NEW ENERGY LANDSCAPES

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LITHUANIA'S POST-BRELL ENERGY LANDSCAPES:

OR HOW ENERGY INFRASTRUCTURE NETWORKS ARE INTERTWINED WITH THE KNITTED SOCKS

BY SIARHEI LIUBIMAU, JUSTINAS DŪDĖNAS, ŽIVILĖ MANTRIMAITĖ & MARTYNAS GERMANAVIČIUS

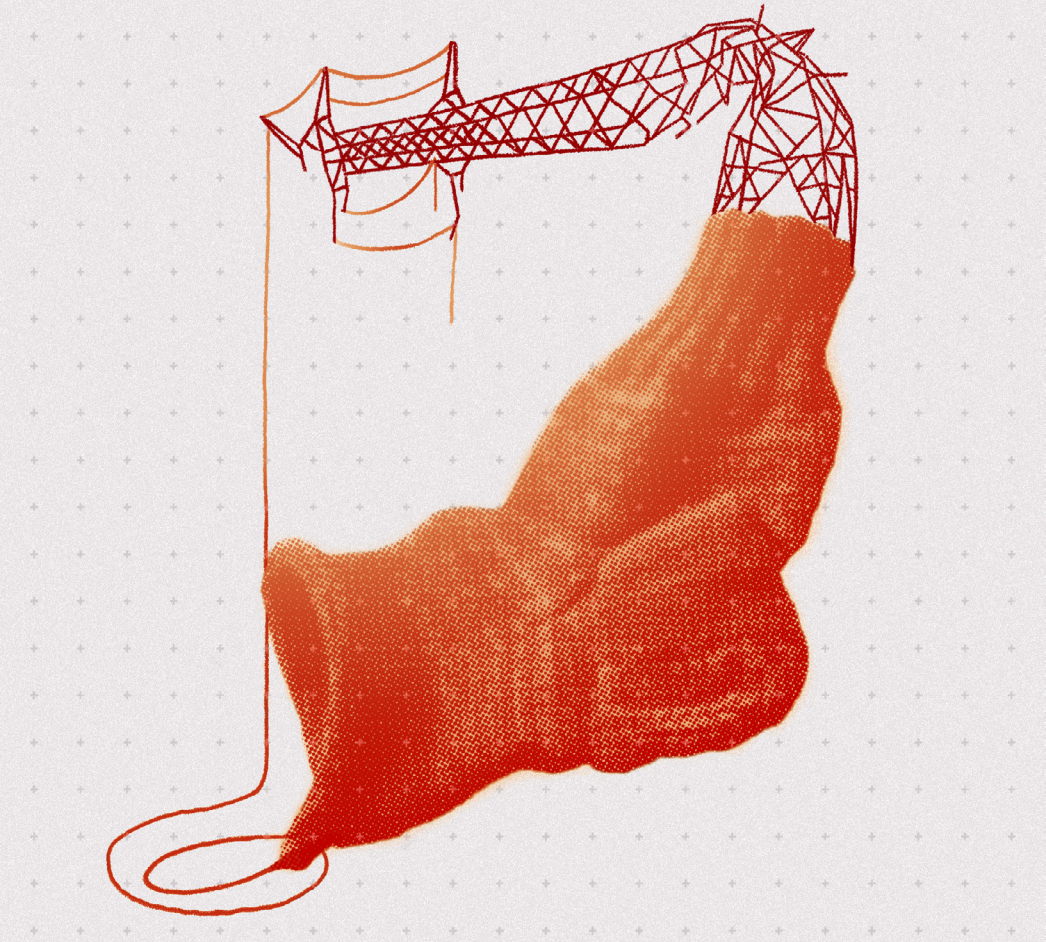


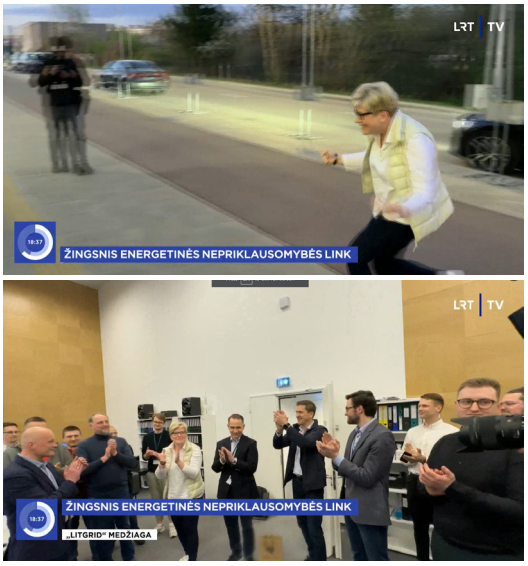
Fig. 1. Intro image depicting the theme of the text

It was a chilly October afternoon. Around 12° Celsius. We received a letter from Daniel Urey inviting us to contribute to a study examining relationships between energy production and landscape from a Lithuanian perspective. The question was more relevant than ever. In Lithuania the topic of energy independence from Russia had been discussed in the public domain for more than a decade. But when Russia launched its full-scale invasion into Ukraine in February 2022, the whole of Europe suddenly realized that the energy politics had to be changed radically. These winds did not promise an easy winter, but most Europeans in the name of solidarity with Ukrainians understood that it was the least price they had to pay for a shortsighted politics of dependence on cheap fossil fuels. The fast changes were also damaging environmentally. As the natural gas prices doubled, Vilnius City Municipality decided to switch to burning fuel oil for district heating. Furthermore, in national energy policy wood biomass's role as the substitute of natural gas was reinforced. The political changes turned out to be a bodily experience. One had to wear a winter jacket and knitted socks in an office of a building where turning on the heating was delayed because of price increases. The clothing more commonly associated with the outdoors had become casual indoors, which questioned spatial distinction of inside and outside. By establishing the difference between interior and exterior, architecture shapes microclimate. By losing its tools of climatic control due to macro-shifts in energy politics, it faces destabilization of established spatial concepts. In fall 2022 did the domestic sphere become just a part of the continuous landscape? What do we even understand by energy landscapes in multi-scalar lens - from geopolitical pivots to our corporeal experiences?

Modernity project supposes that the landscape is a resource for human needs: meadows and fields are lands for producing food, forests for generating timber and other biomaterials, quarries for mining and extracting fossils and minerals, waters for recreation or transportation. Over the last hundred years the landscapes have been transformed in a particularly striking way for the production, transmission and consumption of energy. This had an especially strong connection with modern statehoods, strategically sustained by the energy infrastructures to be massively used by citizenry. In the Baltic states that formed their political statehood in the beginning of the 20 century, territoriality, landscapes and the realities of daily lives have been and continue to be strongly shaped by energy and electrification infrastructures developed during the Soviet occupation, in the mode of Soviet fossil modernity. These infrastructures embody difficult political legacies, but they are also the inevitable basis for the future scenarios. Today the energy transformation here feels hasty, and in the context of the climate crisis does not always take into account the environment in which this energy is produced, transported, stored or consumed. When discussing the future of energy infrastructures, how far could we go beyond the modernist approach to landscape and address the environmental and societal complexities that shape it? With a turn towards renewable energy and solar energy in particular is it possible to fundamentally rethink the cultural relationship of energy and the landscape? In the following pages we aim to explore how imaginaries, physical infrastructures and our needs constitute our practices of energy production and consumption within the landscapes of Lithuania. How are energy infrastructure networks intertwined with the knitted socks we wear at home? And why solar grill experiments help us to grasp future energy geography? [Fig. 1]

On April 22, 2023 Lithuanian electricity transmission operator *Litgrid* conducted an unprecedented experiment - 10 hours of full disconnection from the Soviet made and dispatched from Moscow electricity transmission system BRELL (an acronym standing for Belarus, Russia, Estonia, Latvia, Lithuania). Practically it was a test of conditions under which electricity consumed in Lithuania is either produced inside the country or imported from the energy systems beyond BRELL, via two existing links - with Swedish and Polish electricity transmission systems. The experiment was widely celebrated as a milestone in the process of Lithuania gaining self-reliance vis-a-vis Russian Federation infrastructural energy politics. In this view Lithuania is the pioneer among three Baltic states to implement the adopted in 2017 shared roadmap for Lithuania, Latvia and Estonia to disconnect from the Soviet-made, controlled by Russia system; and, subsequently, to connect to the system of continental Europe by 2025.

On one hand, this experiment retrospectively reveals that despite the profound transformations in economy, in institutions and in political culture after Soviet communism, the core of the infrastructural domain of Lithuanian society remained predominantly in the Soviet path. The questions stemming from this observation, applicable to most former socialist societies, were discussed by the authors of the book Post-Socialist Urban Infrastructures, published in 2019. On the other hand, this experiment triggers futurist thinking on how Lithuania's and Baltic states' geography could change after the BRELL infrastructural reality is over. How profound the reconfiguration of relations between energy, space, state and economy could be in the post-BRELL conditions?



Prime minister Ingrida Šimonytė congratulates LITGRID workers after a successful test. Source: https://www.lrt.lt/mediateka/irasas/2000269293/istrige-valtyje-su-latviais-ir-estais-judeti-energetines-nepriklausomybes-link-lietuva-yra-pasiruosusi-bet-kitos-baltijos-salys-neskuba

Although BRELL is formally a legal reality - an agreement on synchronization of electricity transmission among five states, its endurance is defined by the materiality of infrastructures for electric current used to transmit electricity among five BRELL states. These are the transmission lines for 300-330 kV voltage that bind together Belarus, North-West Russia, Estonia, Latvia and Lithuania in the Baltic Sea region.[1] Furthermore, those transmission lines cannot be reduced to BRELL only, as they constitute an entire electricity region in Europe, including also Ukraine - from the Baltic and further Barents Sea in the north to the Black and further Caspian sea in the south. High voltage electricity transmission lines are used to connect large electricity producers with consumers, located hundreds kilometers away. On the Baltic states territory, it was a part of a large-scale Soviet modernisation project after World War II, expressed in industry development, the massive growth of urban population and built environment. It entailed a certain mode of territorialization - creating a measurable, controllable,

[1] In addition to 300-330 kV lines, the agreement envisages the usage of 750 kV lines connected to Nuclear Power Plants, as well as 500 kV lines available only in Russia.

bounded geography, with strategic power loci set according to the principles of Soviet economy and society.
It also expressed the scale of energy production and transmission for the industrial and consumer purposes, characterized by large generation facilities, centralization and thus much more top-down (as opposed to organic, bottom-up) spatial planning and development in comparison to those regions of Europe to the West. In addition to yellow electricity transmission lines of 300-330 Kv voltage, we also see a few blue lines of 750 Kv voltage in this region between Baltic Sea and Black Sea. The latter ones are connected to the extra- large electricity producers in the former West of USSR - nuclear power plants in western Russia (Leningrad NPP, Kalinin NPP, Smolensk NPP and Kursk NPP), in Ukraine (Zaporizhzhia NPP, South Ukraine NPP, Khmelnytsky NPP, Rivne NPP and Chernobyl NPP) and in Lithuania (Ignalina NPP). [Fig. 2]

[2] A map of the 300-330 kV transmission lines in Europe

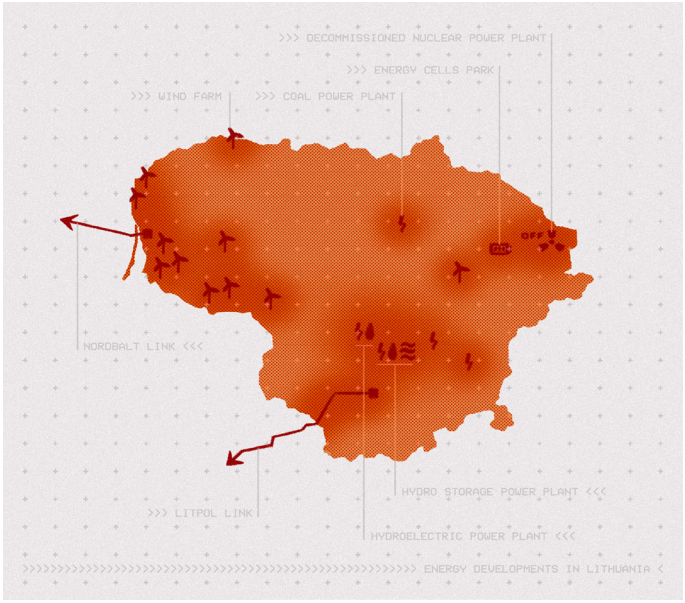
Should this post- WWII human-made electricity region be viewed as a tool of Soviet strategic domination in Estonia, Latvia, Lithuania, Belarus and Ukraine, or as a foundation of statehood and long-term regional cooperation between these states? There is space for a variety of interpretations of this region's shared future, enabled by political, economic, cultural cooperation among the states in between the Baltic and the Black Sea. The most sound interpretations from the past were centered on Poland and tried to revive the pre-industrial polities. This is the case of Jozef Pilsudski's widely known *Intermarium* concept, aimed to re-invent the 16-18th century Polish-Lithuanian Commonwealth in early 20th century conditions (including also the states located towards the Adriatic Sea from Poland - Slovakia, Czech Republic, Hungary, Romania, and former Yugoslavia).

[3] Intermarium map

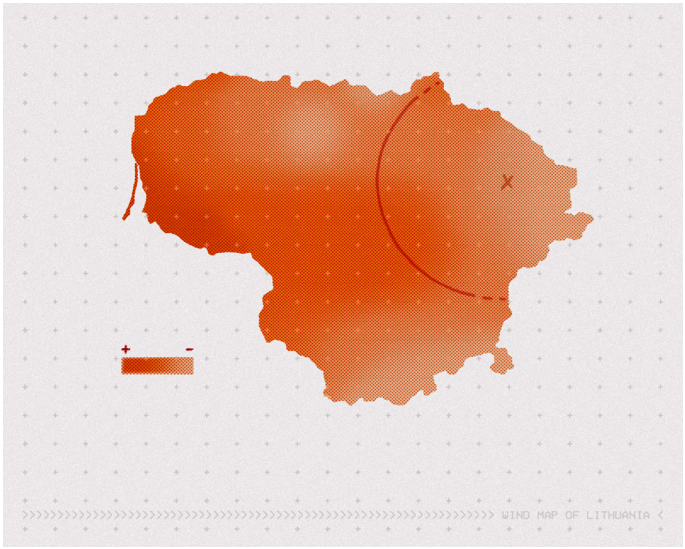
The 20th century post- WWII history of 300-330 Kv electricity transmission infrastructures is just another manifestation of the shared destiny of the lands between Baltic and Black Sea. In this case this shared destiny is about material scaffolding for rapid industry driven urban growth. The fact that these lands were tragically devastated during WWII, made them often a 'clean slate' for Soviet infrastructural politics. And the fact that development of the energy system in the region happened under Soviet rule adds just another dimension to the understanding of how troubled this region was in the 20th century. The beginning of the 21st century is by no means less troubled. Due to this shared infrastructural scaffolding, today Lithuania, Latvia and Estonia are the most helpful to repair Ukrainian electricity transmission infrastructures (mainly electrical substations), which are systematically targeted by the Russian military during the invasion from February 2022, and more intensively starting from October 2022. Combination of Russia's ongoing attempts to destroy Ukraine's energy system and statehood, of the disconnection from BRELL by Lithuania, Latvia and Estonia, and, broader, of the measures to deal with the climate crisis, all dramatize the region's prospect in view of the current war in Europe. Will this electricity region from the Baltic to Black Sea persist? Or will it dissolve under pressure of war, geopolitical tensions, and green transition? Do we witness the end of the regional manifestation of the 'long 20th century', or, in other words, the end of Soviet fossil modernity?

[4] Baltoscandia map

On the European regional level, the anticipated post-BRELL conditions for Lithuania are closer not to the contours of *Intermarium*, but to those of *Baltoscandia*, a 20th century vision, developed by geographers Sten de Geer from Sweden and Kazys Pakštas from Lithuania. It is the union of Denmark, Iceland, Norway, Sweden, Finland, Estonia, Latvia and Lithuania. Emergent energy geography in the Baltics reminds these contours due to actual physical connections between Estonia and Finland (EstLink), as well as between Lithuania and Sweden (NordBalt). So far the most articulate tendency one could recognize in Lithuanian geography in the course of its dis-integration from the Soviet-made energy system is the port city of Klaipeda gaining the role of national energy hub. This reterritorialization tendency implies less even and more differentiated national energy geography. The new hub position of Klaipeda is defined by its infrastructural access to external energy markets - to liquified natural gas from Norway, US, etc. (via LNG Terminal), as well as to the electricity from Sweden (via the 400 kV cable for direct current and 700 MW converter station). The second Lithuania's electricity transmission link beyond BRELL is a 380-400 Kv line connecting Alytus (with 500 MW back-to-back converter station) and Elk in Poland. Functioning of a Liquified Natural Gas terminal in Lithuania and thus the opportunity to import gas from beyond the Russian Federation and Belarus, gives the country a competitive advantage among the neighboring Baltic states and Poland. And it grants Lithuania a leadership position among three Baltic States in post-BRELL energy politics. At the same time, Estonia and Finland, despite advancing in the introduction of the new renewables, are planning to build LNG terminals too. Such a new energy hub role of Klaipeda and of the adjacent Lithuanian Baltic Sea side are amplified by the fact that the major facilities of wind electricity generation are equally located in the west of the country, close to the coast. Moreover, there is a plan to finish 700 MW offshore wind power plants just outside of Klaipeda by 2028, with capacity to generate a quarter of Lithuania's electricity demands. In the current context of war in Europe, such an energy hub role of Klaipeda is risky due to its proximity to the highly militarized Kaliningrad exclave of Russia.



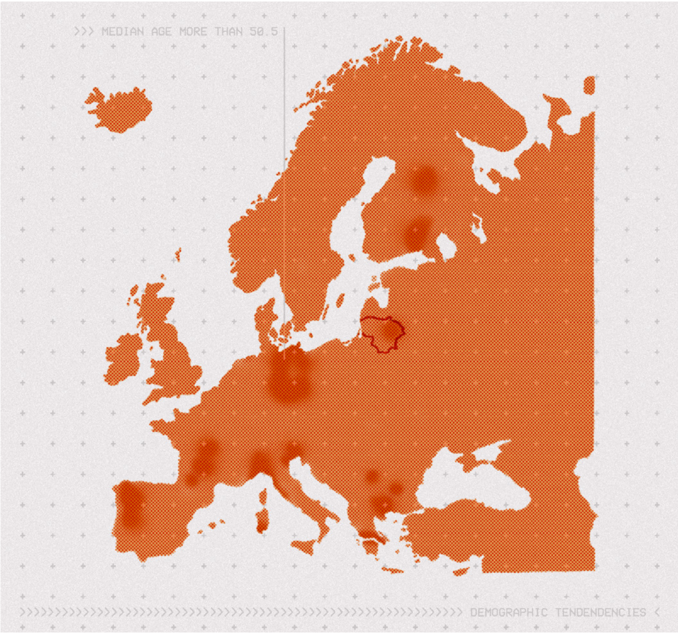
[5] A map showing current energy developments in Lithuania with emphasis on Klaipeda, with onshore and offshore wind generation capacities, the cables to Sweden (NordBalt) and to Poland (LitPol), Energy Cells park in Utena.



[6] Wind map of Lithuania. Source: O. Rathmann. The UNDP/GEF Baltic Wind Atlas. Risoe National Laboratory, Roskilde, Denmark, 2003

At the same time the eastern part of Lithuania is barely addressed in terms of energy developments, despite the first wave of projects to enhance national electricity autonomy in course of disintegration from BRELL such as the "Energy Cells" battery park in Utenos county. Furthermore, after the closure of the Ignalina Nuclear Power Plant in 2009 (which is in a state of being dismantled at least until 2038), the Eastern part of the country can be seen as a niche for new energy projects to balance the national energy territory and to develop post-BRELL trans-border links with Latvia. This can be recognised in the demographic dimension of East of Lithuania as well - combination of large quantity of aging

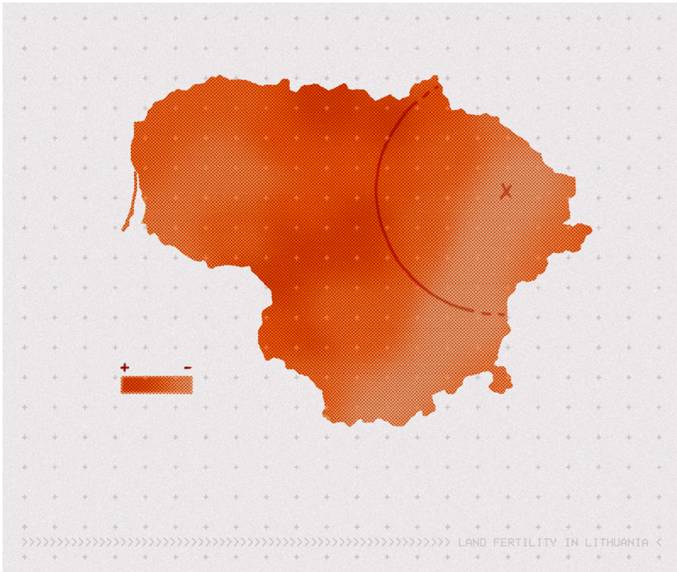
specialists in energy engineering from the closed INPP and aging population in general (Utenos county has one of the highest median ages in the entire EU).



[7] Statistical map from Eurostat showing demographic tendencies of Europe and especially North of Lithuania.

In the course of development of the renewable energy projects, the characteristics of landscapes become essential factors. Relatively flat West of Lithuania, facing the Baltic Sea coastline and the regular winds, has advantages for wind generation. Landscapes of the East of Lithuania with mellow relief and pine forest would rather fit solar power projects. Besides, the East of Lithuania is characterized by the low fertility of land, which due to the national legislation makes it easier to experiment with solar energy by building solar parks and other less conventional energy facilities. What are the legal constraints to develop solar energy landscapes in Lithuania?

Since 2022, the Lithuanian government has immensely reduced the zoning regulation set out for new solar power projects. According to the 2022 national legal act on Environmental Regulation for Building and Operating Solar Power Plants, priority to build solar energy facilities is given to already existing buildings and to the territories already exploited by humans like landfills. The priority is also given to 'solar agriculture', when the solar panels are to be built on agricultural land. This is the solution when the land is still exploited for agriculture, combined with not extensive build up of solar panels or with solar panels raised 0.5 meter above the ground. In such a case, in every 1 kilometer of solar panels, a passing corridor for animals is a necessary condition. Solar energy facilities are to be installed at least 200 meters away from water resources, or, if built closer, solar panels have to have white edges to protect the fauna of water. If built next to urban territories or territories to be urbanized, on 100 meters distance, there should be 1 meter height hedges surrounding the solar complex. This regulation is also compatible with the 2022 Directive of the European Parliament and the Council on the promotion of the use of energy from renewable sources. The restrictions for building solar power facilities in agricultural land are better reflected in the 2019 Law on Special Conditions of Land Use of the Republic of Lithuania, rather than the general renewable energy policies. After the discussions in 2022, the Lithuanian government has allowed to build solar power on any arable land. However, the law on land use put restrictions on it: arable land with soil productivity above the national average, as well as the land where land reclamation systems are in operation, must be used in a way that does not result in land degradation (with the exception of ecologically impoverished areas of the natural framework), or in a way that does not deteriorate the properties of the soil. This basically implies that solar power facilities can only be built in arable land, which is below the national average in fertility. And this makes the East of Lithuania the major potential area for both large scale commercial and experimental, prosumption driven solar power projects.

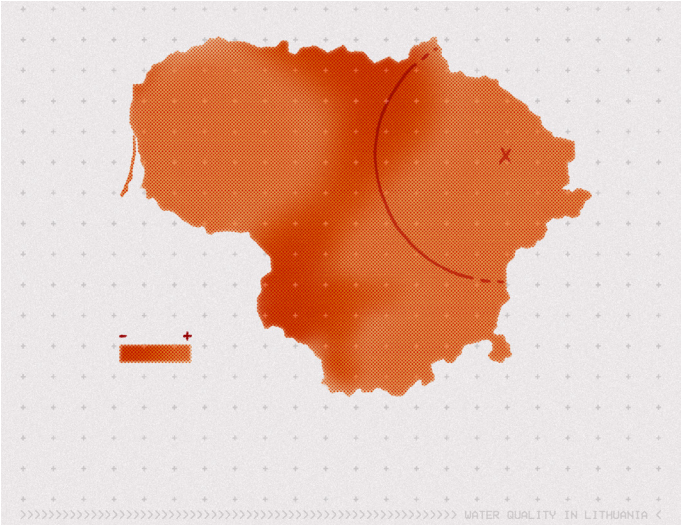


[8] Map of land fertility in Lithuania

On one hand, lower land fertility of the East of Lithuania can be considered a disadvantage. But on the other hand this directly resulted in less polluted water sources in this part of the country. The pollution of surface water sources in the central part of Lithuania shows how damaging modern agriculture is for the environment. In the XX century, and especially the post- WWII period to enhance productivity the soil was heavily fertilized and nutrient with other chemical supplements. The largest chemical factory in the Baltic for nitrogenous fertilizers *Achema* and phosphate fertilizer producer *Lifosa* were built in the Central part of Lithuania in the 60's when the USSR started the chemization programme in agriculture. These factories as well as chemical use in fields were publicly criticized even during Soviet rule in context of broader environmental discourse that became a form of resistance against the occupation. This criticism was strengthened by real accidents that happened in factories.

After Lithuania gained independence, these large chemical factories were turned into large private companies that up till now operate and produce fertilizers not only for the domestic market, but also to export. The treatment of landscapes based solely on extraction of resources of the land, even in the form of artificial nourishment, shows how damaging the modern approach to landscape is for ecosystems that make the landscape.

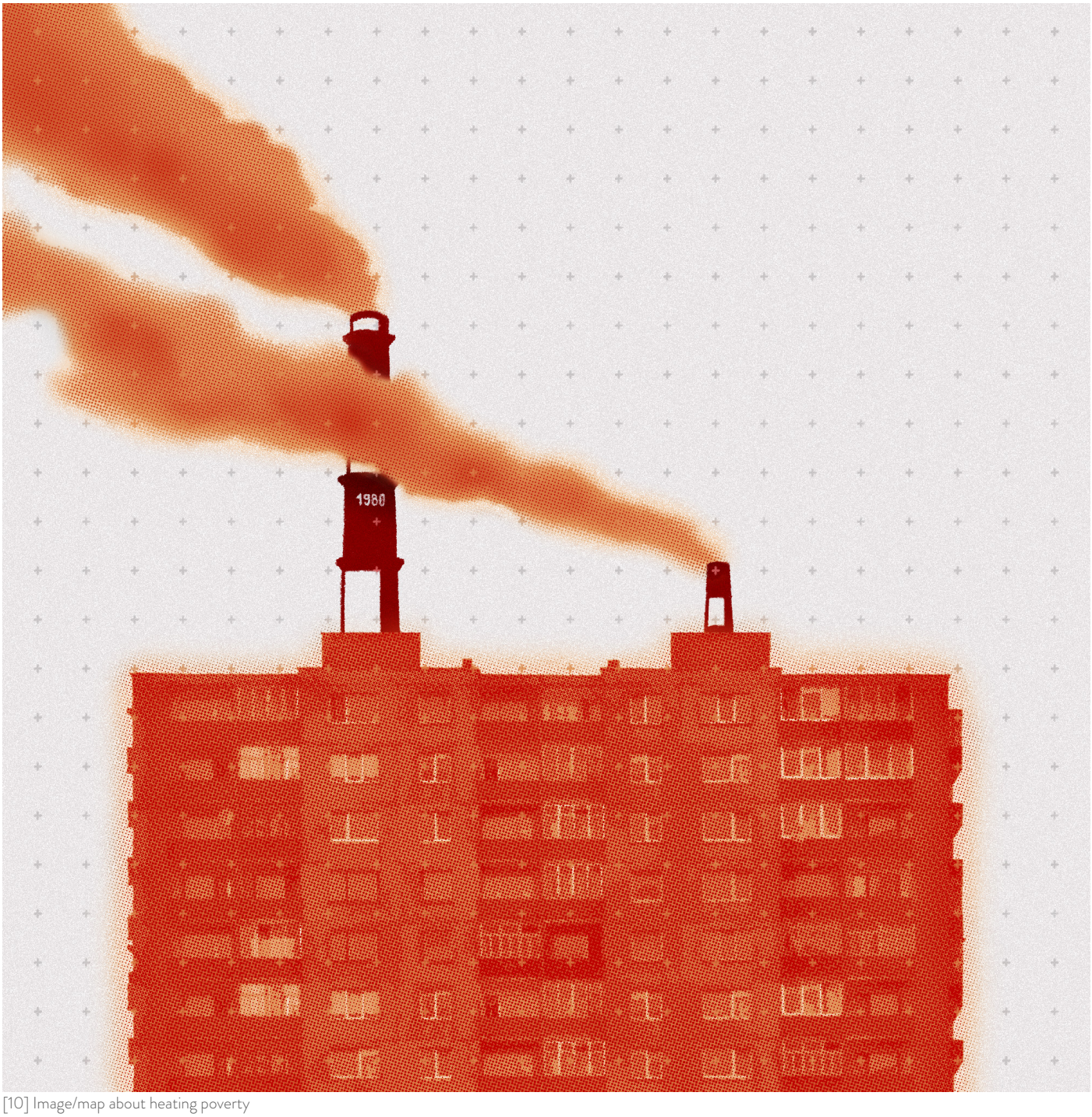
In terms of land use the energy sector is usually seen in opposition to agriculture. However the spatial impact of the energy developments usually can be similar to one of modern agriculture. Large monotonous energy infrastructures change the environment and disrupt ecosystems. Thus when talking about renewable energy one has to not only address the landscape properties that usually are exploited for energy generation, but also to consider the potential impact it might create for the existing ecosystems. Can this impact be seen as something more than an inevitable point of conflict - as a field for negotiations ensuring that energy developments are done with sensitivity to the landscape? And, more radically, could renewable energy production become regenerative for the environment it is situated in? In this respect it is interesting that the North-East of Lithuania is characterized by the availability of large amounts of fresh water that together with dense forest areas enhances the region's potential as a recreation destination according to the Comprehensive Plan of the Territory of the Republic of Lithuania 2030. Having in mind the broader context of accelerating global water strains, Lithuania and this region in particular is in a fortunate situation. In these conditions water (and lakes' related landscapes in particular) are gaining even more importance as a public value. Thus when working with landscapes one should also aim to see how physical advantages can be combined with economic production and wider ecosystems creating lively spatial encounters that encompass preservation of natural resources, nurture environmental justice and social welfare, and ensure needed energy supply.



[9] Map of water resources in Lithuania

In the light of the climate crisis and energy transition it is important to critically assess the energy consumption according to sector, energy type, and primary fuel sources. Business oriented green agenda concentrates mainly on developing renewable energy (solar and wind generation) in the form of electricity. However, total consumption numbers show that less than 20% of total national energy in Lithuania is consumed in the form of electricity. And more than 40% of energy is consumed as oil products. At the same time, transportation is the main sector based on oil products, meanwhile electric energy used in this sector still makes up a very insignificant part. As in Lithuania the transportation sector consumes 40% of the whole energy (source), a lot of energy transition initiatives are trying to make changes in this sector. Nevertheless it is important to address that households make a significant 26% of total state energy consumption (source). The energy used for hot water and for heating makes 75% of the whole households' energy use (source), and the rest of energy is consumed mainly for lightning and electrical appliances. Thermal energy is produced by burning gas, biomass, firewood and agricultural waste. It is delivered to households for heating and hot water mainly via district heating systems. Thus a major part of this energy is produced releasing large carbon emissions. And switching to renewable electricity generation would not be efficient to later produce heat. In this context it is significant that in 2012 the European Commission has set targets for total energy consumption effectiveness, where Lithuania's goal is to reduce existing total energy consumption in half by 2030 (in 2020 it was around 66 TWh and the target set by directive 2012/27/ES is less than 28 TWh).

This is to be reached partially through programs of renovation of energy inefficient buildings. Most often energy inefficient buildings are multistory apartments built during Soviet occupation when urbanization accelerated dramatically. Till this day more than 60% of the country's housing was built between 1941-1991 (source). Since the start of the renovation program, only 4520 houses have been renovated in Lithuania, which makes only 12% of the housing stock, which has been identified as heating inefficient. This suggests that at a pace renovation programme is working now, Lithuania would not be able to reach the savings set out and that extra solutions are needed. At the same time heat is more than just a technical problem, but a problem of social structure. Currently Lithuania is among the most energy poor countries in the entire EU. According to the Eurostat data for 2021, 22,5% of households in Lithuania cannot adequately heat their homes. Most of the heating is provided in Lithuania in the format of district heating, i.e. via massive use of centrally boiled water distributed to the buildings through insulated pipes. This is the case of most of the post-WWII Soviet urbanization. According to World Bank data published in 2014, 63% of total heated area in Lithuanian cities is covered by district heating. The total length of the Lithuanian district heating network is 2,497 km.



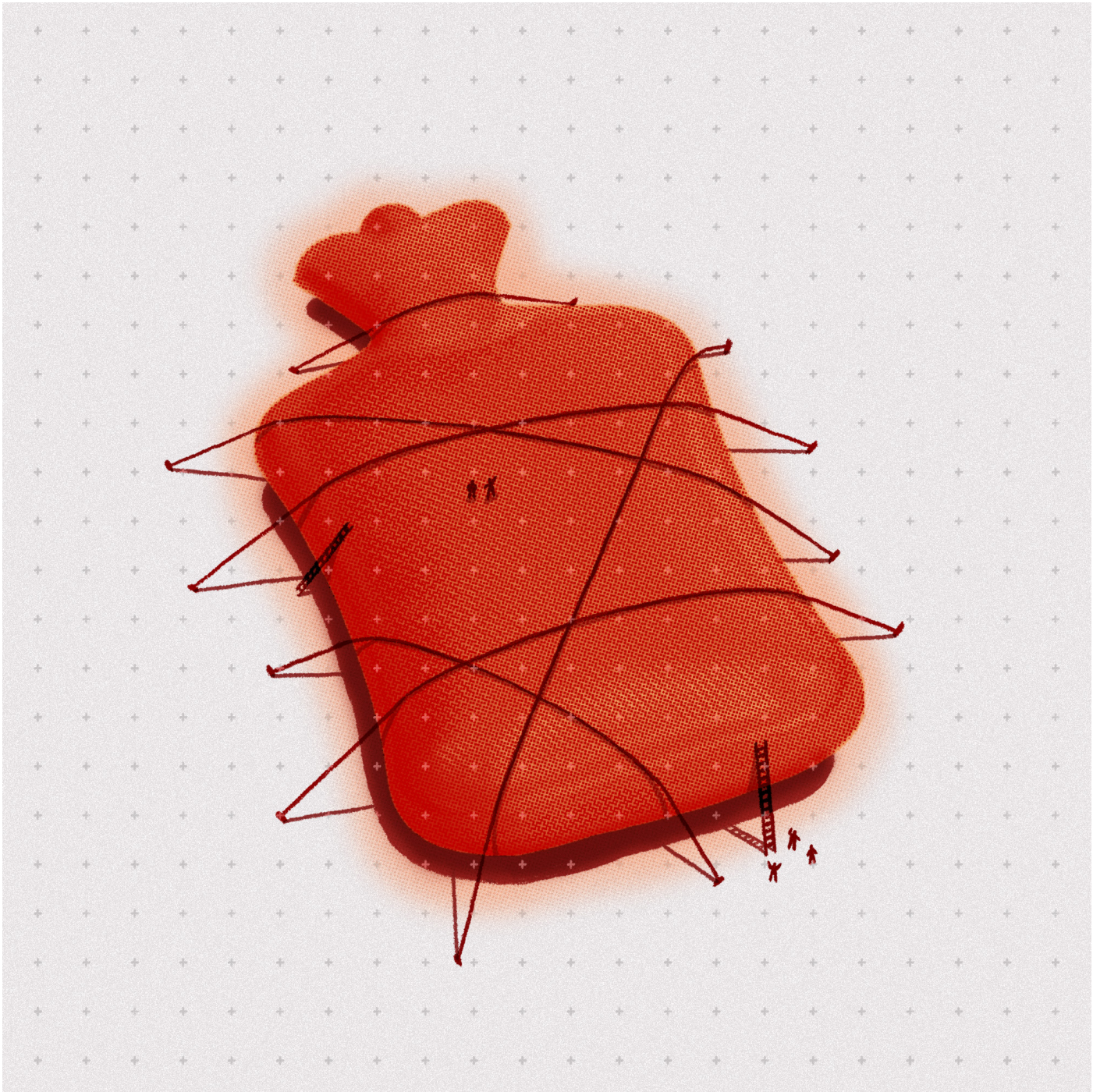
[10] Image/map about heating poverty

Heat supplied this way accounts for 51% of the housing stock. And 73% of it (19,357 buildings out of 26,636) are multi-apartment buildings. This World Bank report documented that heat consumption by the buildings in Lithuania is significantly higher than in the other Nordic countries, and that in 2012 17,3% of district heating consumers had debts for heat (primarily due to high natural gas prices). [Fig. 10]

This suggests that we must highlight both the need to prevent heat losses by buildings and the ways household heating and hot water preparation could become more sustainable. In this process vernacular practices of storing heat could become the inspiration for scaled-up massively introduced solutions. Those living in poorly heated apartments might know that when feeling cold the most effective methods to warm up are very basic - as mammals humans need warm environments to have balance for maintaining inner temperature balance. Our bodies have a natural ability to produce heat. Basically the reason we need clothes and buildings is to make the thermal conductivity controlled. Wearing a pair of Karpathian wool socks is an act of creating such balance, where our body actually heats itself. Thus knitted socks are an inspiration to search for a stable solution for the net zero agenda. In geographies like Nordic countries with the deficit of sun rays during most of the year, additional sources of warmth are needed. However we would argue here that the main technological advancements needed in this and similar regions are not so much about producing the heat, but about methods that capture the heat to last it longer and control its release. Examples of such principles could be found among contemporary household appliances like thermos that keep tea hot throughout the day or like masonry heaters that ensure steady warmth conduction in the rooms even when the burning process is over. What can we learn from these micro practices when thinking about large scale energy transitions? In the light of the climate crisis should we indeed shift our focus from energy production to energy accumulation and storage as the main sphere that needs innovation? What if we could scale up these micro practices both spatially and temporally, so as to capture the heat excess throughout the year to make it available for the buildings and entire districts in the course of months? [Fig. 11]

Thus post-BRELL conditions should imply addressing not only electricity generation, transmission and storage, but also heating supply. This first of all concerns designs for higher heating efficiency of buildings from the Soviet period. But it also concerns possible massive applicability of renewable heat storage solutions - such as stones, salt, or water. In longer-term perspective determined by climate crisis, it also suggests a more open-ended experimental dis-entangling old and re-entangling anew the national and local welfare formats, renewable energy sources, electricity, design of buildings and dwellings, as well as water used both to deliver heat to the buildings and to store it. Features of the North-East of Lithuania post-BRELL potential such as absence of wind power facilities, large amounts of water for recreation and domestic consumption, relatively low fertility of land in the national context, demographic problems, energy engineering workforce remaining from the Ignalina Nuclear Power Plant, as well as close proximity to Latvian border, all together make Utenos county and Zarasai town area in particular our site to experiment with solar power technology. High median age in the broader Utenos county (together with the very realistic upcoming pension system crisis) requires experimentation with multi-modal welfare infrastructures with particular emphasis on seniors as a social group. Thus what kind of integrated spatial strategy - addressing territorial, scalar, and landscape niches and constraints - can address all the mentioned circumstances? Trying to respond to this question, the next research step we make is one through speculative design. In particular, we develop the proposal of the project of *Zarasai Special Energy Zone* for a long-term heat storage solution and direct solar heating for a variety of both the public recreational and household uses. This is an exploration of the niches for the post-BRELL transformations specifically in North-East Lithuania, guided by a range of research and design questions. What new formats of welfare could be grown from solar power? How far beyond the Soviet territorial planning and urban design solutions for electricity and heating can they go? How do solar power driven solutions for storage and transmission of electricity and heat determine urban form - especially landscapes and public buildings? How do these design transformations match or do not match with the prevalent normative and cultural realities?

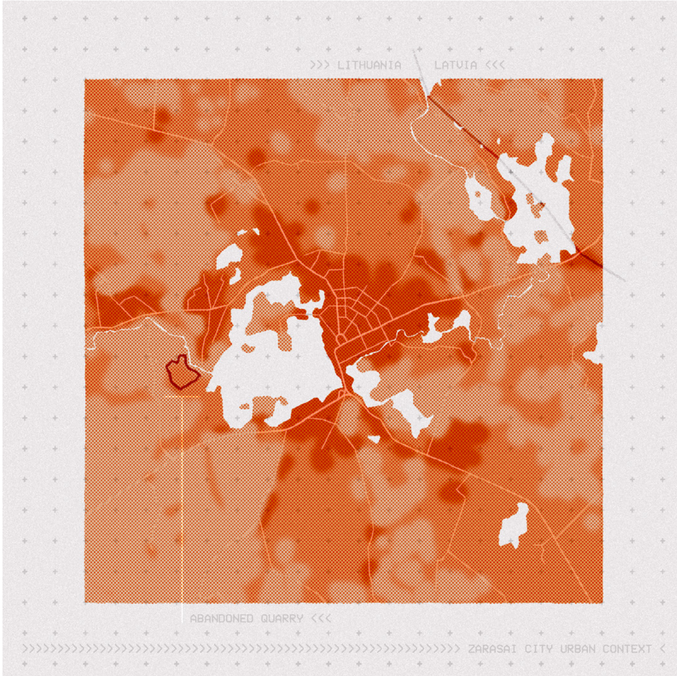
Our institutional solution for the *Zarasai Special Energy Zone* is a Renewable Energy Community (REC). In Lithuanian legislation RECs are not-for-profit entities, such as NGOs, cooperatives of multi-apartment housing or public bodies such as municipalities. Not-for-profit here means that if REC is generating any profit, it either goes into other projects, which benefit the community (for example, fixing roads or public infrastructures) or into developing further renewable energy projects. Generation and utilization of the profit must be foreseen in the legal statutes of the community. Membership should consist of at least 51% of members legally registered as living or having a business in the same county (Utenos county in case of Zarasai). Residents, small-medium enterprises, NGOs, and other public bodies can become members of such communities. The community can install renewable electricity or heating systems. The profit made by such a community can also be used to reduce energy prices even further. Depending on the legal statutes of the REC and the individual contracts made with the members of the specific community, the produced electricity and heat can be supplied free of charge or at a reduced price. This provision allows energy poor residents to participate in and benefit from the community. The power of installation is not limited, however it can be restricted if the community applies for governmental benefits to reimburse part of the installation.



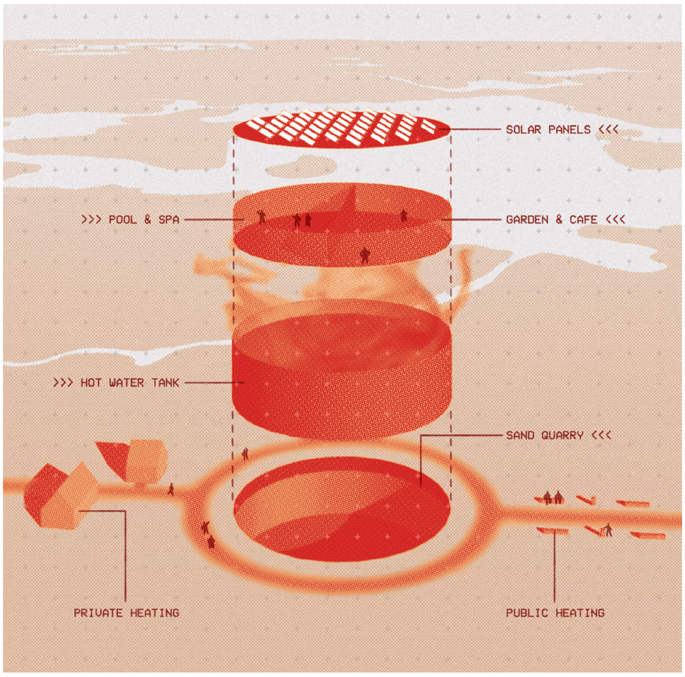
[11] Image about how we can learn from wool socks and/or hot water bag

In case of energy change driven by communities or by other forms of small scale cooperation, the legislation context is important, but the individuals on the ground are the key drivers for this change. People's views, aspirations, initiatives, as well as habits of trust and mistrust constitute a distinct culture compatible or incompatible with bottom-up energy change. Culture of small-scale bottom-up cooperation in the Baltic states was repressed during Soviet rule and even now remains somewhat crippled with slow formation of the needed new habits. In Lithuania mass cooperation for broad political goals dictated by grand narratives, like regaining independence or supporting Ukraine under attack, appears to be more organic than cooperating with neighbors on local issues. In this context the climate crisis interestingly does not appear to fall under those grand narratives in Lithuania at all. For instance, in the 2023 parliamentary and municipal elections this topic not only did not dominate the discourse. It has not even been among a few most discussed issues. Here one can hypothesize, together with historian Tomas Vaiseta, that the prevailing take on national development in Lithuania is historical, as opposed to social critique driven. Alternative political agendas and design briefs for new energy landscapes are crystallized in our imaginations, however their materialization has to overcome a range of thresholds: the infrastructural path dependency of highly centralized Soviet energy sector, the massive inertia of market logic, or fragility of DIY culture and bottom-up development projects. In this context one should recognize the relevance and potential of science fiction and political environmental art - from solarpunk fiction to experimentation with the cultures of human-environment relations by artists like Tomas Saraceno. This genre is still rather niche, but its social function is to plant environmentally and politically grounded visions of a better future, and then to nurture them in our collective imagination. Thus they need more conceptual undergirding, as well as reinforcement through localized scalable socio-economic and governance practice.

This is the intention of the *Zarasai Special Energy Zone* project - to nurture solar power infrastructures, which are both future oriented and grounded by the research of past and current constraints. Technologically solar energy suffers from the same deficiency as wind power: irregularity of generation, which in turn requires storage capabilities. Paradoxically in discussions and in the collective imagination of solar power, both in enthusiastic and in skeptical approaches, the generation topic has much more attention than the storage topic. Storing energy in the form of electricity is usually using either vast water reservoirs or the lithium based batteries, which are very problematic in terms of scarcity and the environmental impact. Furthermore, efficiency of photovoltaic elements is still several times lower compared to directly capturing heat energy. This fact and the fact that heating is a crucial factor of Lithuania's energy insecurity, drives us to project heat energy as the focal point of *Zarasai Special Energy Zone*. In particular, in our project we propose a scenario for massive hot water storages, huge basins in abandoned and infertile places like the quarry, to shape the local landscape by integrating multiple functions based on the abundance of community produced cheap heat.



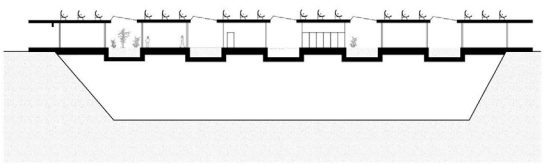
[12] Image showing Zarasai urban context



[13] Image showing diagram of the solar storage intervention in the quarry

One of the main technological challenges for designing large hot water storages is good insulation. By excavating the basin into the ground, a thick layer of artificial insulation is reinforced with naturally warmer underground sand, which has beneficial properties of heat conductivity. But digging in deeper, even in a convenient site of a former quarry, quickly starts raising the construction costs. Therefore most of such formations result in huge flat and apparently unusable fields of insulation layer.

Simply building greenhouses on top of them could turn the losses of always imperfect insulation into a controllable function and convert this little synthetic desert into a welcoming and productive community space, with seniors as the prioritized demographic group. Fresh gardening products would supply a nearby public solar kitchen which would operate in synergy with sustainable saunas, open swimming pools and natural sun tanning services, bringing a new type of recreational welfare economy to the area already seen in national context as a recreational destination in the summer. The pool storage would also be the center of an underground district heating pipeline, spreading through the built environment. During the cold season the pipeline would play a significant role in the public space. Abundance of extremely cheap hot water would be used to de-ice walkways and roads and to provide heated benches and hot water dispensers, which would improve the experience ofoutdoor activities and extend its periods of comfort.



[14] Long section cut showing scenarios of the Special Energy Zone intervention in Zarasai

There are multiple ways to heat water by using the sun, but one of the most effective are parabolic mirror concentrators, directing the sun rays into the vacuum insulated tubes. They would top most roof surfaces, where shade is more desired than transparency for natural light, creating a distinctive skyline of bent mirror and straight glass. Not all of the solar heat capture would be stored as water. Some of it would be useful for cooking directly and for controlled tanning. If tanning requires sophisticated and secure mechanical equipment, precise measuring and complex software, cooking with sun is much closer to casual DIY practices. In fact we already have small businesses providing various solar cooking equipment. Portable solar cookers of high quality are available to purchase. And derelict satellite dishes are often refurbished into quite effective grilling devices, which in our proposal would be available as amenities in public spaces. We tried out several different solar power cooking techniques during "The Generator" field school (run by European Humanities University), which opened our imaginations for even more daring large-scale designs.

For example, by tiling two inner corner walls with controllable mirrors, a smart and extremely efficient solar power kitchen could be constructed, which would precisely redirect any desired portion of a huge sunlit area to one's pan, pot, oven, moka and so on. Shiny environments broadcasting mosaic pieces of the sky would signify spaces for food production. Combination of the engineering skills among the region's population and regional policies for recreational and health economy gives us some shaky ground to speculate on such futurist energy landscapes. But much more importantly, we also get an opportunity to discipline our collective imagination by research and design, which is a prerequisite for growing more aware energy societies from energy communities.

To understand the future of Lithuania and other Baltic and Eastern European region countries in terms of energy landscapes, it is important to assess the existing infrastructure linkages. Broad regional cooperation, dismantling colonial infrastructural dominance in the region and creation of the conditions for the development based on solidarity is the emerging political culture of our times. Historically, geopolitical imaginaries have often been about visionary goals, whereas the existing material structures enabling real cooperation are in slower transitions and often embed difficult legacies of the past. Looking at the trajectories of the post-BRELL countries, we see the endurance of regional energy infrastructure. Today it needs to be actively re-entangled by political and physical interventions in order to respond to contemporary needs. Post-BRELL should not only be about re-terrotialization via connection to other energy systems and thus prioritization of new spaces of energy imports and generation. It should also be about new relations between landscapes, forms of collectivity, state and welfare. Areas facing social problems such as aging populations or landscapes marked by deprivation and extraction could become a priority in the development renewable energy agenda. The energy transition is also more than just replacing old energy production methods with new ones, but action in which the whole cycle of energy consumption is critically assessed. Known for long cold seasons, the Nordic-Baltic region and Lithuania in particular, require addressing not only electricity, but also heating as one of the main points where state and household fragilities intersect. These complex fragilities are defined by climate crisis, extractivist economies, militarization of energy sources, de-regulation of the energy sector, the risks of housing and pension crisis, etc. In such lens landscape is a category which can be helpful to start disentangling the role of energy in this complex fragile geography. Having all these questions in mind, the Zarasai Special Energy Zone for Utena county is a research through design proposal on the form and purpose of solar infrastructures for Lithuania's post-BRELL future.

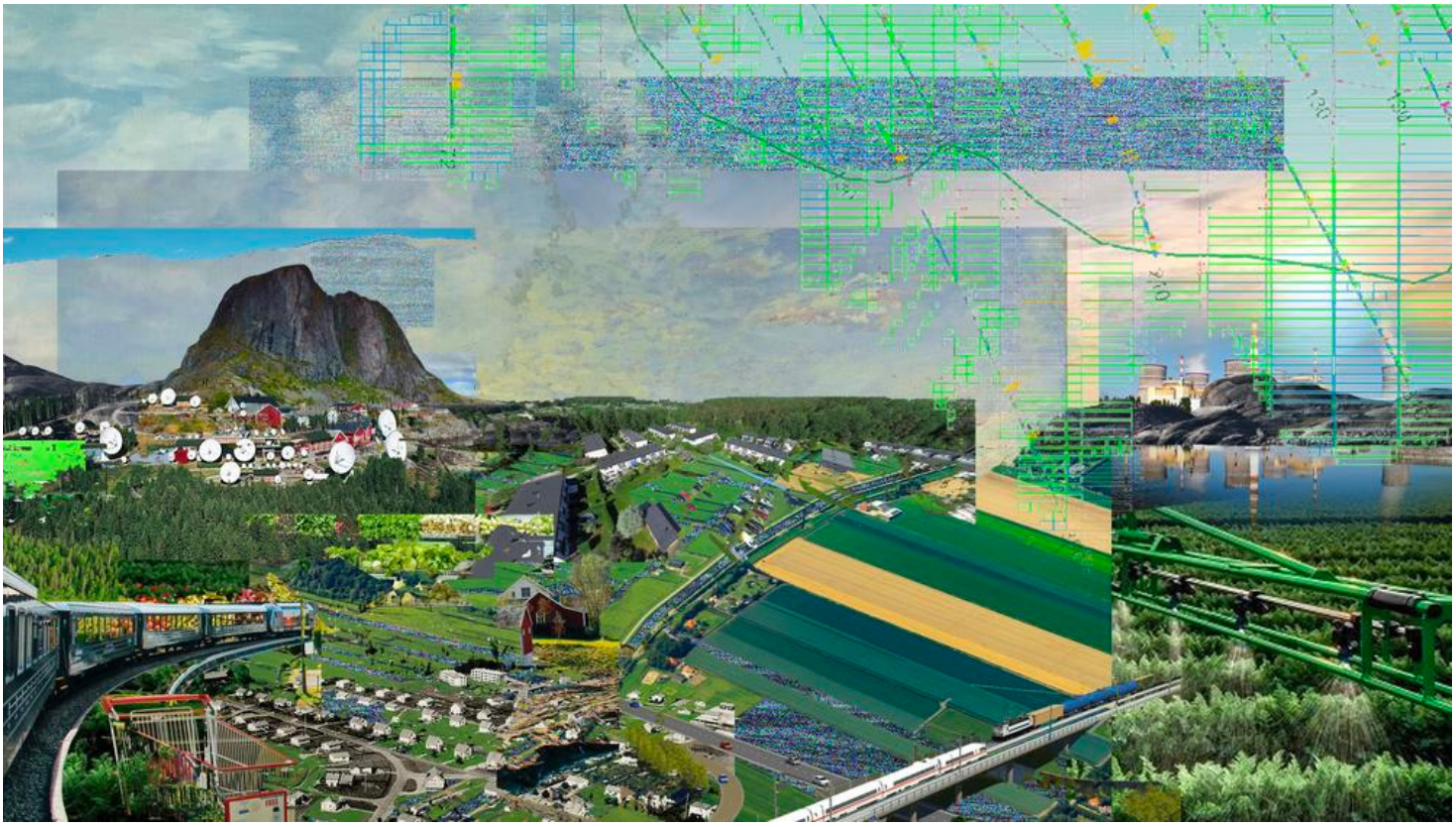
ABOUT THE AUTHORS

Siarhei Liubimau is Associate Professor (2014) and co-founder of the Laboratory of Critical Urbanism (2007) at the European Humanities University in Vilnius. Currently he is a member of CityIndustries International Research Network and a Steering Committee member at OSUN Experimental Humanities Collaborative Network. Previously he was a fellow at Central European University in Budapest, Institute for Human Sciences in Vienna and at Helsinki Collegium for Advanced Studies.

Justinas Dūdėnas is trained as an architect and semiotician. Justinas is practicing as exhibition designer, curator in Architektūros fondas and co-host in a national radio show about architecture and urbanism “Žmogus ir miestas”. Since 2023 a doctoral candidate and lecturer in Vilnius Academy of Arts.

Živilė Mantrimaitė is currently completing her master’s at European Humanities University with interest in how physical urban environments intersect with gender. She is also an active advocate for climate justice and sustainable renewable energy development in Lithuania.

Martynas Germanavičius is an architect, curator and cultural producer working in the fields of culture and education. Between 2020 and 2023 he was the director of the non-governmental organisation Architektūros fondas. As a curator-researcher, he has initiated Visaginas architectural guide and interdisciplinary project “(A) typical architecture as an event” (2019-2020), curated the exhibition and symposium “Erdvės politika” (2022) and workshop “Altering Matters: urban materials and their trajectories” (2023) in the cultural center SODAS 2123.



ABOUT LABLAB:

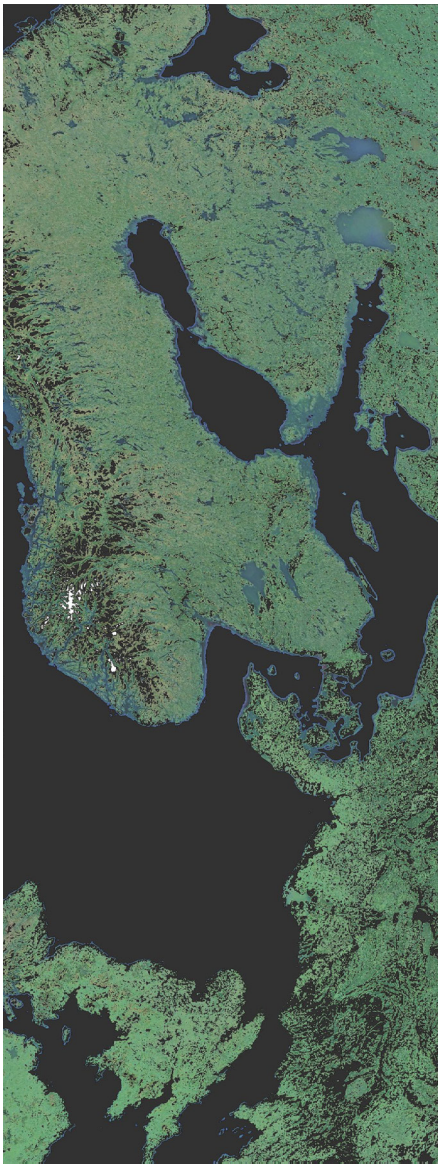
LABLAB is a research and design think tank dedicated to understanding the social, ecological and spatial transitions. We explore the potential of linking theory and practice to identify and work within new classifications and configurations of the built and unbuilt environments. Disciplines, expertise and experience coalesce in cross-sectorial and trans-disciplinary collaborations to move beyond existing means of interpretation and innovation. In our work we bridge academia with practice, develop processes and evaluations, co-create knowledge in cross-border collaborations between municipality, region, industry and research.

With funding from the Swedish Institute LABLAB is currently running a research project on new energy landscapes in the Baltic Sea area together with SLU Alnarp, Region Dalarna as well as academia and municipalities in Estonia, Latvia and Lithuania. The project has identified the challenge to tackle a lacking consideration of linking spatial planning with social, cultural and ecological values when planning for land-based renewable energy projects.

We have collaborated with Orsa municipality regarding energy transition and dialogues with residents. We also run projects in the Dalarna Region around spatial planning and energy transition. Together with SLU Alnarp and Chalmers, we have a collaborative project with the municipality of Boden linked to their need to quickly plan and scale up their municipality to meet the green investments and establishments that are underway.

At LABLAB we have different backgrounds and expertise: we are architects, spatial/urban planners, landscape architects, change leaders and communication strategists. The starting point for everything we do is the place and the people.

By building on existing knowledge, our work process identifies, manages and communicates significant societal changes and issues that affect rural areas today and for the future. Our method is based on a site-specific and inclusive process that links spatial planning, communication, innovation and cross-sector collaboration and can be applied in strategic, local, regional and international planning.



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