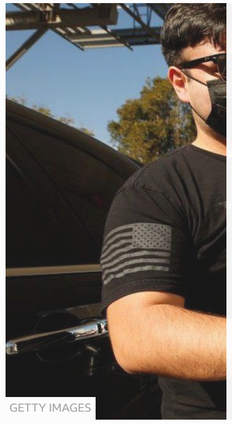


European Green Deal diagram
Source: European Comission, 2022.

Shell defends 'difficult' decision to buy Russian crude oil

2 days ago

Russia-Ukraine war



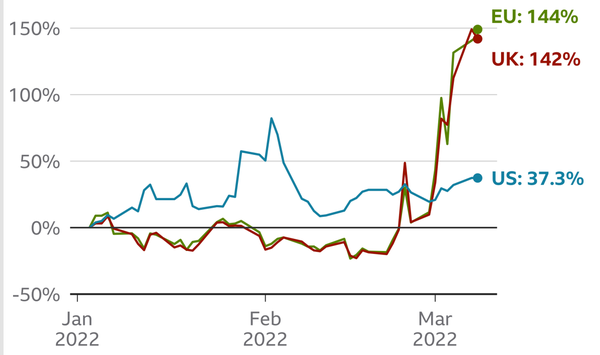
GETTY IMAGES

Rutte: ban on Russian oil would have ‘enormous consquences’ for Europe

Politics March 8, 2022

How global gas prices have changed

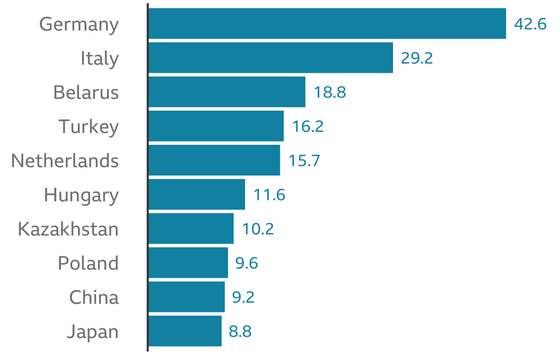
Percentage change since 1 January 2022



Bloomberg. Last update: 8 March 2022 11:00 GMT BBC

Russia's gas exports

Countries by billion of cubic meters imported from Russia



Source: IEA, Data for 2020 BBC

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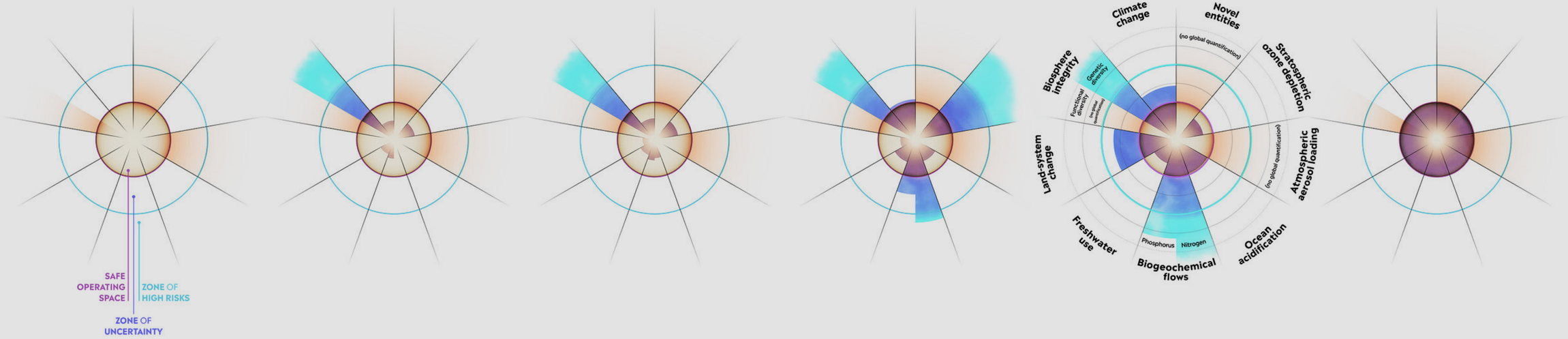
Markets

The US Is Now Sending the Bulk of Its Export Gas to Europe

The US sent nearly three quarters of all its liquefied natural gas to Europe in the first four months of 2022, up from one third last year.

PLANETARY BOUNDARIES

PREINDUSTRIAL 1950 1970 1990 **CURRENT** *2050*



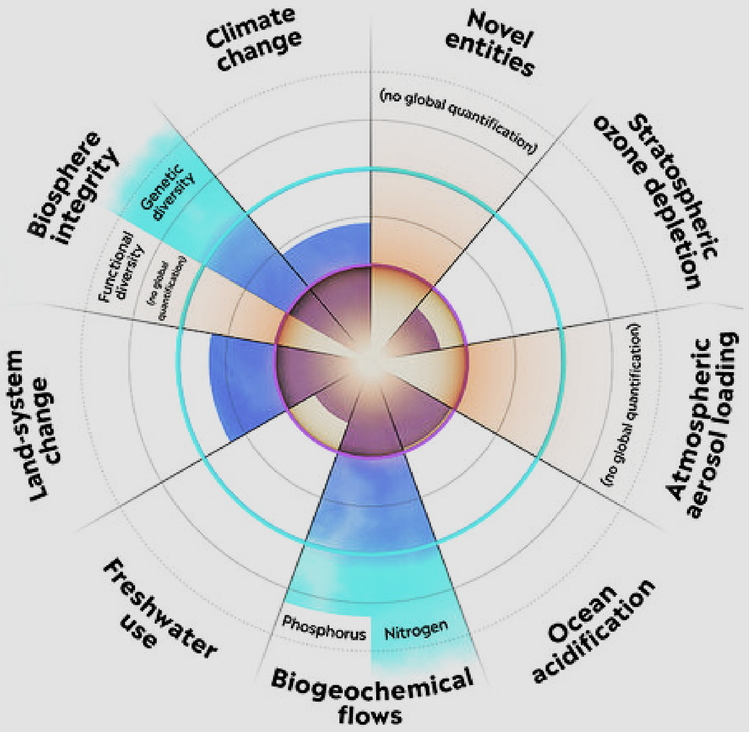
ENVIRONMENT

Planetary boundaries framework.
Source: Steffen et al., 2015.

PLANETARY BOUNDARIES

ENVIRONMENT

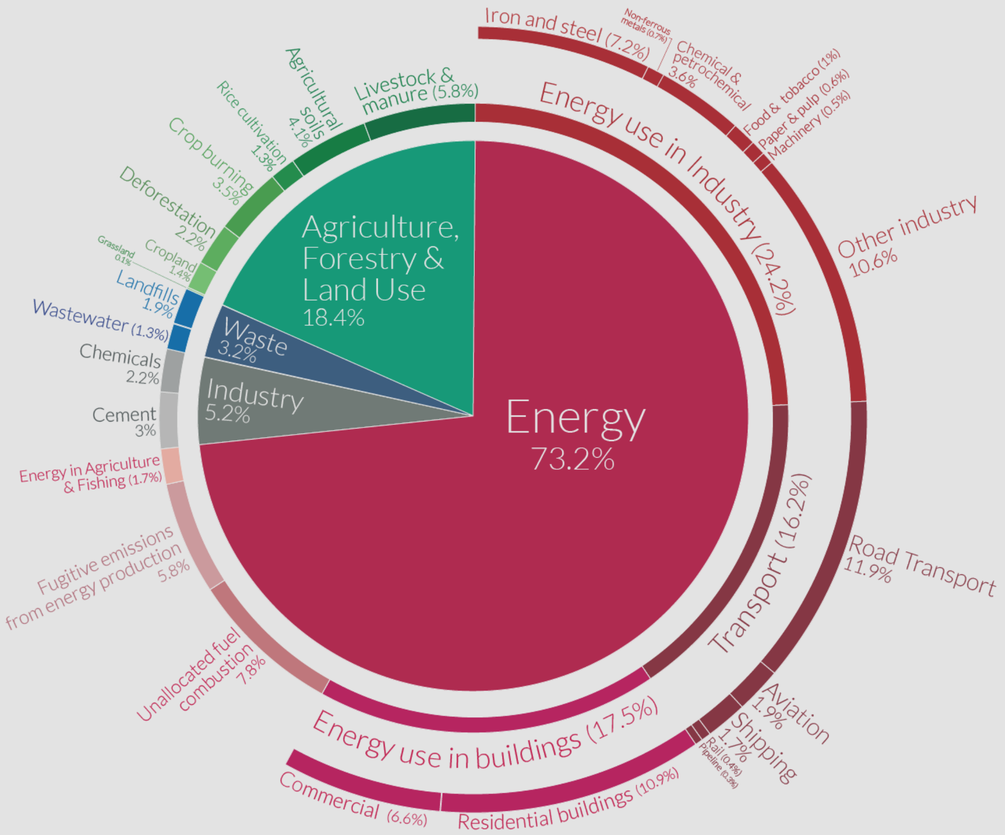
CURRENT



Planetary boundaries framework.
Source: Steffen et al., 2015.

“Energy is ultimately a root cause of the exceedance of many planetary boundaries.”
(EEA, 2020)

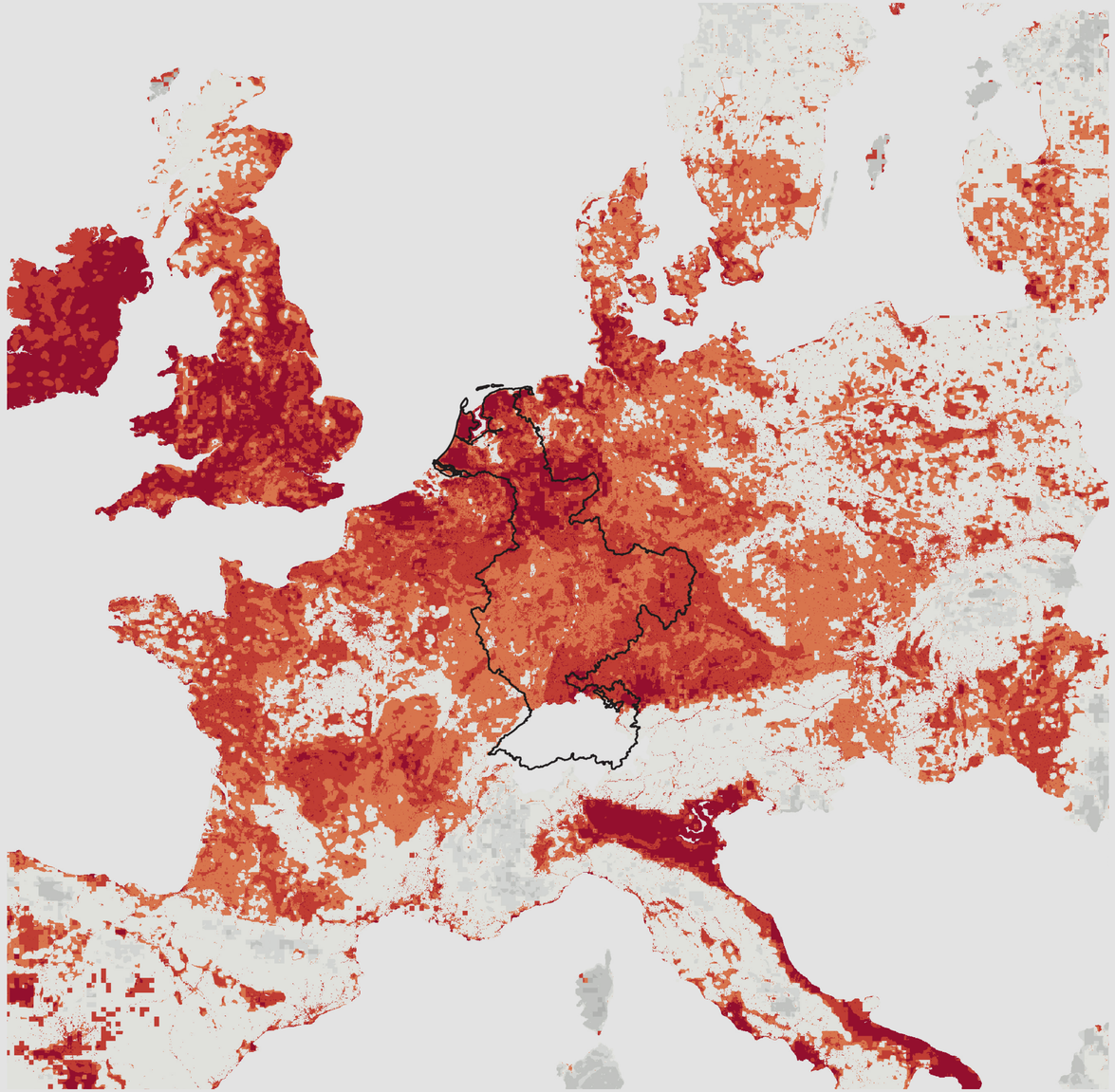
ENERGY IS RESPONSIBLE FOR ALMOST 3/4 OF EMISSIONS



INDUSTRY

The diagram shows how the energy sector is responsible for almost 3/4 of emissions that cross planetary boundaries like the climate.
Source: Our world in data, 2016

LOW ECOLOGICAL INTEGRITY



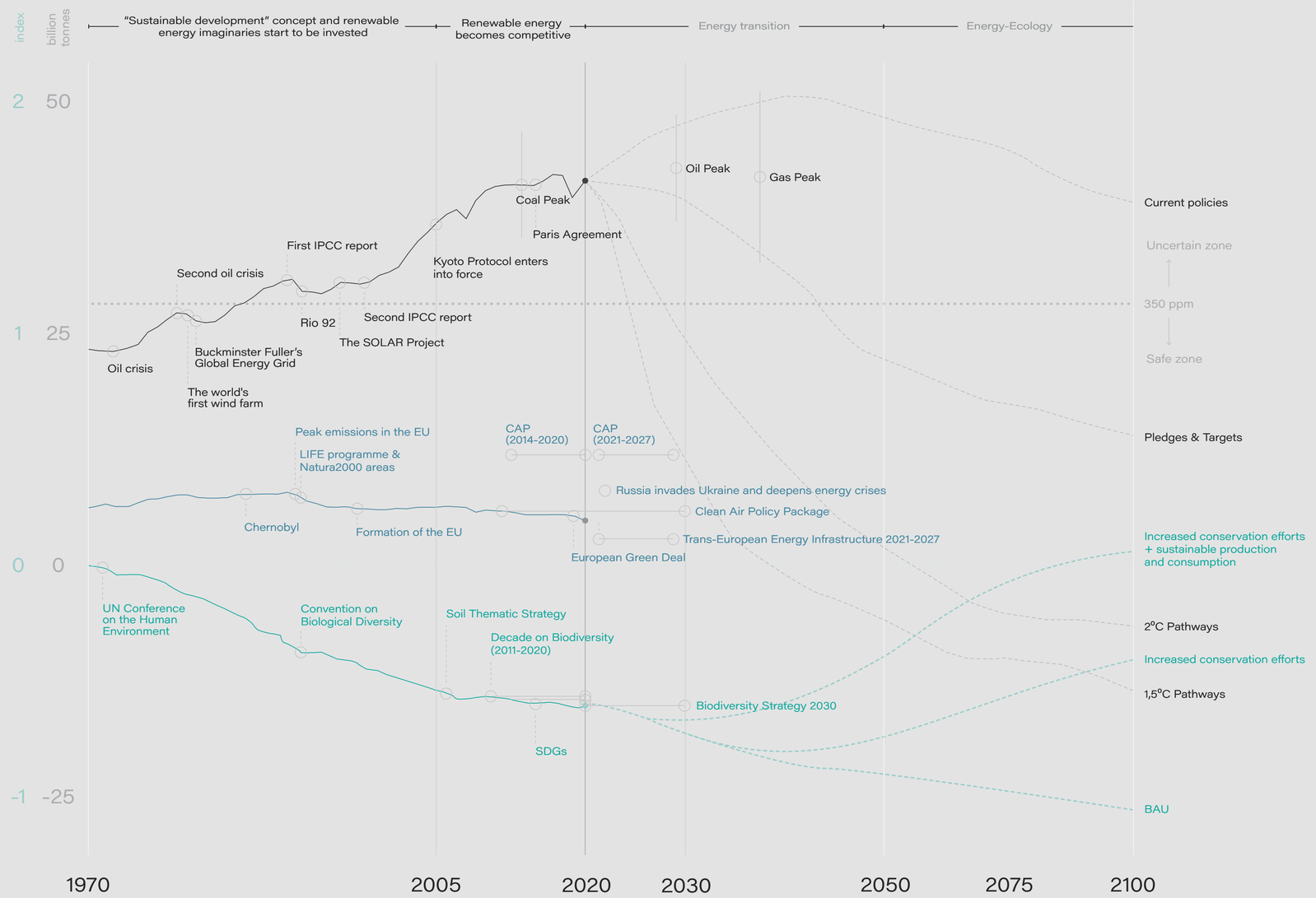
ECOLOGY

"Ecological integrity" is measured from three major components of "wildness", which are, trophic function, connectivity and natural dynamics. "This indicator aims to reflect the extent to which anthropogenic defaunation, fragmentation of the landscape and the continued extraction of natural resources, have altered the natural state of ecosystems." (Fernández et al, 2020)

Ecological integrity, with the Rhine basin highlighted
Data: Boosting Ecological Restoration for a Wilder Europe, 2020

CROSS-CHRONOLOGY OF ENERGY AND BIODIVERSITY

TEMPORALITIES



RESEARCH QUESTION

How can energy landscapes mediate a socio-ecologically just urbanisation for future modes of energy production in the Rhine basin?

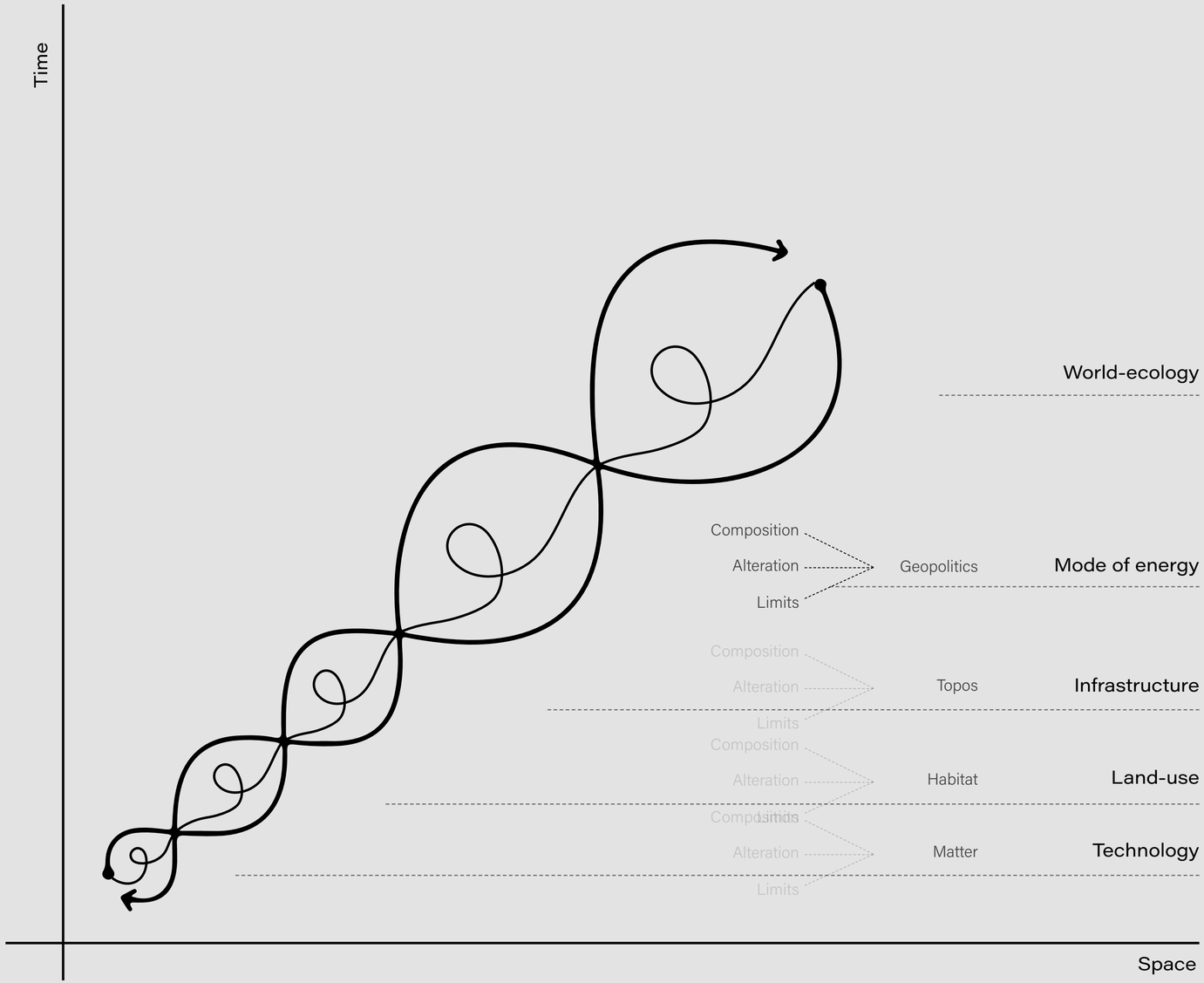
RESEARCH QUESTION

Methodology

METHODOLOGY

ADAPTIVE CYCLES

ANALYTICAL FRAMEWORK



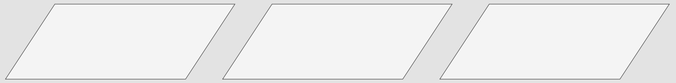
inheritance anticipation projection

NARRATIVE STRUCTURE

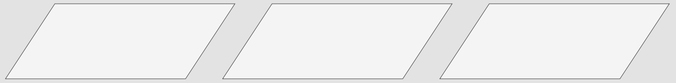
inheritance

energy crisis

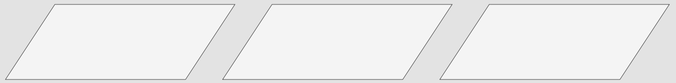
Technologies



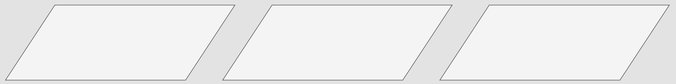
Land-use



Infrastructure



Geopolitics

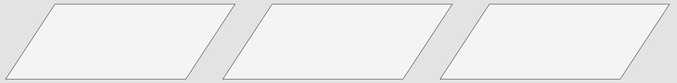


Scale: Rhine basin

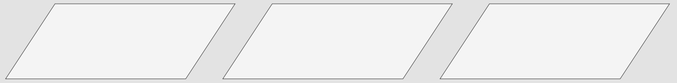
anticipation

energy transition

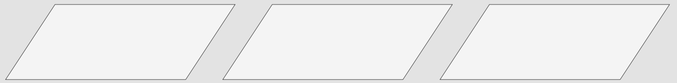
Technologies



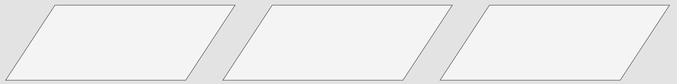
Land-use



Infrastructure



Geopolitics



Scale: Rhine basin

world-ecology

the terraforming

operational landscapes

DESIGN WORKFLOW

energy crisis

energy transition

Inheritance

+

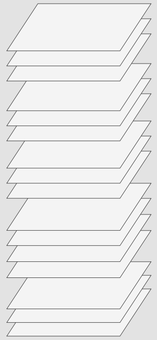
Anticipation

↓ ↓ ↓

Projection

Cartography

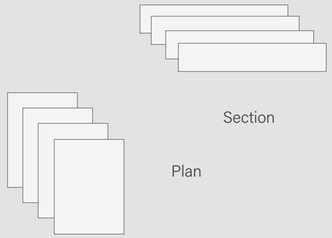
Method:
Vertical overlay
Scale:
Rhine basin
Communication:
Plan
Temporality:
Now



Plan

Deconstruction

Method:
Deconstruction
Scale:
Regional
Communication:
Plan & Section
Temporality:
Speculative

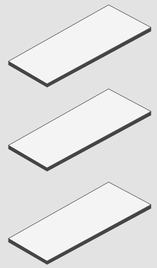


Section

Plan

Terraforming

Method:
Deconstruction
Scale:
Landscape
Communication:
Transect
Temporality:
Speculative



Transects

Outcome:
Energy-Ecology Network

Outcome:
Corridor Typologies

Outcome:
Territorial Typologies

energy as a spatio-temporal project

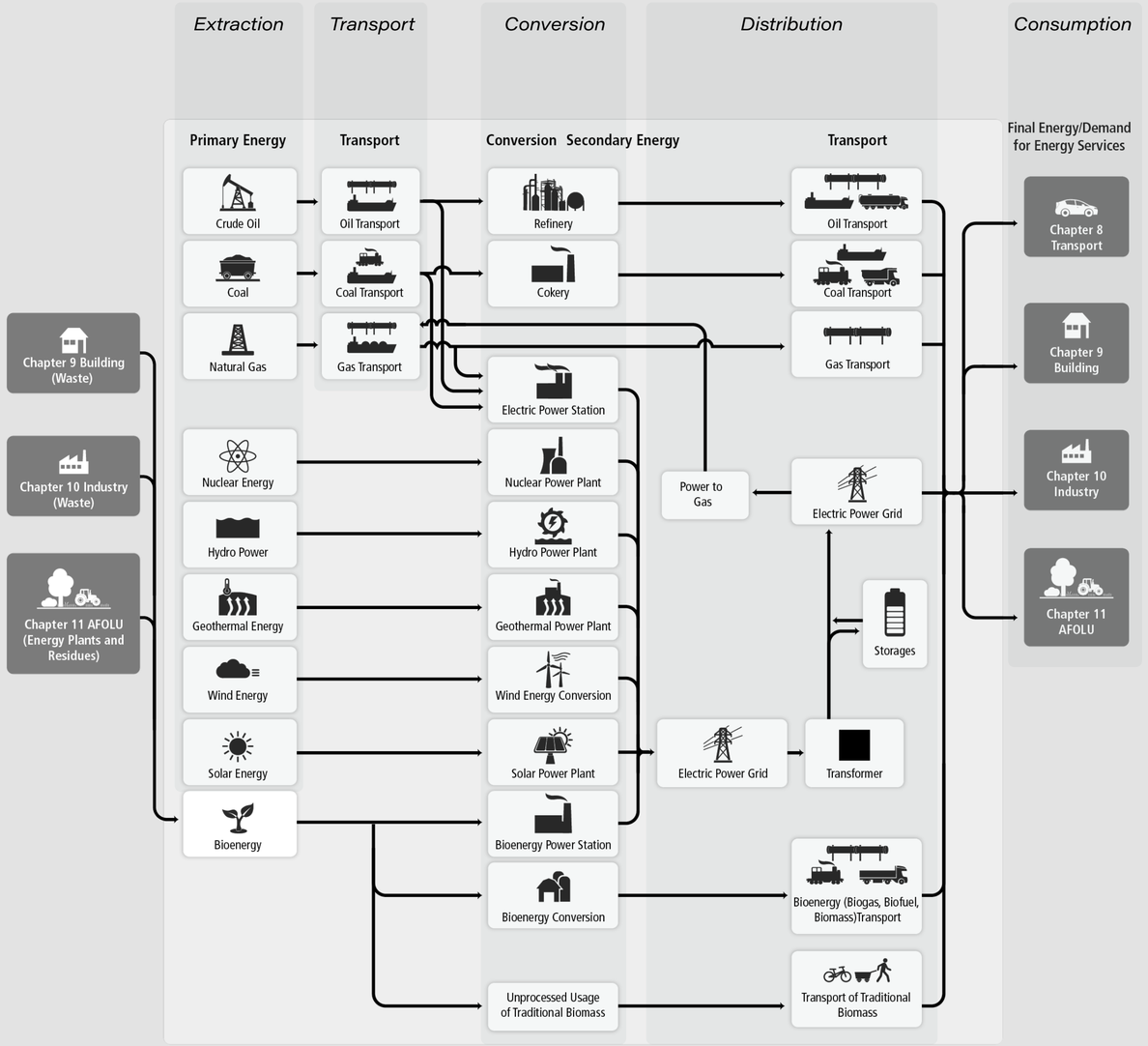
DESIGN WORKFLOW

Inheritance

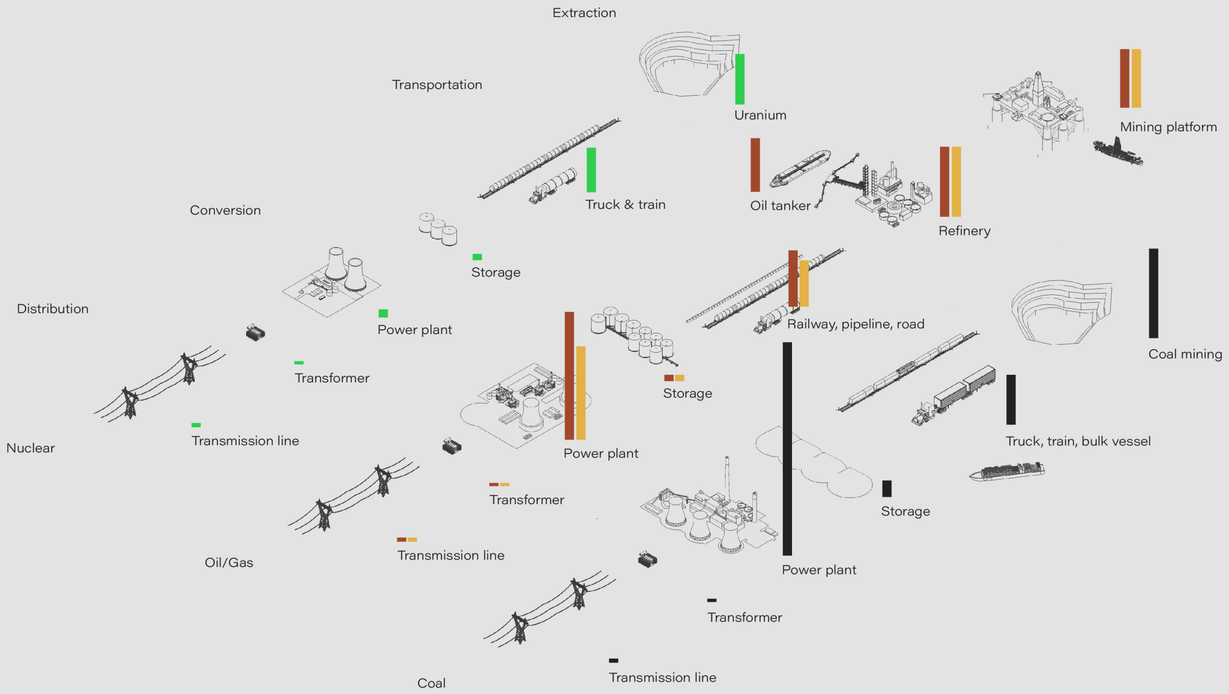
INHERITANCE

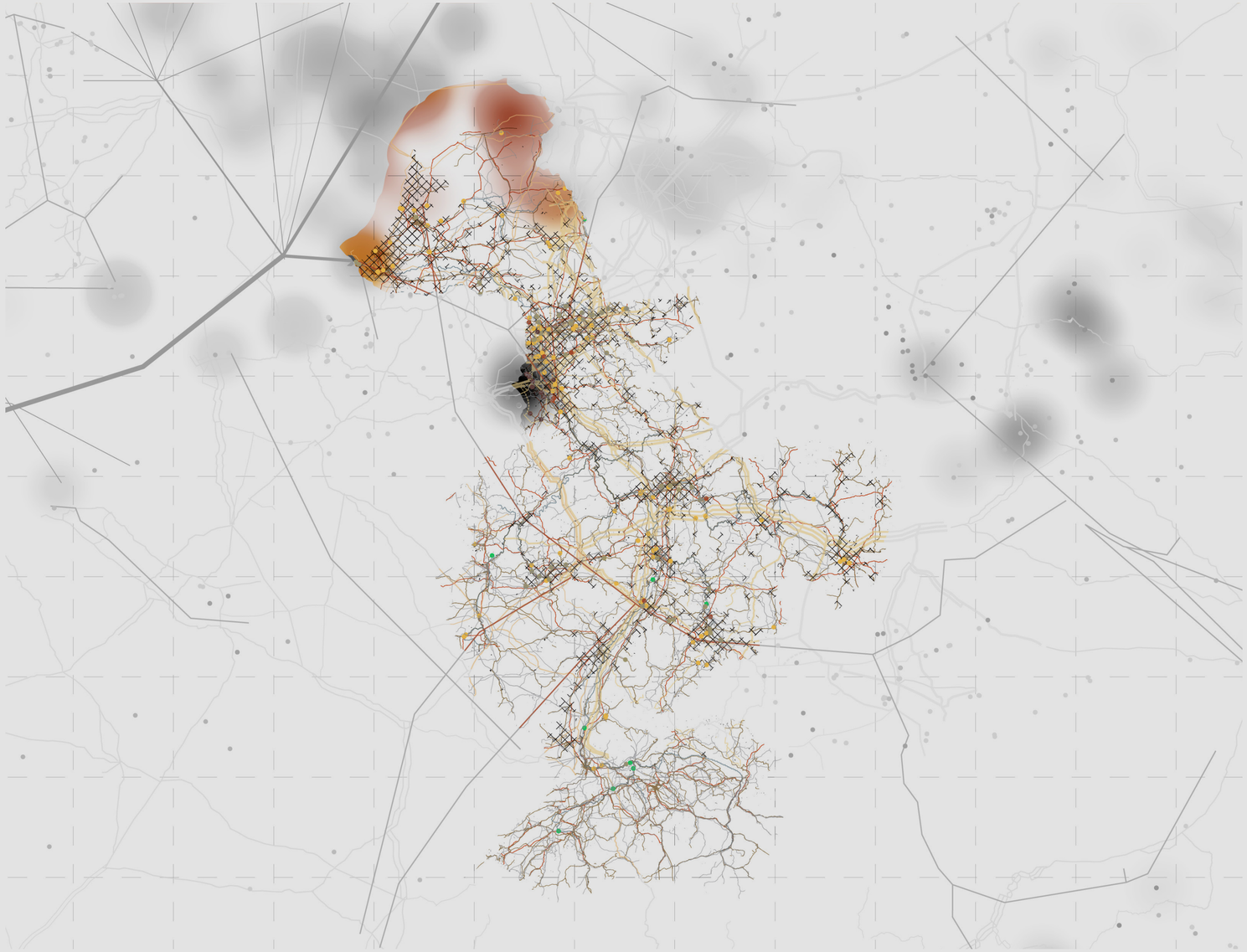
ENERGY LANDSCAPES

PROBLEM FOCUS

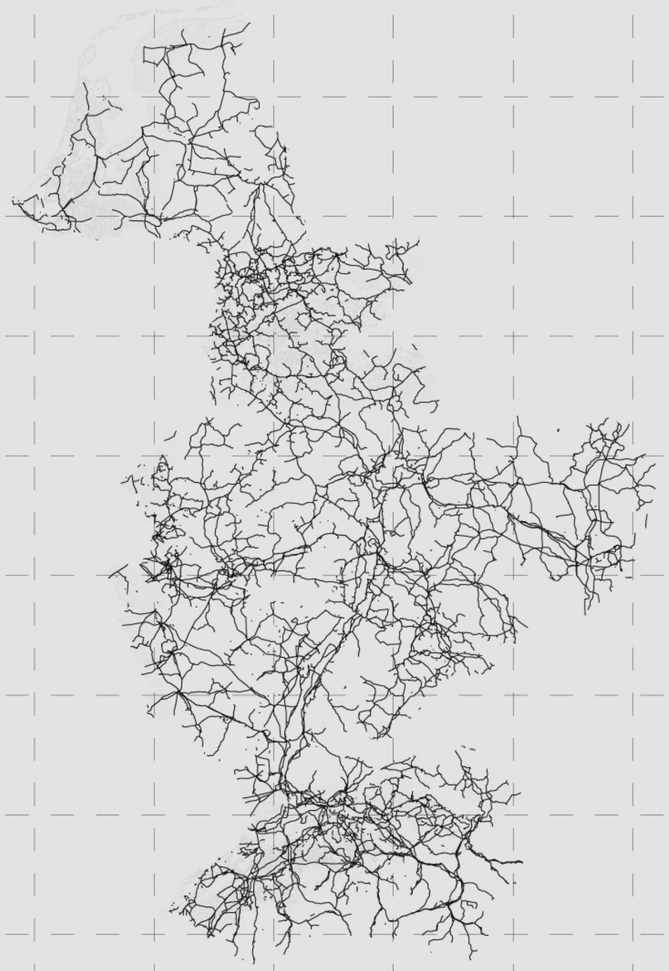


Source: IPCC, 2018


Extraction
Transportation
Uranium
Mining platform
Truck & train
Oil tanker
Refinery
Conversion
Storage
Distribution
Power plant
Railway, pipeline, road
Coal mining
Transformer
Storage
Nuclear
Transmission line
Power plant
Truck, train, bulk vessel
Transformer
Storage
Oil/Gas
Transmission line
Power plant
Transformer
Coal
Transmission line


High PM 2.5 concentration
Imports of oil tanker traffic
Gas pipelines
Oil pipelines
Rhine river and main estuaries
Non-renewables power plants and mining in gradient
Lignite
Coal
Gas
Oil
Nuclear

CONNECTIVITY OF THE ENERGY GRID

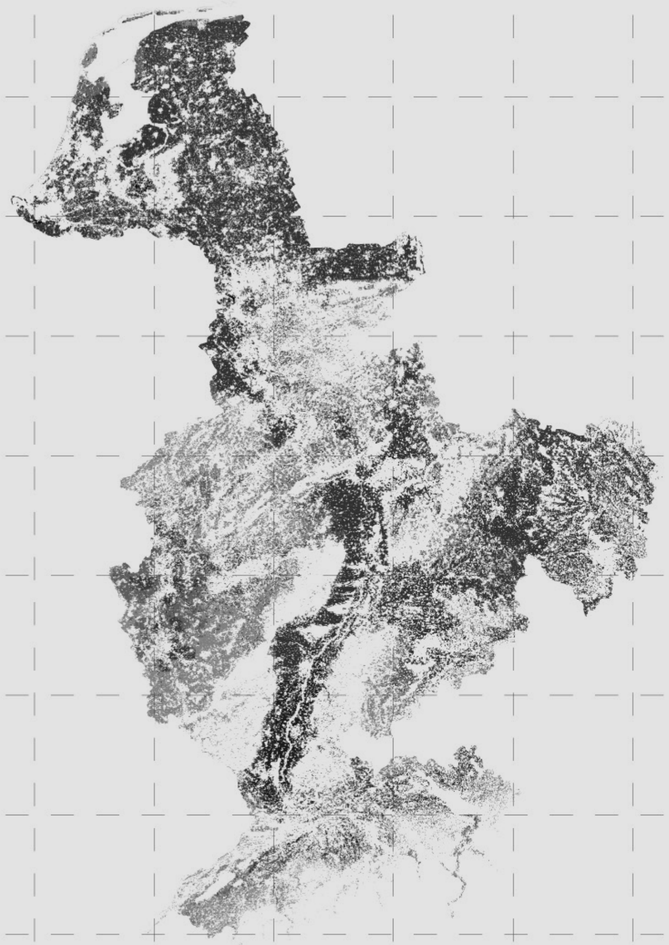


— High-voltage transmission lines grid

TAKEAWAYS

Tower and transmission line in Delft, NL
Source: Photo by author, 2022

EXTERNALITIES



TAKEAWAYS

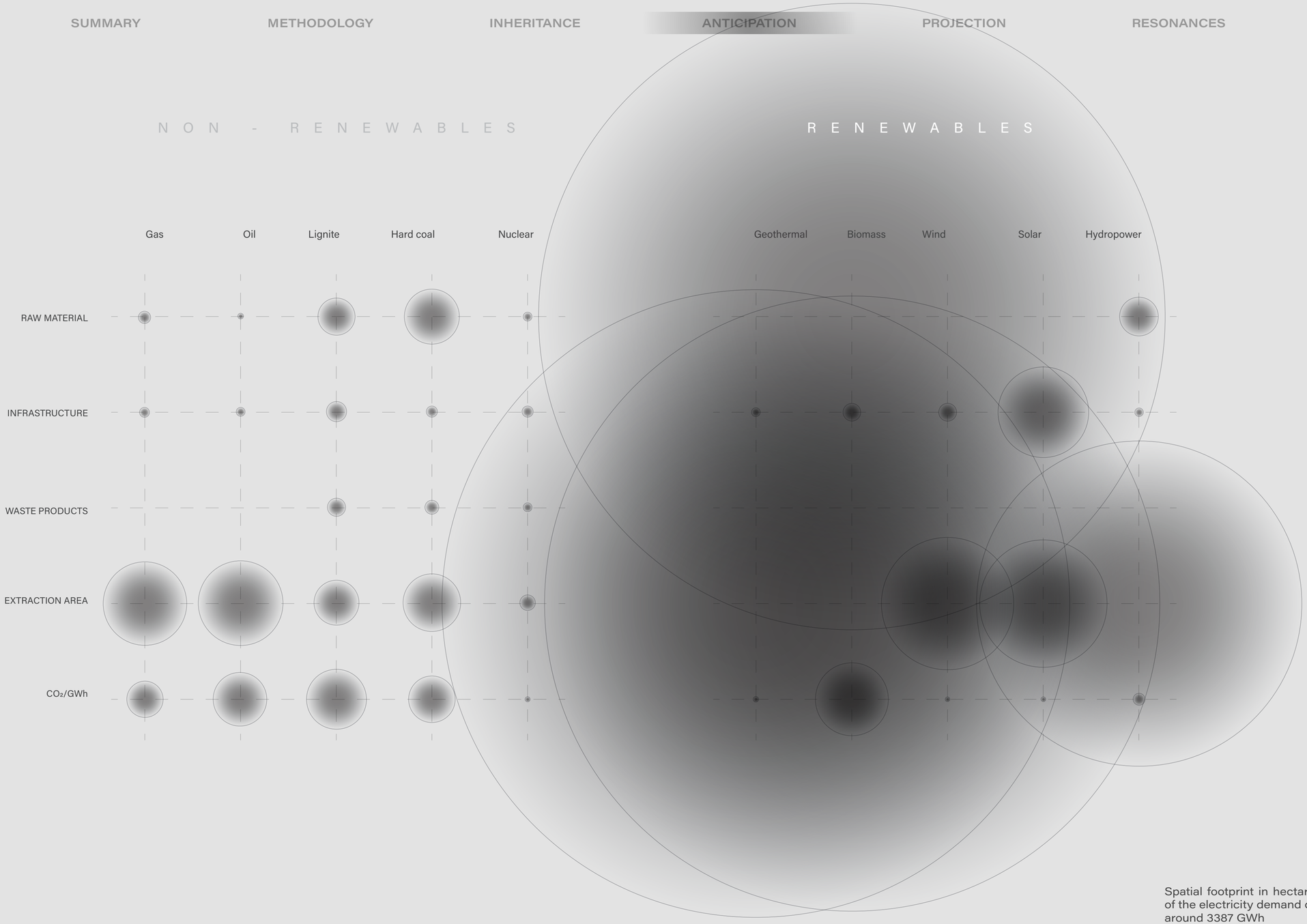
Harmful concentration of air pollution

Anticipation

ANTICIPATION

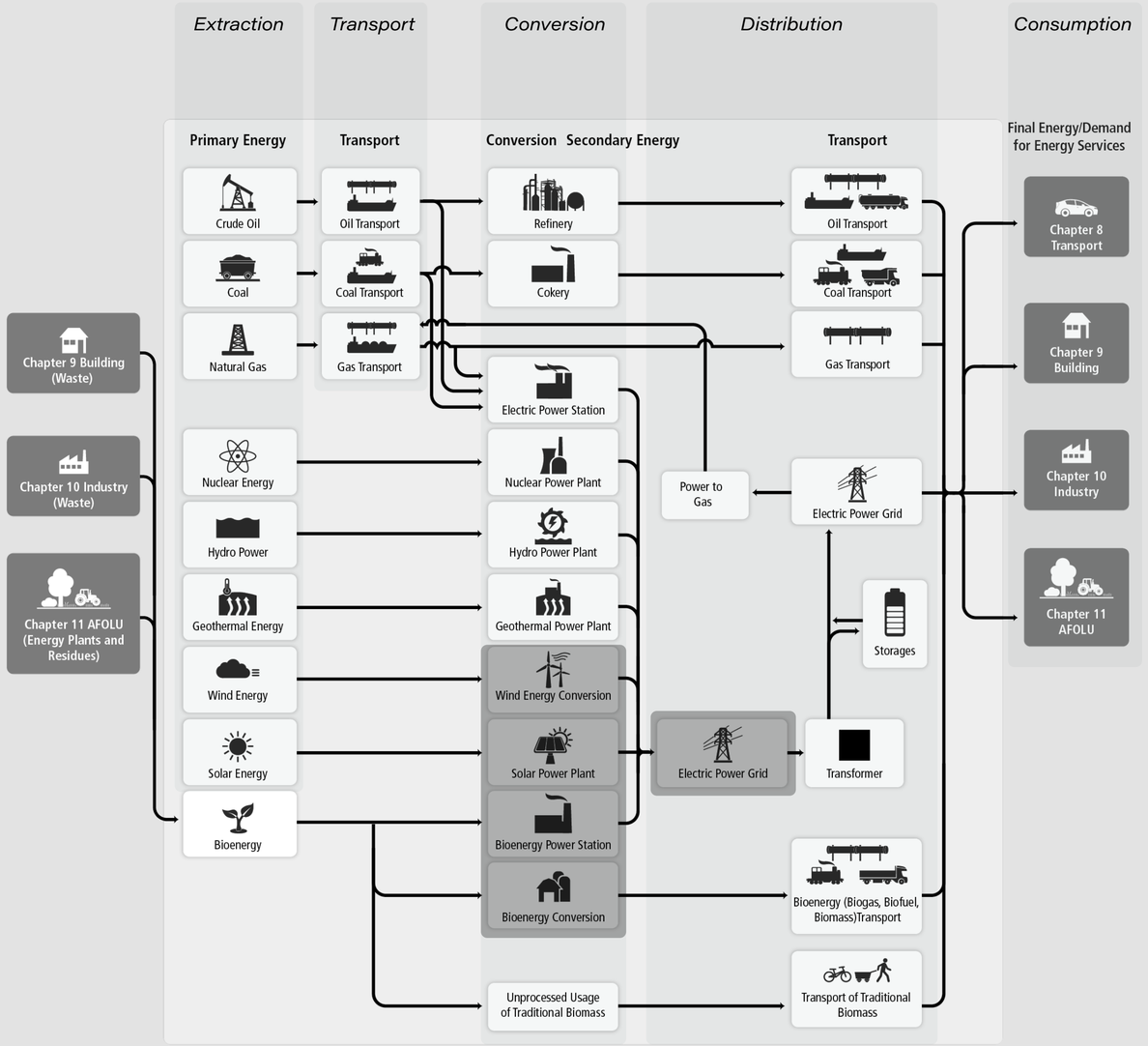
SPATIAL FOOTPRINT OF ENERGY

ENERGY AS A SPATIAL PROJECT



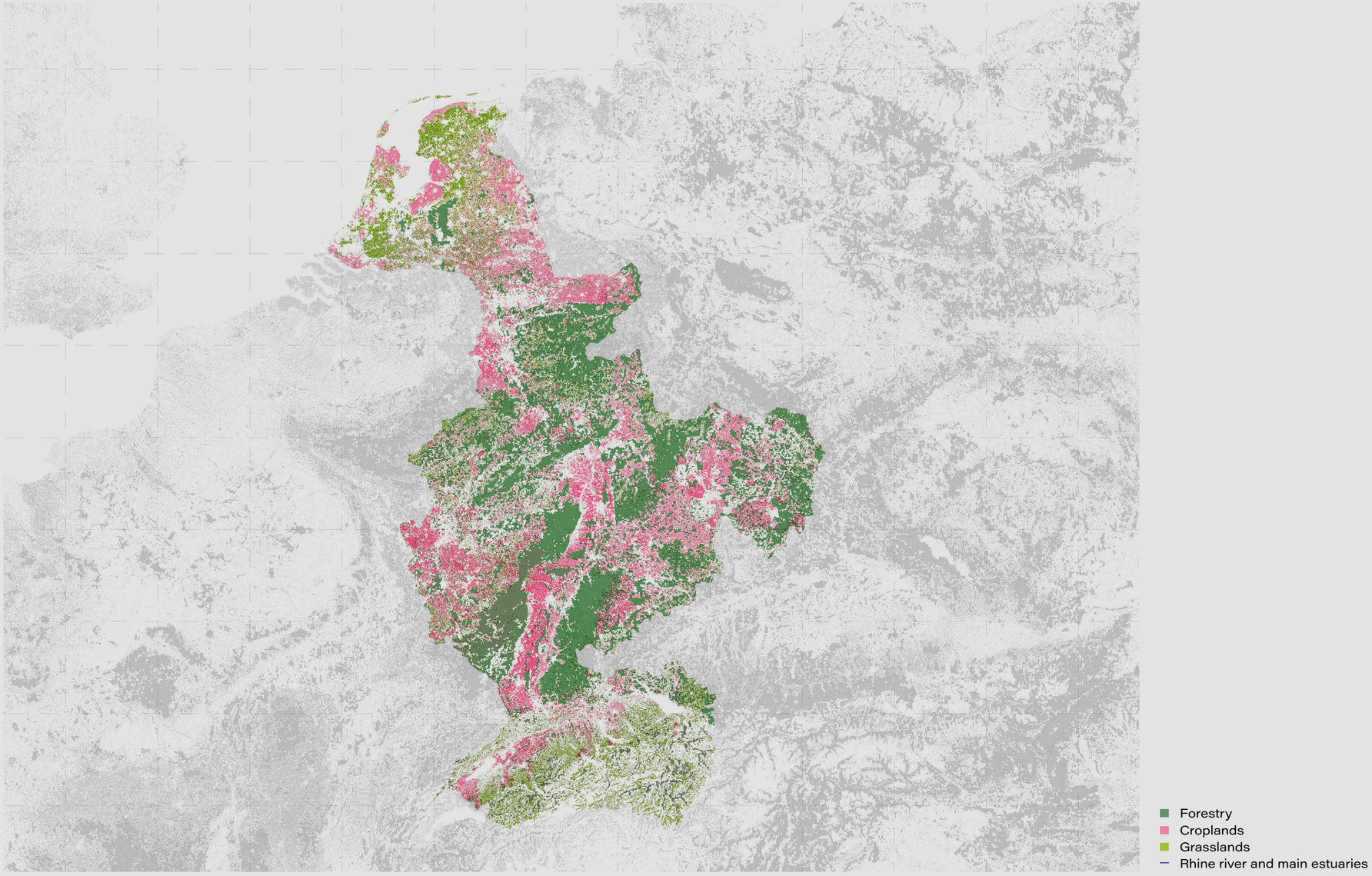
Spatial footprint in hectare for the equivalent of the electricity demand of 1 million homes, or around 3387 GWh
Source: Sijmons, 2014; EEA

RENEWABLE ENERGY LANDSCAPES

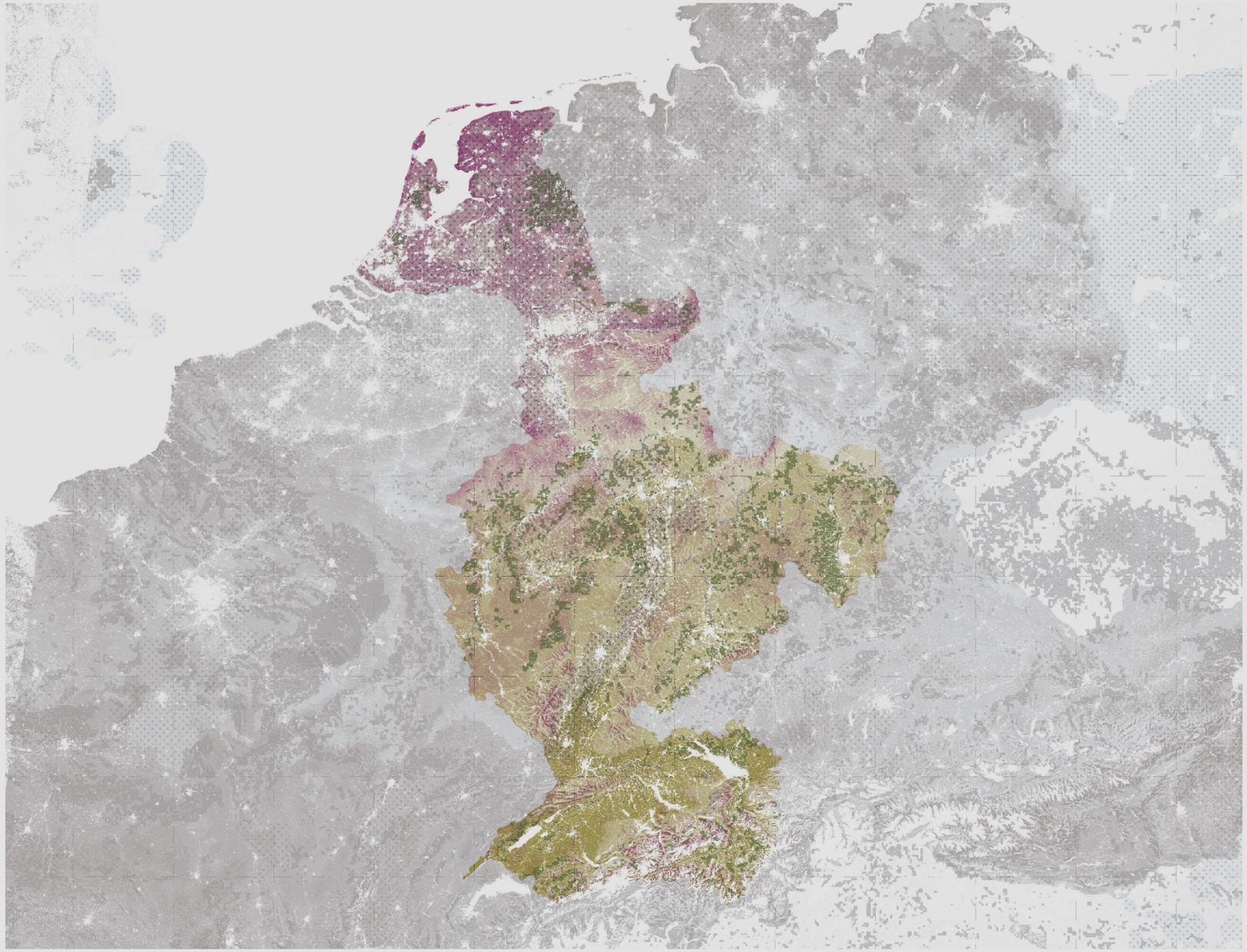


PROBLEM FOCUS

Source: IPCC, 2018


Forestry
Croplands
Grasslands
Rhine river and main estuaries

RENEWABLES POTENTIAL



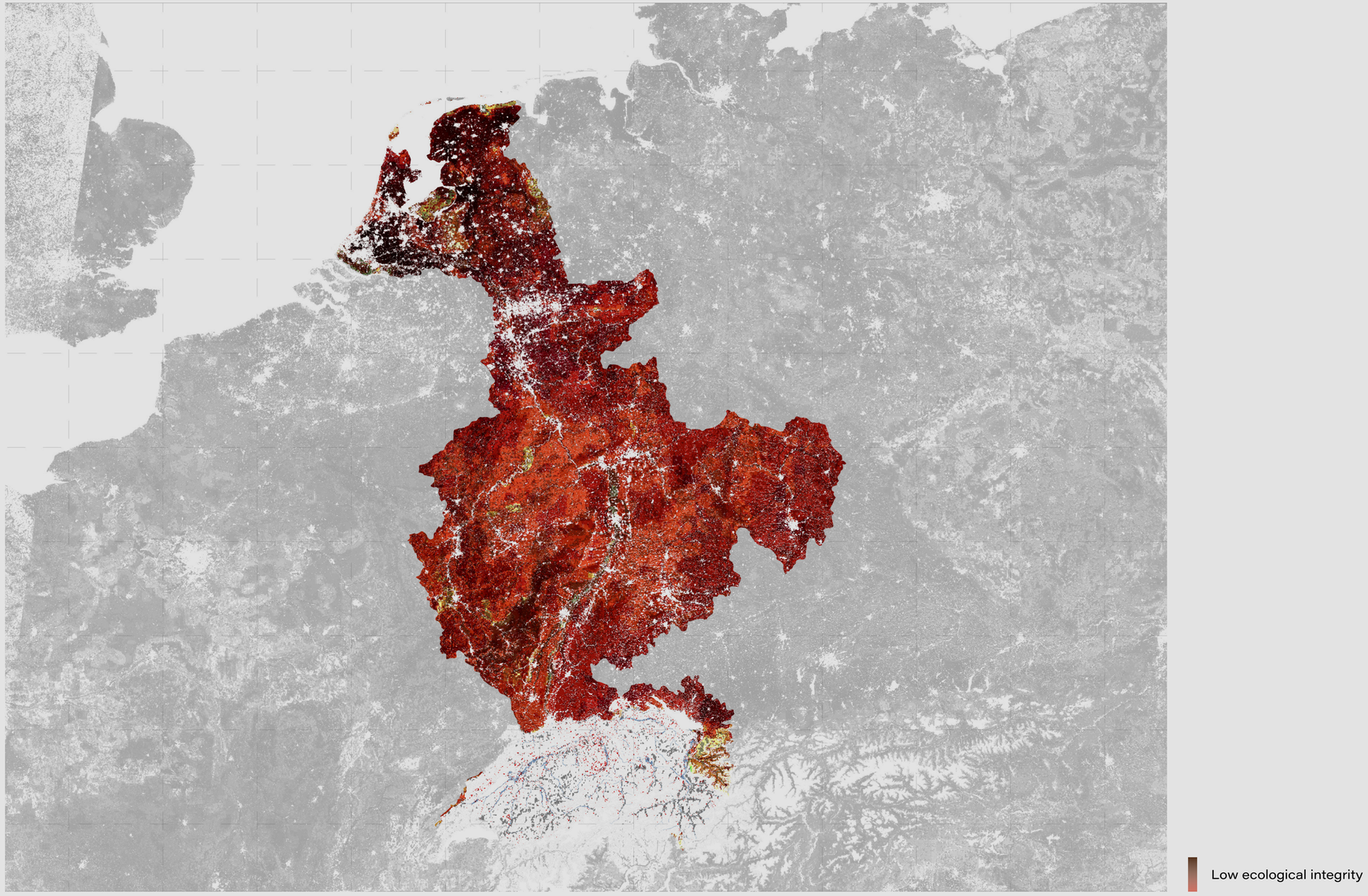
ANTICIPATION

“Yet energy is not only electricity and power for machines. [...] Energy undergirds the form that ecological relationships take, giving everything on Earth its particular contours. Energy moves and, as it does, all life exists in a perpetual state of transformation, taking on specific form in moments and then dissolving only to define a threshold - between species, systems, or spaces.” (Iturbe, 2021)

LOW ECOLOGICAL CONNECTIVITY

TAKEAWAY

LOW ECOLOGICAL INTEGRITY

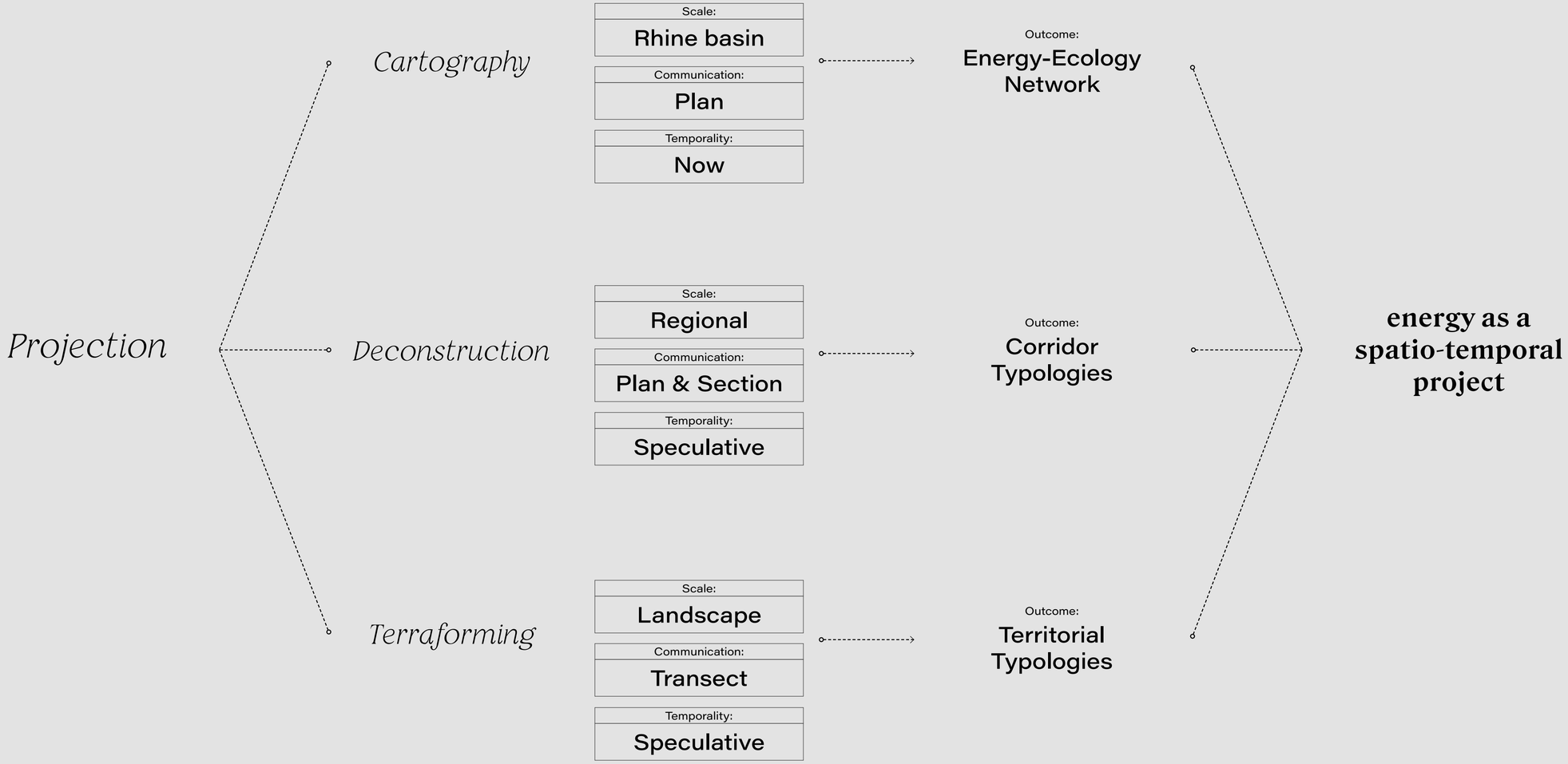


TAKEAWAY

Projection

PROJECTION

DESIGN WORKFLOW



DESIGN WORKFLOW

Cartography

CARTOGRAPHY

PROPOSED ECOLOGICAL CORRIDORS

CARTOGRAPHY

Energy-Ecology

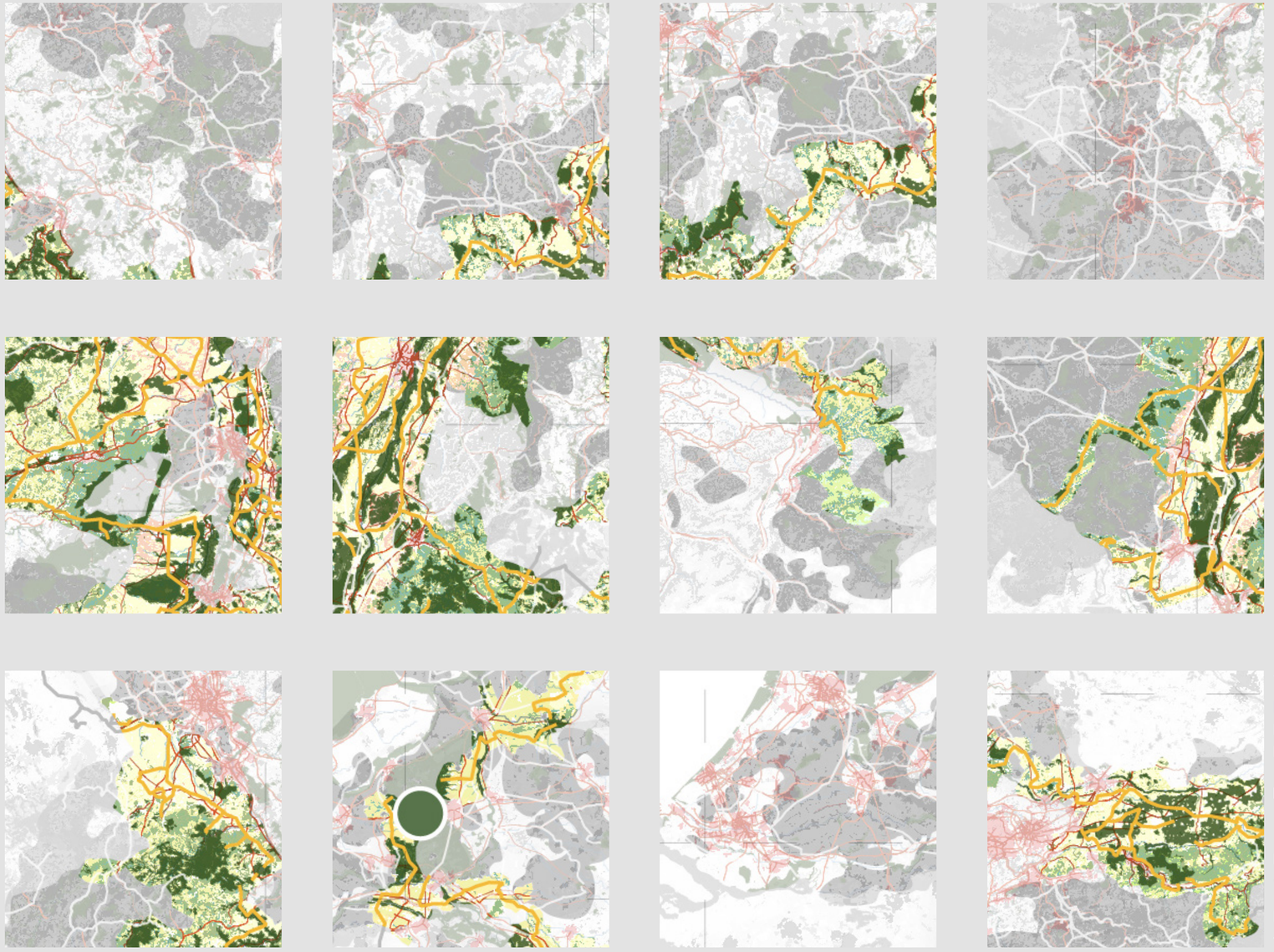
CARTOGRAPHY

ENERGY-ECOLOGY NETWORK

CARTOGRAPHY

ENERGY-ECOLOGY NETWORK

CARTOGRAPHY

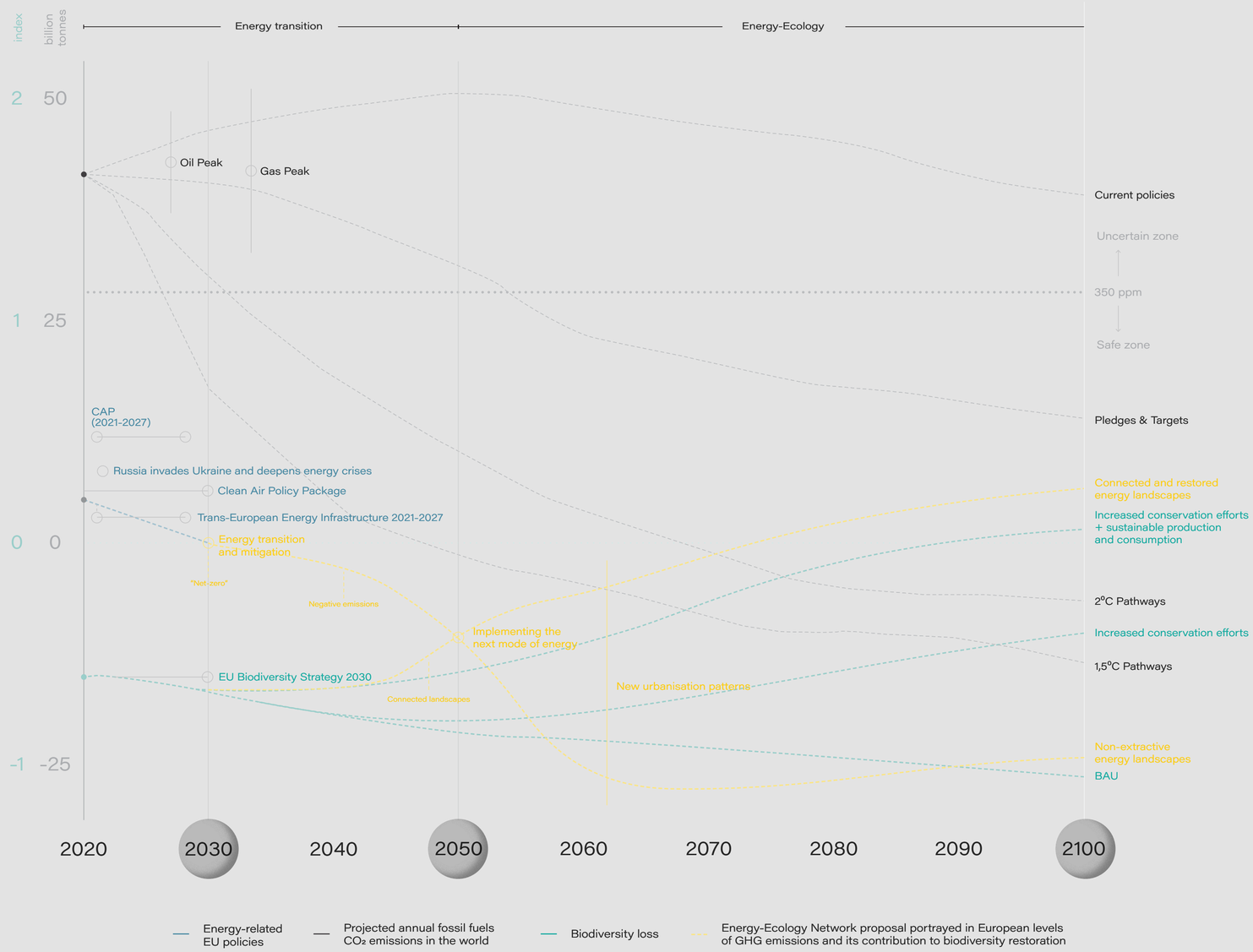


Deconstruction

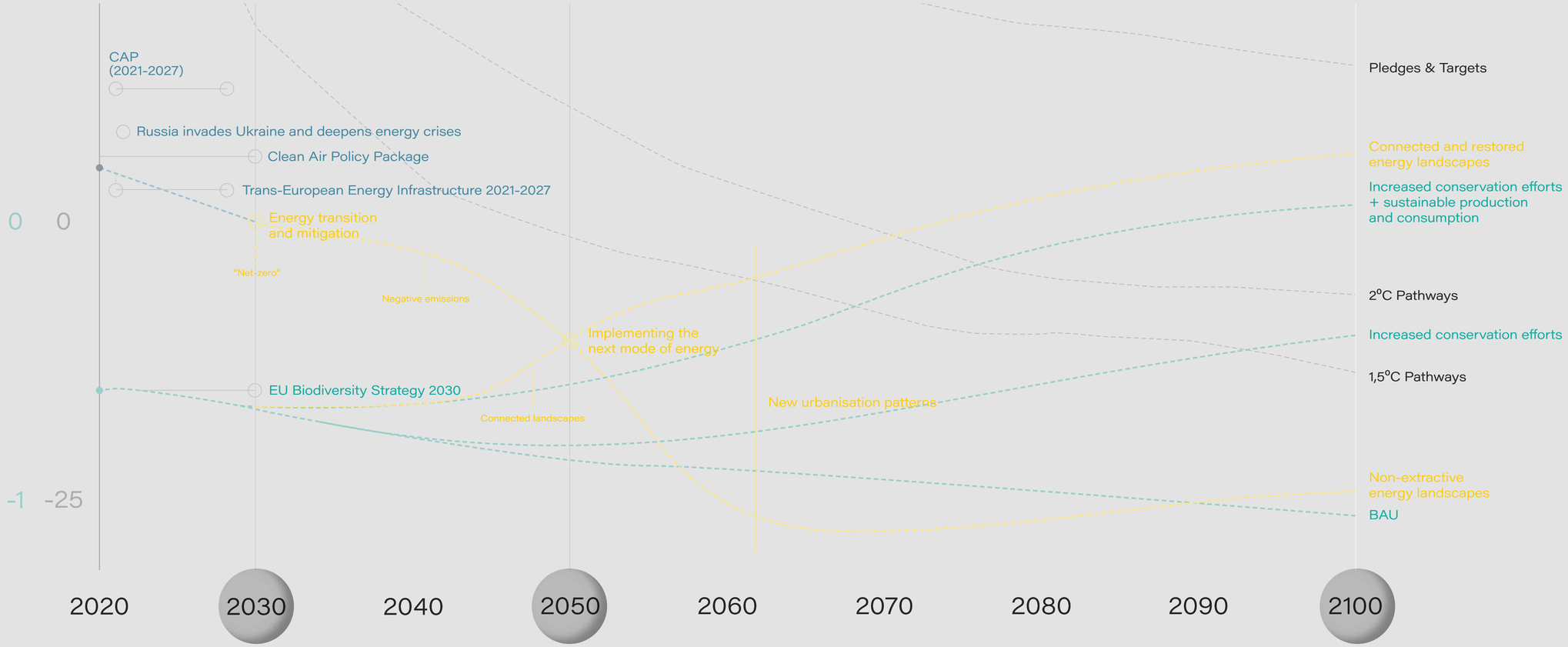
DECONSTRUCTION

FUTURE TEMPORALITY OF ENERGY

DECONSTRUCTION



FUTURE TEMPORALITY OF ENERGY



DECONSTRUCTION

Energy-related EU policies

Projected annual fossil fuels CO_2 emissions in the world

Biodiversity loss

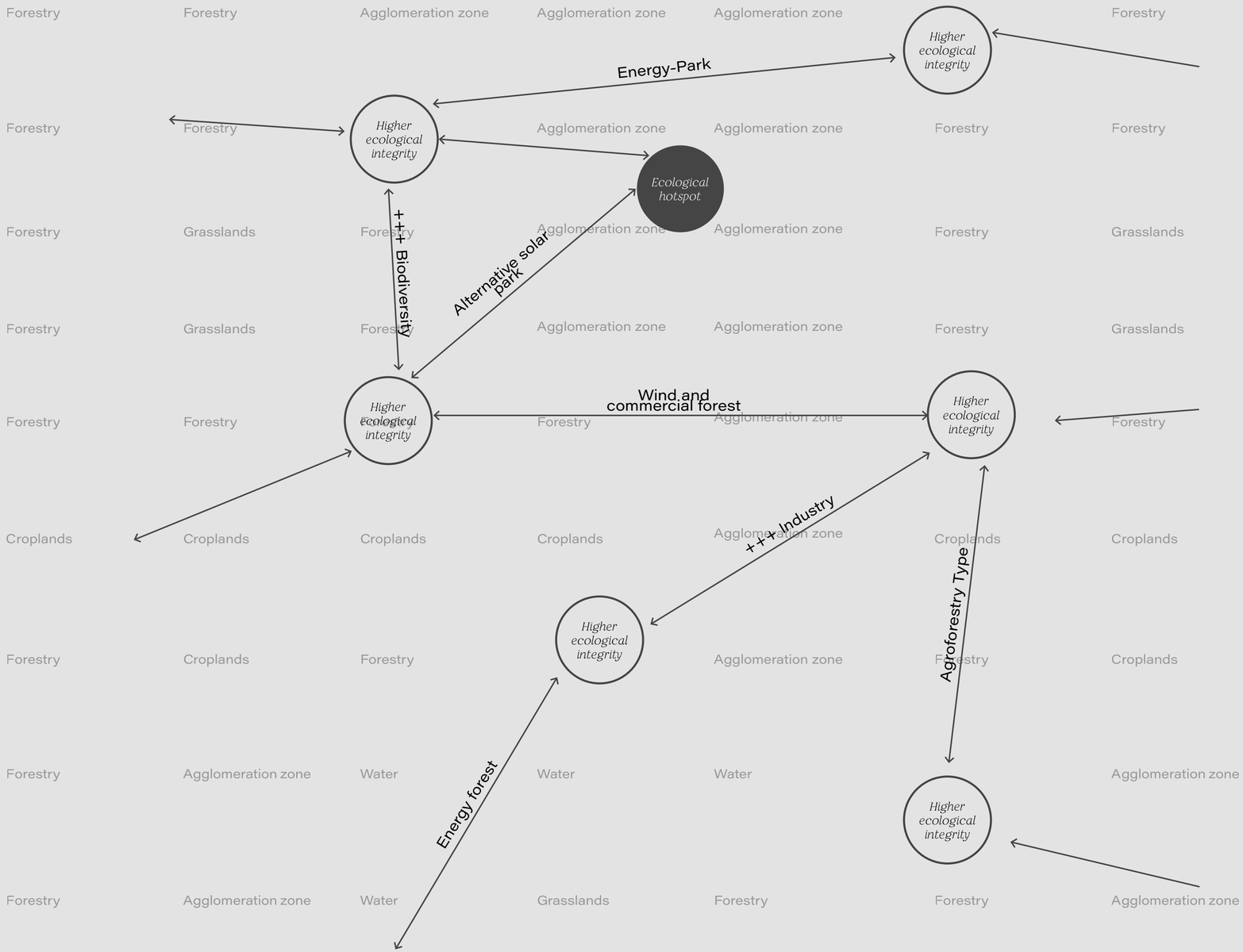
Energy-Ecology Network proposal portrayed in European levels of GHG emissions and its contribution to biodiversity restoration

Energy as coexistence

BALANCES OF COEXISTENCE

Balances of coexistence

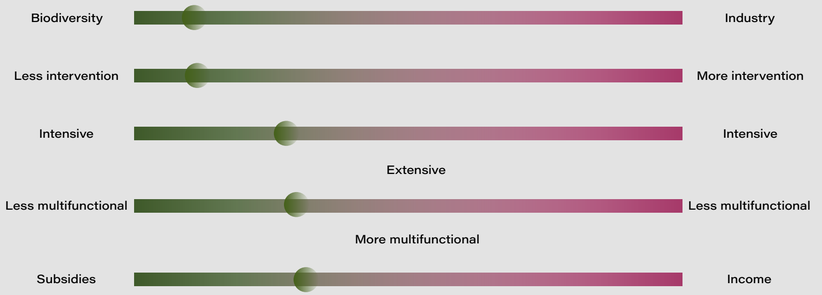
ENERGY AS COEXISTENCE


Higher ecological integrity
Energy-Park
Higher ecological integrity
Ecological hot.spot
+++ Biodiversity
Alternative solar park
Higher ecological integrity
Wind and commercial forest
Higher ecological integrity
+++ Industry
Agroforestry Type
Higher ecological integrity
Energy forest
Higher ecological integrity

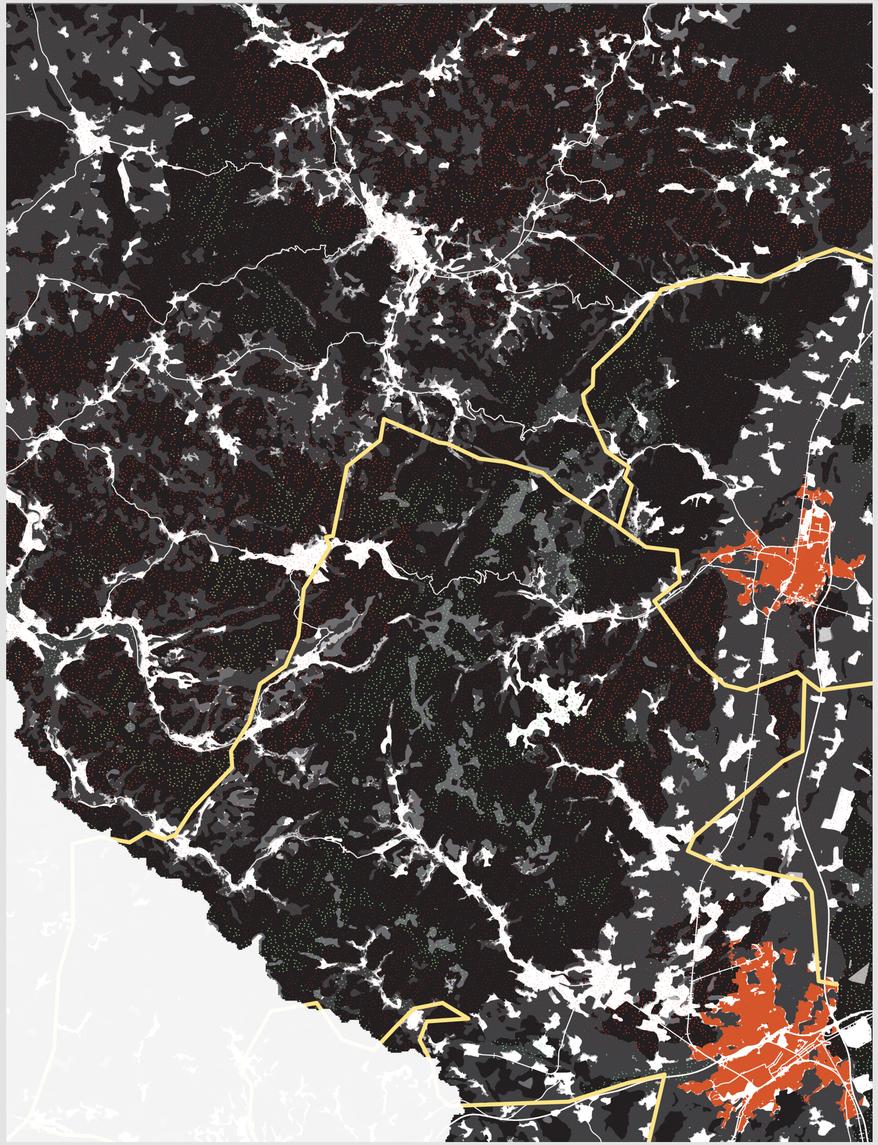
NOW

DECONSTRUCTION

+++ Biodiversity



Balances of coexistence

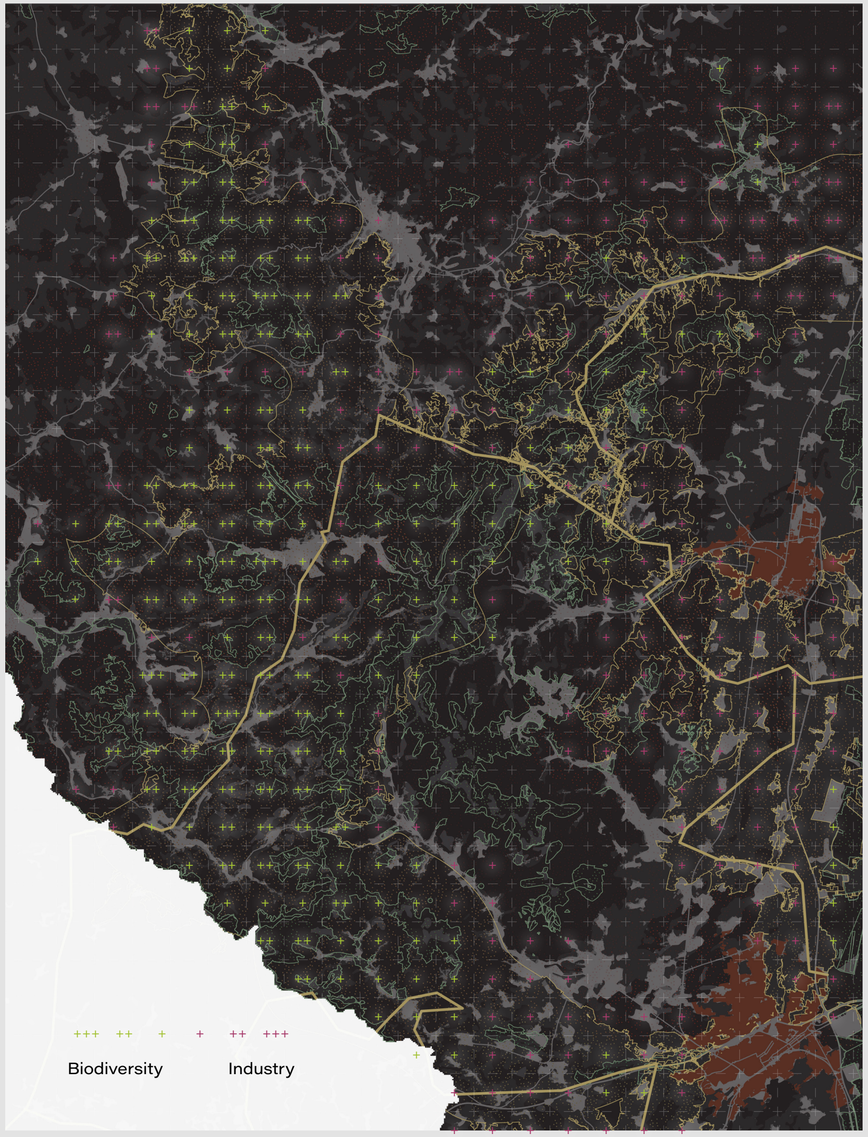


High-voltage transmission lines
Energy-ecology corridor (5km buffer zone)
Conservation areas (Natura2000)
Commercial forest
Agglomeration zones > 1M inhabitants
Agglomeration zones < 1M inhabitants
Highway and railway
Soil degradation and high GHG emissions
Forestry and woodlands
Grasslands, heathlands and shrublands
Croplands

2030

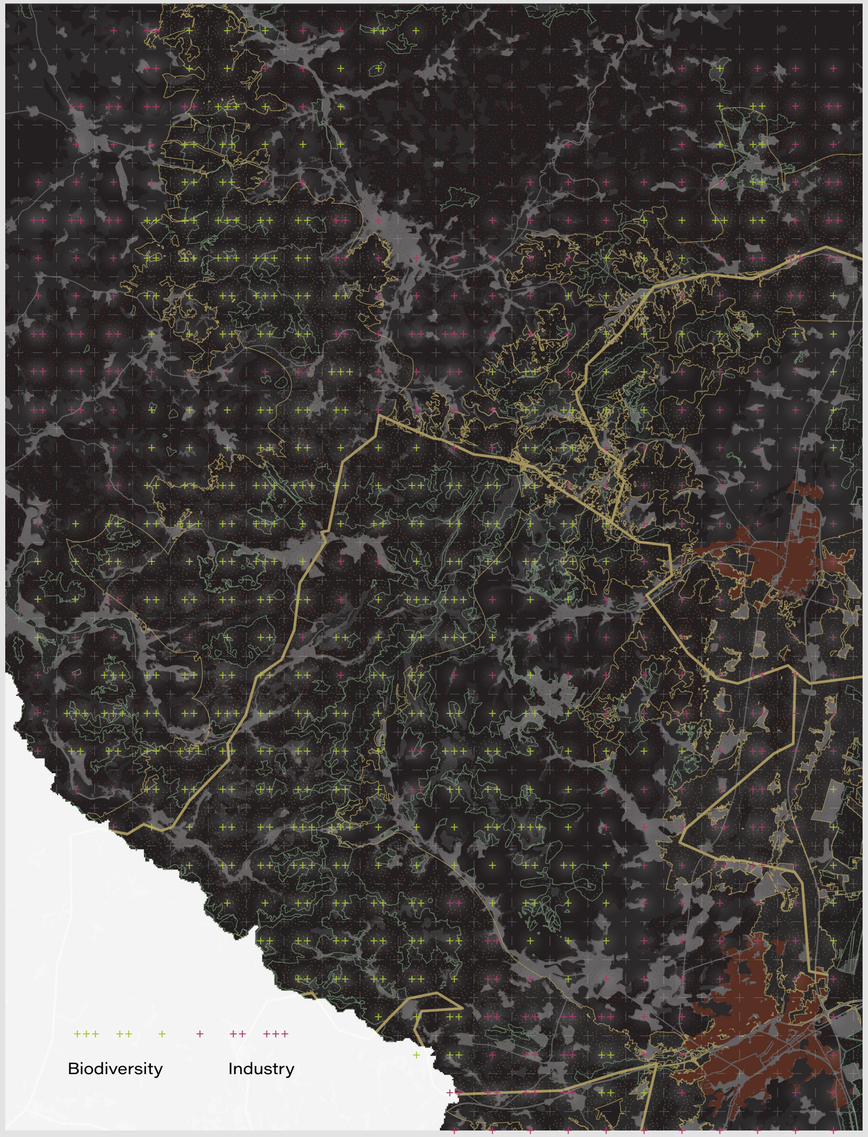
DECONSTRUCTION

Landscape (Land cover)	Elements (Land-use)	Energy-Ecology intervention	Category	Intensity	Action
Built-up	Inhabitation				
	Power plant		Production of electricity	+	From forestry residues
	Highway				
	Railway				
Forestry	Woodland	Renewable energy	Primary forestry residues	++	Available residues only from residue extraction but no stomp removal allowed
			Secondary forestry residues	++	
		Habitat for humans	Recreation	+	Allow for sustainable use of the areas
		Habitats for biodiversity	Effective ecological corridor	+++	Assign areas for low intervention and begin implementation
		CCS	Biological	+	Practises of restoration of soil health
					Low intervention of the forest
		Soil and nutrient protection	Restoration	+	Practises of restoration of soil health
		Foster local community	Eco-tourism	+	Assign areas
	Natura 2000	Renewable energy	Primary forestry residues	+	Available residues only from residue extraction but no stomp removal allowed
		Habitat for biodiversity	Conservation	++	Rewilding practices
	For production	Foster local community	Roundwood production	+	Reduce competing demand for non-energy purposes
		Renewable energy	Roundwood production	+	Increased woodland productivity by fertilization harvest mechanisation efficiency and increased mobilisation of wood from smallholders
					Biomass from stews
Ecotone	Meadows or forestry	Habitat for humans	Recreational park	+	
		Renewable energy	Primary residues	++	Available residues only from residue extraction but no stomp removal allowed
			Secondary residues	+	
			Solar park	+	Accessible PV structure
		CCS	CCS plant	+	
	Croplands	Food production	Agrivoltaics or other combinations	+	Food and other biomass production



2050

Landscape (Land cover)	Elements (Land-use)	Energy-ecology intervention	Category	Intensity	Action
Built-up	Inhabitation				
	Power plant		Production of electricity	++	From forestry residues
	Highway				Minimun 2km wide brige for fauna&flora habitats
	Railway				
Forestry	Woodland	Renewable energy	Primary forestry residues	++	Available residues only from residue extraction, stomp removal allowed
			Secondary forestry residues	++	
		Habitat for humans	Recreation	+	Allow for sustainable use of the areas
		CCS	Biological	+++	Practises of restoration of soil health
					Low intervention of the forest
		Soil and nutrient protection	Restoration	++	Practises of restoration of soil health
		Foster local community	Eco-tourism	+	Assign areas
		Food production	Agroforestry	+	Food and other biomass production
	Natura 2000	Renewable energy	Primary forestry residues	+	Available residues only from residue extraction but no stomp removal allowed
		Habitat for biodiversity	Conservation	+++	Rewilding practises
	For production	Renewable energy	Primary forestry residues	+++	Increase in contribution from small holders
			Secondary forestry residues	+++	Reduce competing demand for non-energy purposes
		Foster local community	Roundwood production	+	Important areas become conserved and subsidies to holders for maintenance following rewilding principles
					Biomass from stews
		Food production	Agroforestry	+	Food and other biomass production
	Ecological corridor	Habitats for biodiversity	Rewilding	+++	Expansion and establishment of conservation corridors between fragmented patches
Ecotone	Meadows or forestry	Habitat for humans	Recreational park	+	
		Renewable energy	Primary residues	++	Available residues only from residue extraction but no stomp removal allowed
			Secondary residues	++	
			Solar park	+++	Accessible PV structure
		CCS	CCS plant	++	
		Food production	Agroforestry	+	Food and other biomass production
		Habitats for biodiversity	Rewilding	+	Conservation patches to connect areas

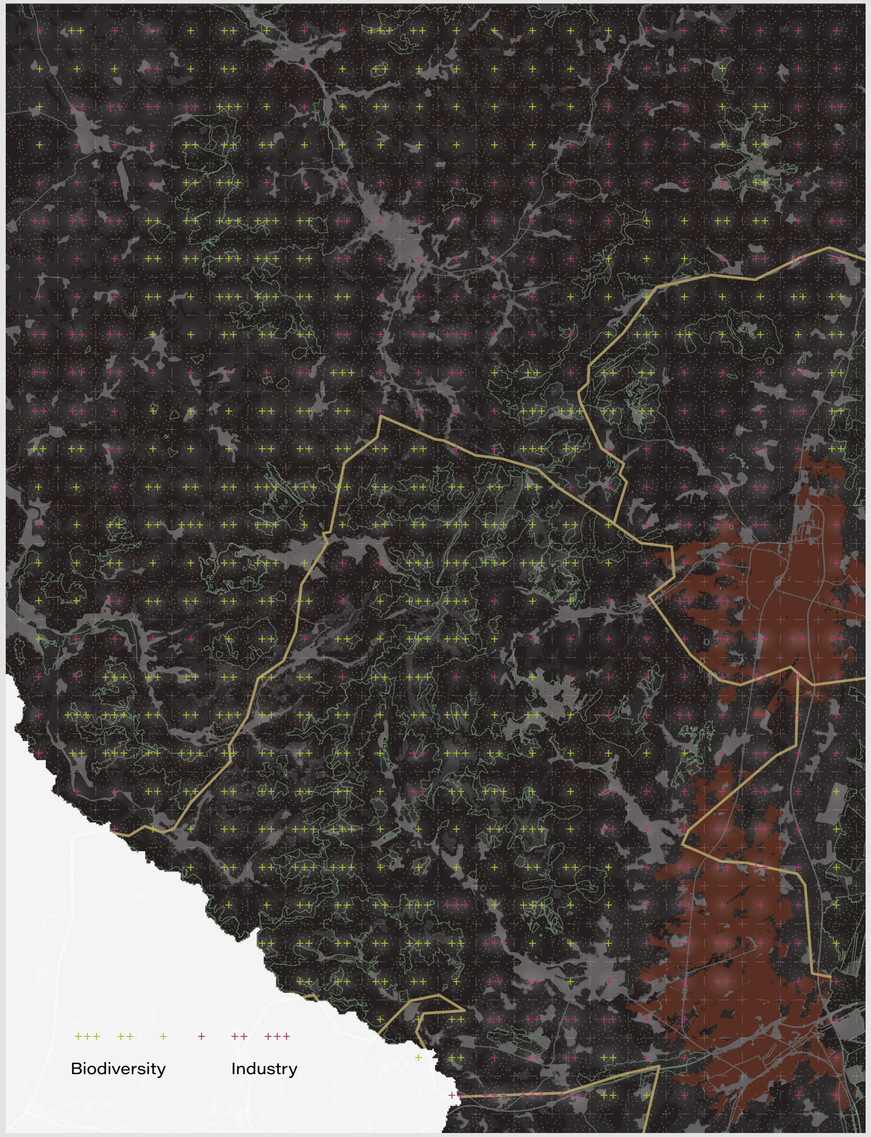


DECONSTRUCTION

2100

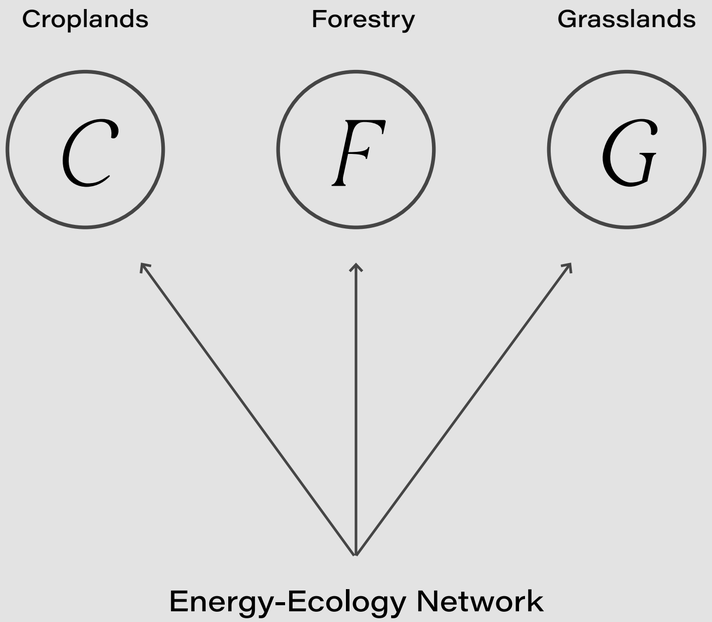
DECONSTRUCTION

Landscape (Land cover)	Elements (Land-use)	Energy-ecology intervention	Category	Intensity	Action
Built-up	Inhabitation				
	Power plant		Production of electricity	++	From forestry residues
	Highway				Minimum 2km wide brige for fauna&flora habitats
	Railway				
Forestry	Woodland	Energy production	Primary forestry residues	++	Available residues only from residue extraction, stomp removal not allowed
			Secondary forestry residues	++	
			Non-extractive	++	Scaling-up, assign areas
		Habitat for humans	Recreation	+	Allow for sustainable use of the areas
		CCS	Biological	++	Practices of restoration of soil health
					Low intervention of the forest
		Soil and nutrient protection	Restoration	++	Practices of restoration of soil health
		Foster local community	Eco-tourism	++	Assign areas
	Natura 2000	Habitat for biodiversity	Conservation	+++	Rewilding practices
	For production	Energy production	Primary forestry residues	++	Increase in contribution from small holders
			Secondary forestry residues		Reduce competing demand for non-energy purposes
		Foster local community	Roundwood production	++	Important areas become conserved and subsidies to holders for maintenance following rewilding principles
					Biomass from stews
		Food production	Agroforestry	++	Food and other biomass production
	Ecological corridor	Habitats for biodiversity	Rewilding	+++	Expansion and establishment of effective conservation corridors between fragmented patches
Ecotone	Meadows or forestry	Habitat for humans	Recreational park	++	
		Renewable energy	Primary residues	+	Available residues only from residue extraction but no stomp removal allowed
			Secondary residues	+	
		CCS	CCS plant	+	
		Food production	Agroforestry	+	Food and other biomass production



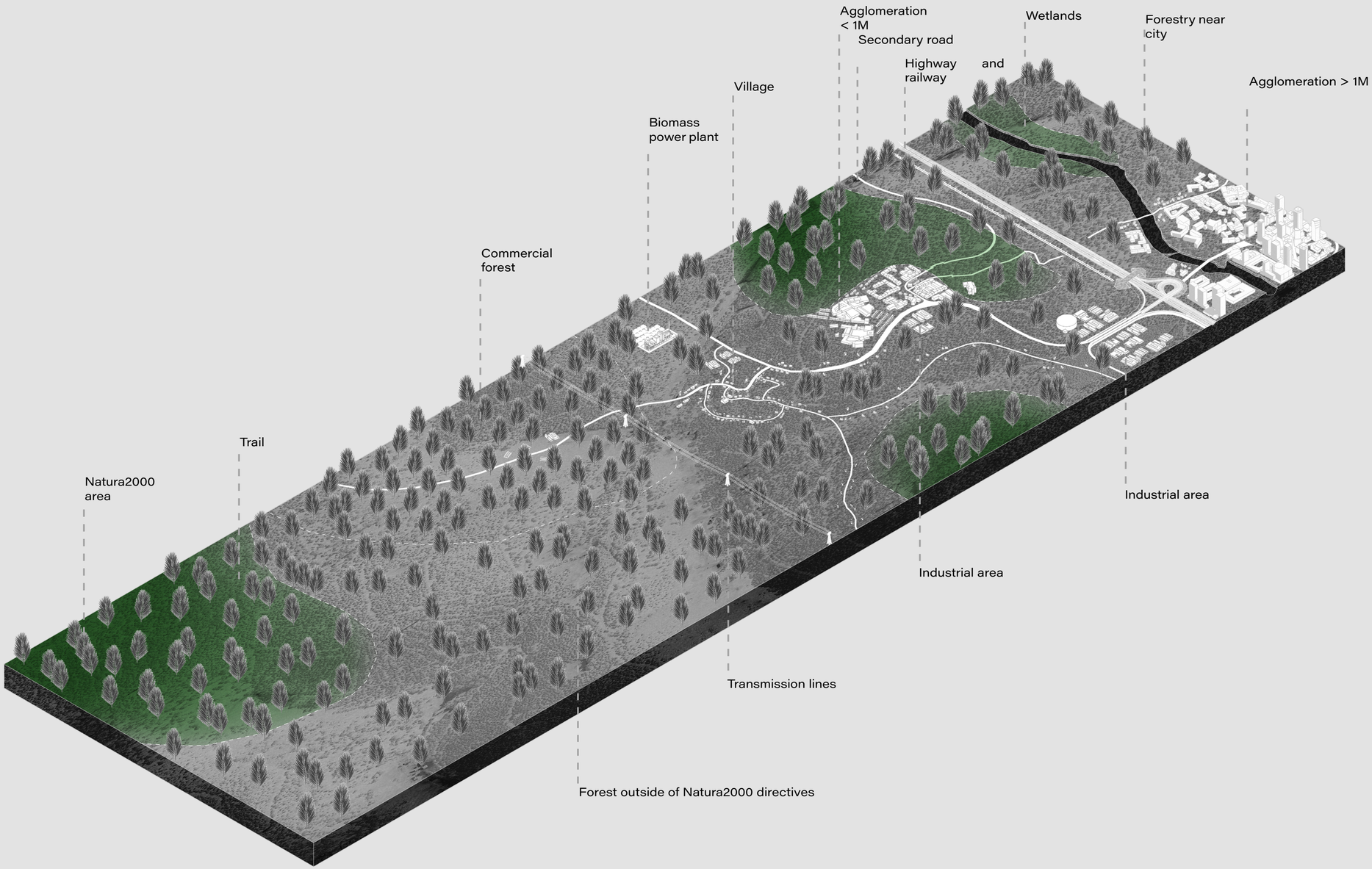
Terraforming

PROJECTION


Croplands
Forestry
Grasslands
C
F
G
Energy-Ecology Network

FORESTRY AND WOODLAND

TERRAFORMING



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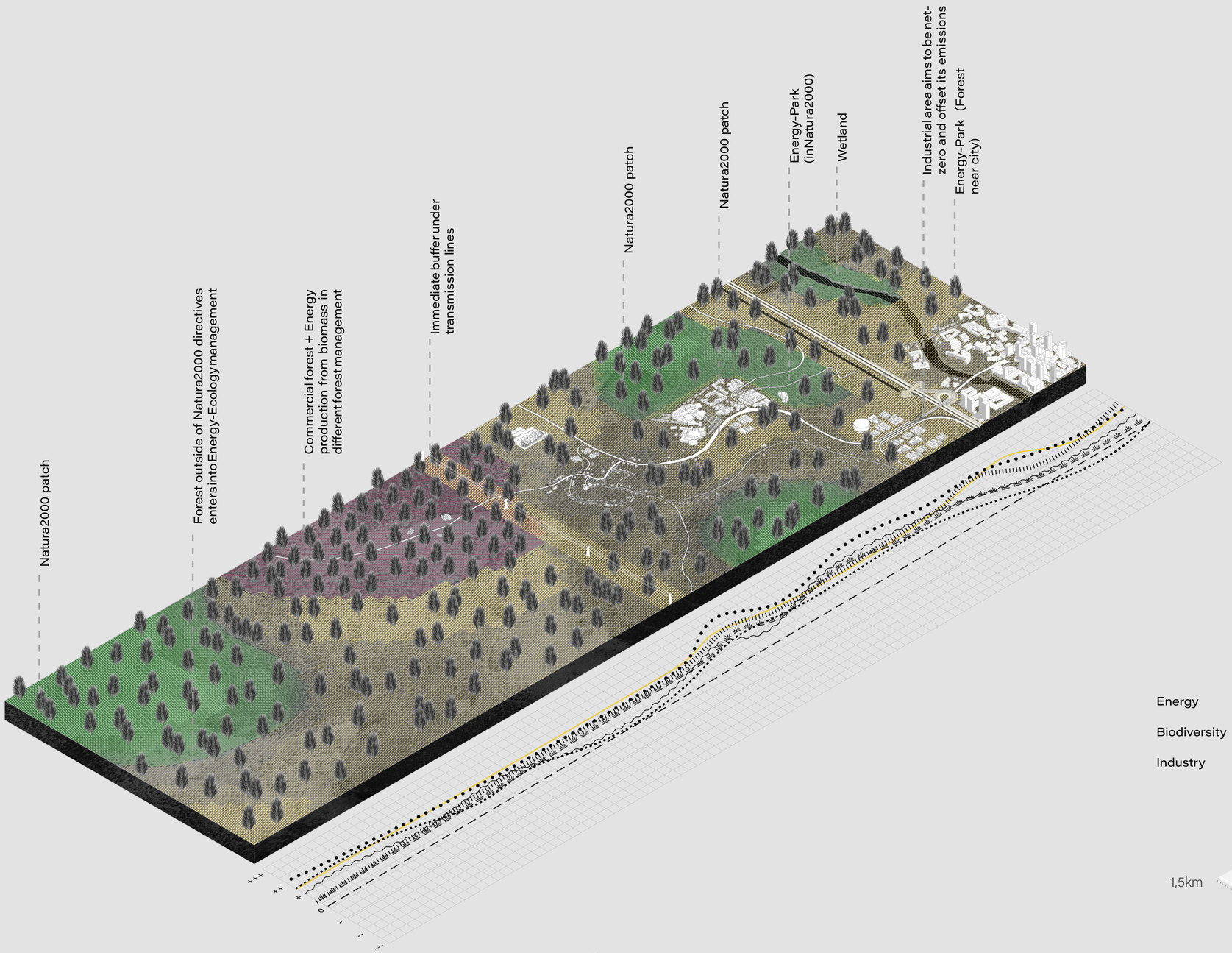
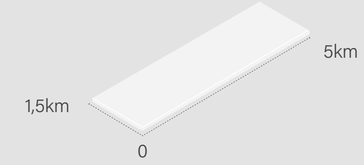
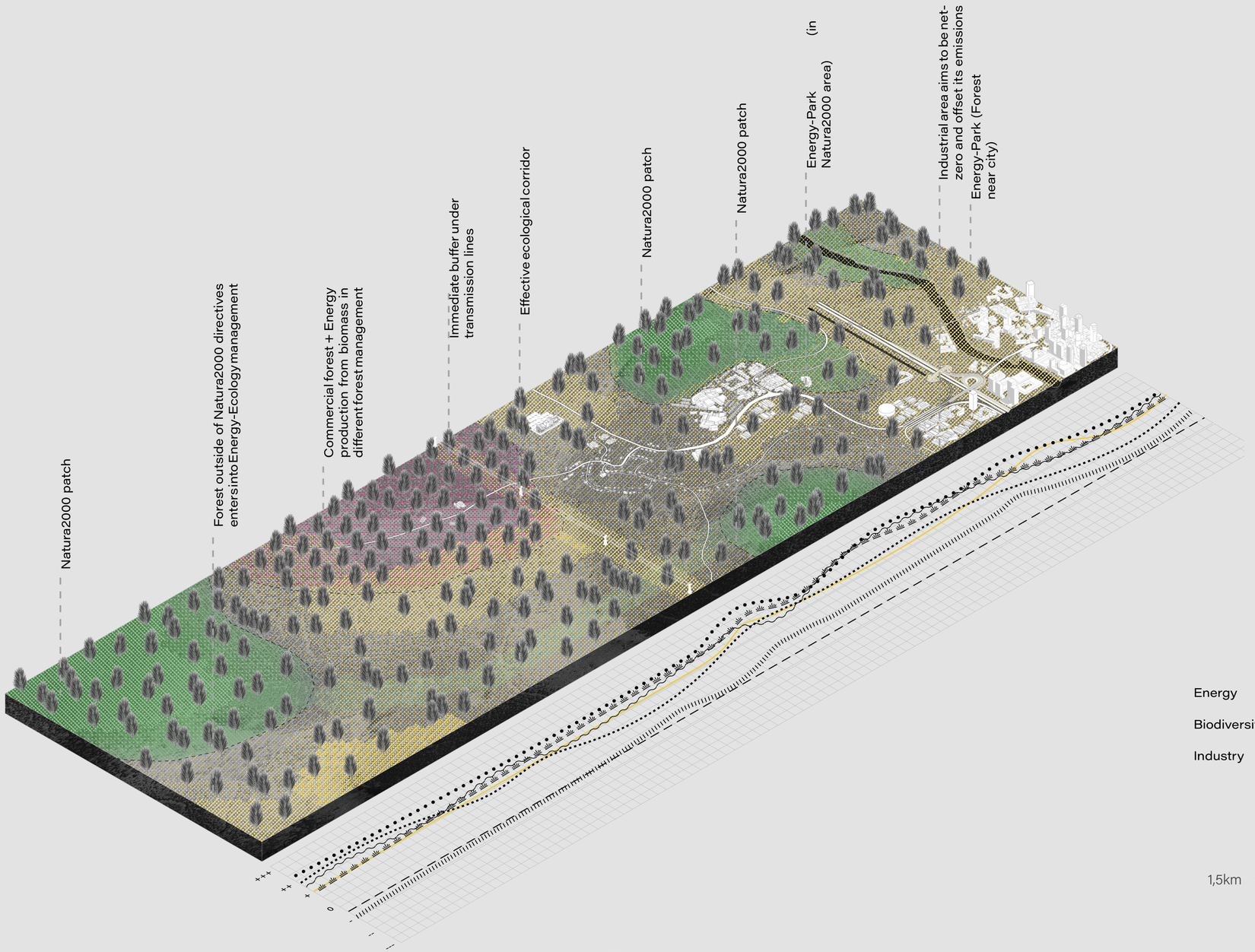
TERRAFORMING

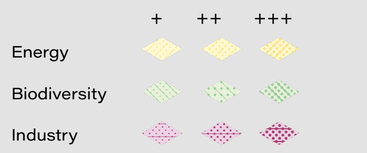


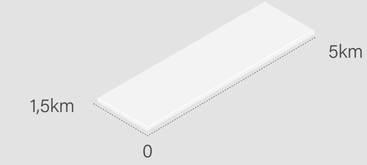


2050

TERRAFORMING

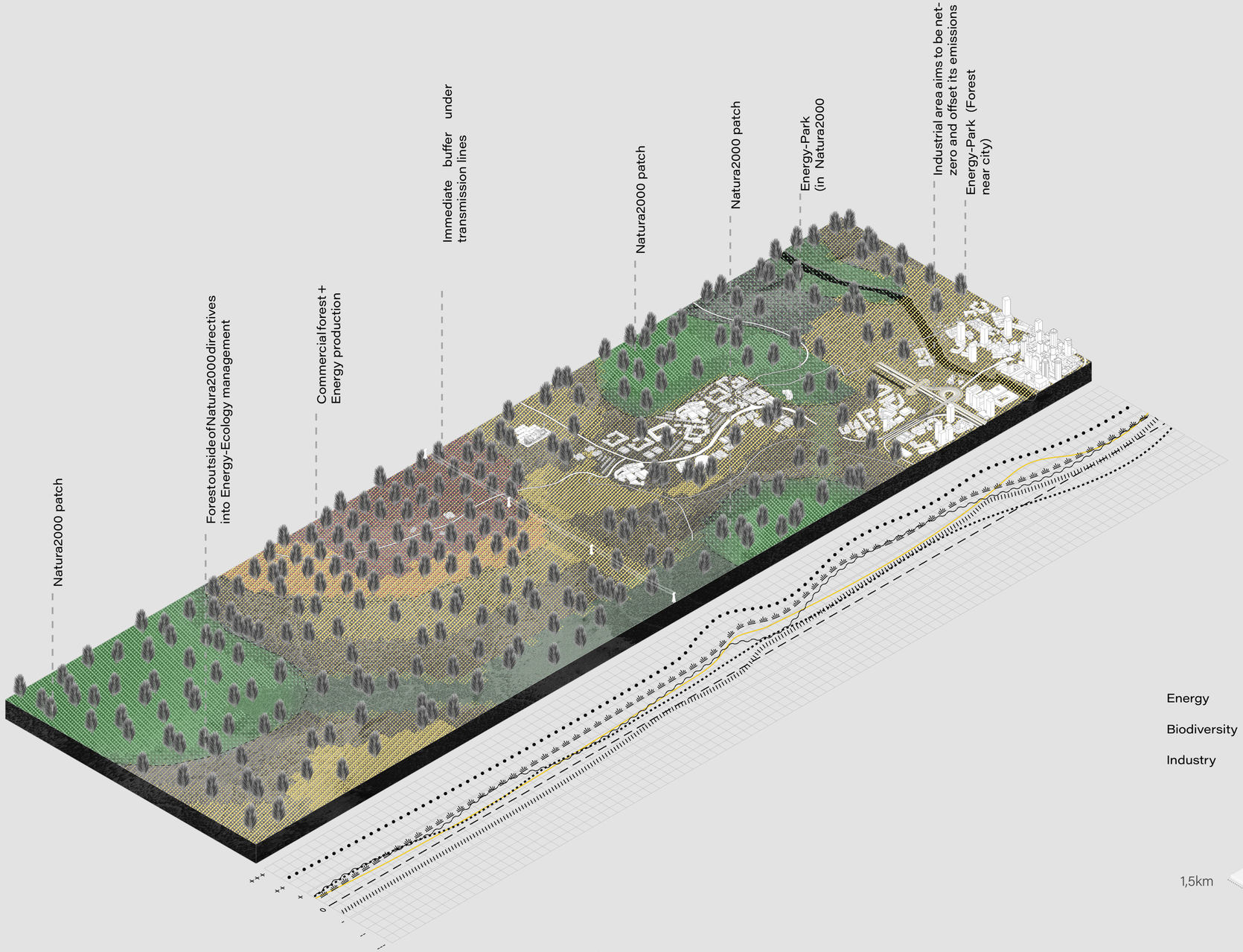






2100

TERRAFORMING



2030 - 2050 - 2100

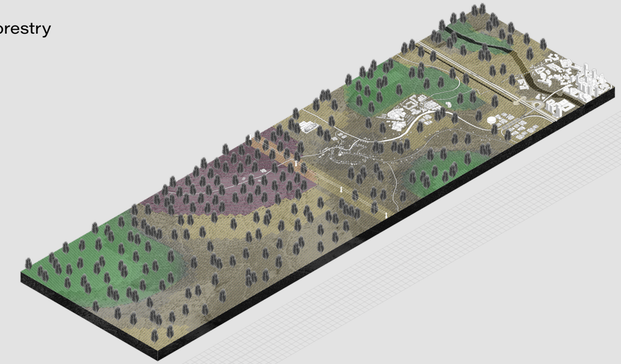
TERRAFORMING

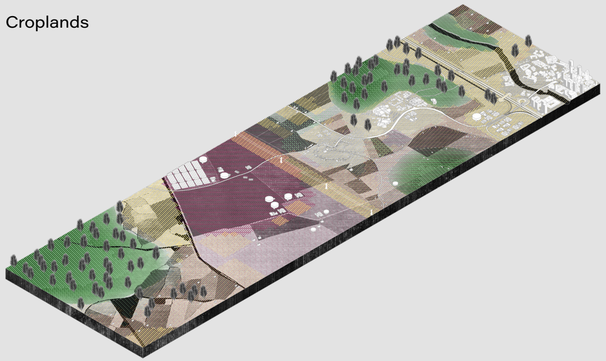
Forestry

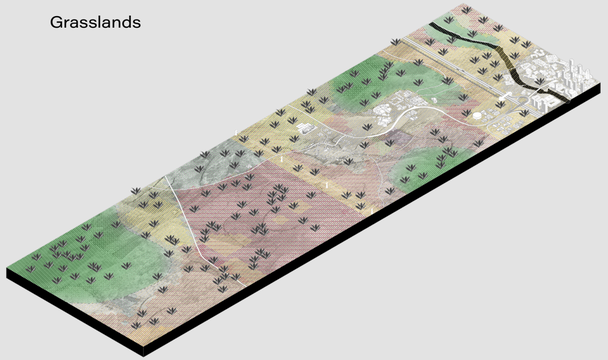
Croplands

Grasslands

2030







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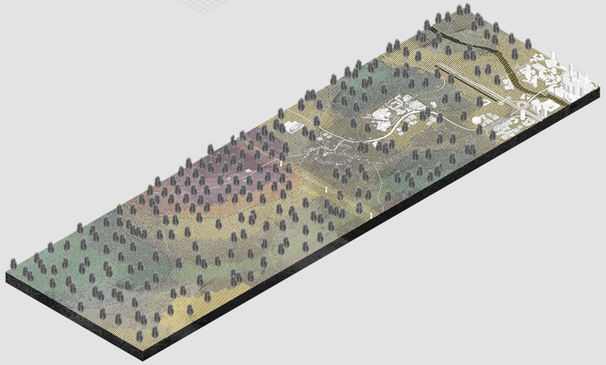

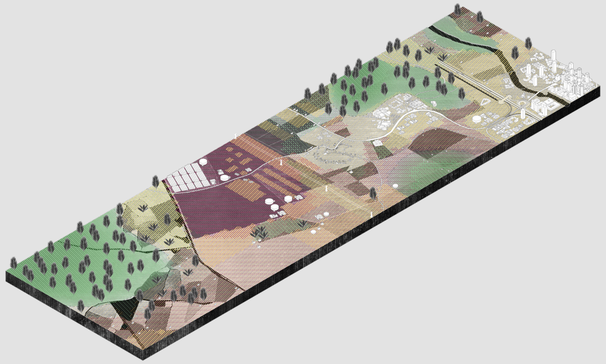

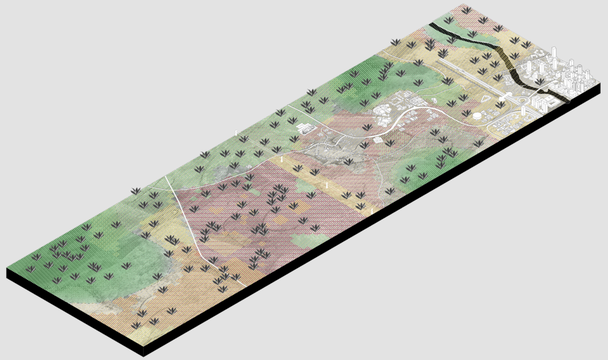

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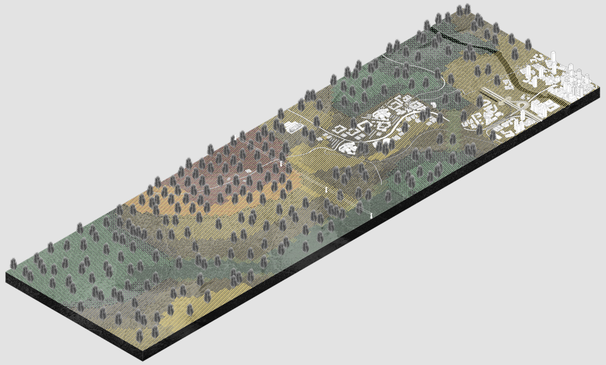
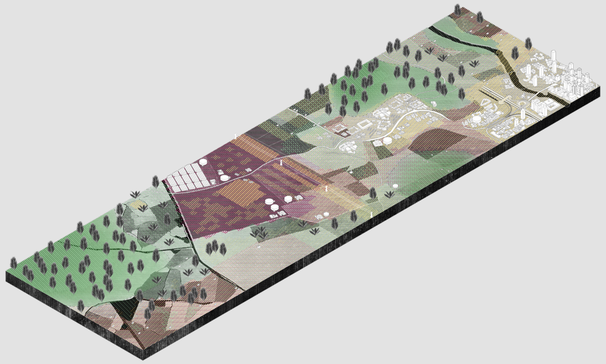
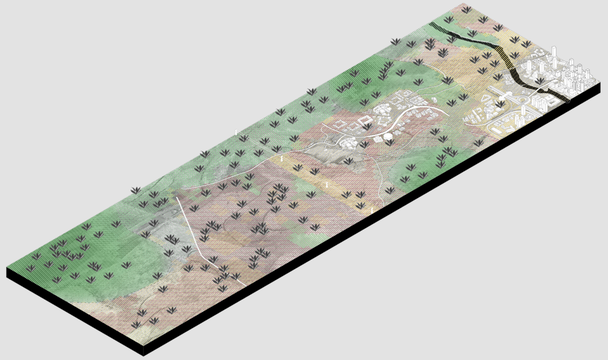
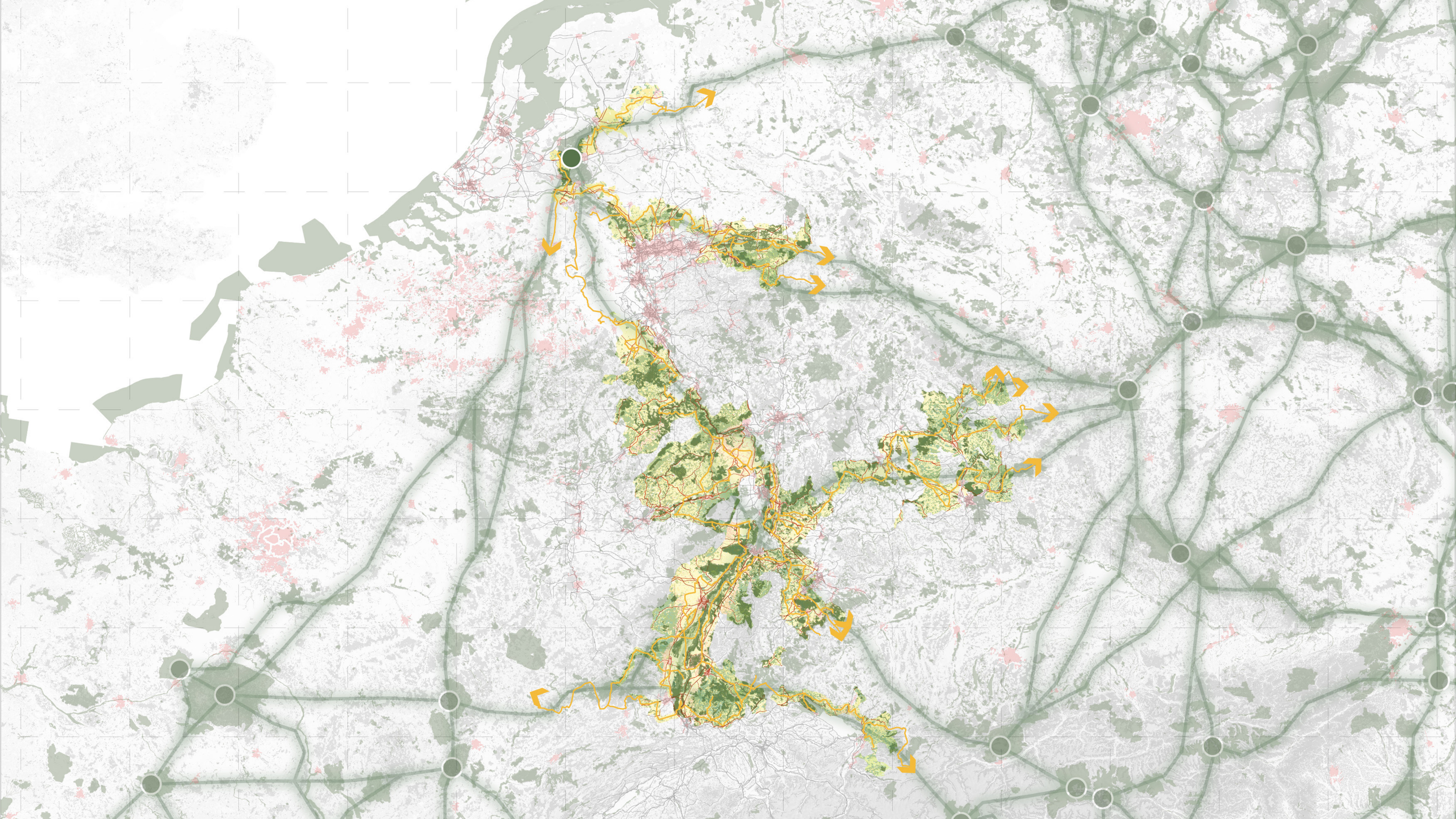






Resonances

RESONANCES



ENERGY-ECOLOGY NETWORK

temporalities of energy landscapes in the Rhine basin

energy as a spatio-temporal project

hugo lopez
transitional territories studio

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p5 presentation