LEIBNIZ UNIVERSITY HANNOVER - GERMANY

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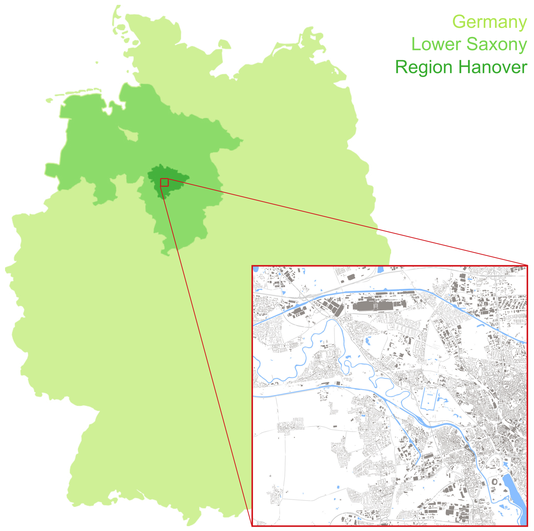


Location of University Campus

Sustainable Campus 2050: Building a consensus

Project and description

Based on existing and proposed regional strategies for dealing with climate change, the aim of this project is to identify the conditions, core areas and opportunities for change in order to achieve a climate-neutral and sustainable Leibniz University Hanover (LUH) Campus in 2050. In 2019, the LUH added a new mechanical engineering campus in the city of Garbsen, which is located about 12 km outside the city center and 11 km from the central LUH campus. Presently, 25.700 students, inculding 3.800 in Garbsen, attend the LUH. The disjointed development of the campus impacts the distribution of the student housing, the student travel by public transport and the institutional structure of the university. Within this context, innovative ideas and measures for a climate-neutral LUH Campus 2050 are proposed to sustainably connect the two university locations.

The 10 x 10 km study area encompasses the LUH campus that is integrated into the city of Hanover, which is located in the flat, agricultural landscape of northern Germany. Hanover is known as a 'Green City' because 50% of the city is green space. Never the less, the city is surrounded by intensive agricultural land, and it is the home to many industries that are the source of emissions and potential pollution. The migration of the population from rural to urban areas will not only generate a need for more housing, but also the increase in residents and commuters from surrounding towns means higher traffic volume. Both developments pose major challenges for the carbon neutral and sustainable development of Hanover and the LUH campus.

The three scenarios: 'early-adopter', 'late-adopter' and 'non-adopter' employ the 8 mandatory systems, supplemented by two further systems: Bicycle Mobility and Carbon Sequestration. The 'Early adopter' scenario represents the campus design for 2050 that includes all the proposed measures to reduce emissions, conserve resources and increase biodiversity for the LUH. The 'Late adopter', which delays the start of innovations until 2035, includes only the measures that were implemented in the first 15 years of the 'Early adopter' scenario. The 'non-adopter' scenario includes only the measures that reflect existing university and regional plans.

The scenarios were developed in the context of a webbased Geodesignhub workshop. As students of the Environmental Planning Master program, we had a strong focus on building a consensus between land use, urbanization, energy infrastructure and green infrastructure.

Major Issues

- Connectivity of the Garbsen and Central-LUH campuses
- Loss in biodiversity: Lack of Green infrastructure
- Reduction of greenhouse gases and increased Carbon sequestration
- Carbon neutral mobility - Bicycle Mobility and public transportation network

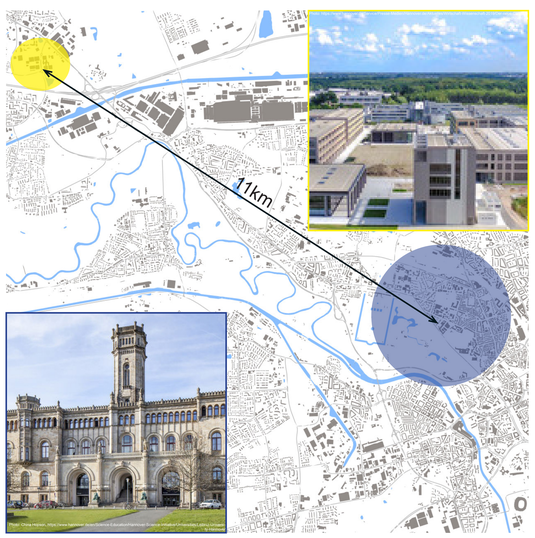
Major Innovations

WAT2	Water retention
AGR1	Organic Agriculture
AGR4	Carbon Farming
GRN1	Resilient Landscape Infrastructure
GRN9	Connected Green Infrastructure
ENE1	Renewable Energy Sources
ENE20	Semiconductor-insulator Solar Cells
TRA14	Passenger Rail Corridors
IND/COM6	Computer-integrated Manufacturing
IND/COM12	Technological Singularity
RES 9	Reduced GHG Concrete Emissions
INS 4	Evolving Education for Future Needs

Status Quo 2020

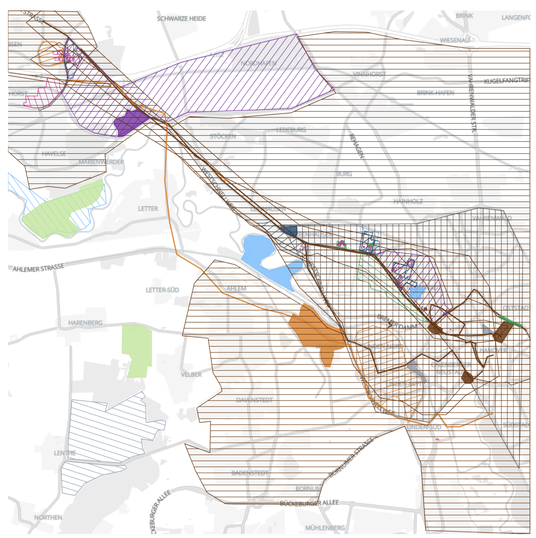
Early Adopter 2035

Early Adopter 2050



Project Surroundings

Non and Late Adopter 2035



Late Adopter 2050

Early Adopter Scenario

The aim of the 'Early Adopter' Scenario was to achieve a sustainable LUH campus by 2050. This goal is partly based on the Paris Climate Convention, and requires that the university reduce its CO_2emissions asignificantly. More specifically, the university must reduce its energy consumption by 70%, and substantially increase its use of renewable energies$_2$. All the projects and policies in the 10 systems were selected with the objective of creating a sustainable campus that can be realized in a cautious, elaborate way and that will be effective in the long term.

Projects proposed for the 10 systems varied in size and effectiveness to attain the different sustainability goals. Projects for Agriculture and Carbon Sequestration account for the largest amount of land and focus primarily on a beneficial impact on carbon emissions. Although the expansion of renewable energy account for only 1% of the projects created, the project sites for photovoltaic systems on campus roofs greatly benefit sustainable energy production. Similarly, numeral projects for a bike friendly city and innovative, low-emission transport system, address our goal of a sustainable, connected campus. These innovations that decrease emissions help to reduce temperature raise. Overall, a sustainable city and campus can develop and grow sustainably with these innovative, effective changes.

Late Adopter Scenario

In the 'Late Adopter' Scenario, the innovations start first in 2035 and uses only the projects that are implemented in the first 15 years of the 'early adopter' scenario. All projects longer than 15 years cannot be fully implemented between 2035 and 2050. This means that the Federal Republic's target of reducing greenhouse gases by 95% by 2050 could probably not be achieved.

In this scenario, 10 of 72 projects (14%) could not be implemented due to time constraints. In the case of the bicycle system, three projects would be cancelled (23%). It would not be possible to set up a low emission zone or free bike rental stations for students. The agricultural system could not support the cooperation between urban agriculture and dining halls (40%). In the transport system, only the introduction of a low emission zone would exceed the duration until 2050 (13%). In the water infrastructure system, the plan to initiate cooperation with farmers would not be feasible in 15 years. Furthermore, the wilderness area and the Raschplatz Highway would not be feasible for the Green Infrastructure System. The planting of trees to reduce carbon would also take longer. Only the Residents, Industry and Energy projects could implement all projects within the 15 years. Since 76% of the projects could be inculded in the 'Late aopter' scenario, it is better late than never to act.

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Methodology

1. Evaluation maps: We modelled ten systems in GIS to identify areas where the systems were suitable, feasible and capable of improvement.

2. Existing plans: In order to identify existing proposed projects and policies for sustainable development of the LUH campus, we researched information about future ideas and plans of the LUH and te Hannover Region. These documents included the Hannover Master Plan and Integrated climate protection concept of the LUH. In addition, we contacted public actors, university experts, and representatives of Students for Future.

3. Workshop: On Dec. 9, 2019 from 9:00-15:00, we, eight students, participated in a Geodesignhub workshop under the direction of Dr. Hrishi Ballal. Prior to the workshop we used Geoforage to input diagrams for each system and continued to develop projects and policies during the work shop that would enhance the sustainability in the campus. In two groups, 'Students for Future' and 'Business and commerce', we developed two designs using the projects and policies. The two groups then negotiated a consensus about a final design which represented the 'early adopter' scenario. After the workshop this scenario was reviewed and adjusted.


Photo: Barty Warren-Kretzschmar


Photo: Antonia Kachel

4. Scenarios: The projects and policies of the 'early adopter' scenario were set up in a timeline from 2020 to 2050 in Geodesignhub. For the 'late adopter' scenario, we then shift the start of the timeline to 2035, i.e. the projects that were implemented in the last 15 years of the 'early adopter' scenario were not included in the 'late adopter' scenario. Finally, for 'non adopter' scenario, we concluded that no project were completed. We then looked at each scenario and their impact on sustainability according to the Sustainable Development Goals.

Non Adopter 2050

How do Scenarios address Sustainable Development Goals?

Under the canopy of the 17 large SDG's, this projects touches many of them, however the effect is often rather neutral or small because the site is only 10 x 10 km. More specifically:

- The goals (1) No Poverty & (2) Zero Hunger are not a focus of our scenarios as Germany is a highly developed country that is not as affected by these issues as other countries. However, the systems AGR and IND do affect the goal, for example, by providing more sustainable solutions for crop production that people all over the world could benefit from.
- (3) Good Health and Well-being is highly influenced by our scenarios because many of the systems include projects and policies that will improve the health of many people. Reducing carbon emission by carbon sequestration and a low-emission transport system will immediately improve people's lives.
- By proposing lectures about certain sustainability challenges at LUH, we tackle the goal (4) Quality Education.
- Goals (5) Gender Equality, (10) Reduced Inequality, (16) Peace and Justice Strong Institutions and (17) Partnership to achieve the Goal are not influenced by any of the systems as the concept of IGC does not adress these goals.
- (6) Clean Water and Sanitation is affected by WAT and GRN and AGR as these will ensure clean groundwater, essential to human life.
- By suggestion the installation of solar panels on more and more LUH roofs, the SDG (7) Affordable and Clean Energy will be met.
- The broad categories of (8) Decent Work and Economic Growth and (9) Industry, Innovation and Infrastructure are influenced by most of the scenarios as they included a broad spectrum of projects related to these SDG's.
- SDG's (11) Sustainable Cities and Communities, (12) Responsible Consumption and Production and (13) Climate Action are the ones that play the biggest role our scenarios. The main goals of this project is to create a consensus for a sustainable future campus .This shows why the SDG's are so intertwined with the scenarios.
- (14) Life Below Water and (15) Life on Land are surely affected by our scenarios in one way or another, especially goal 15. The biggest effects can be seen with GRN and AGR.

Sustainable Development Goals	Early adopter											Late adopter											Non-adopter										
	WAT	AGR	GRN	ENE	TRAN	IND	INST	RES	CARB	BIKE	SUM	WAT	AGR	GRN	ENE	TRAN	IND	INST	RES	CARB	BIKE	SUM	WAT	AGR	GRN	ENE	TRAN	IND	INST	RES	CARB	BIKE	SUM
1: No Poverty	0	1	0	0	0	1	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	1	-1	0	0	0	0	3	0	0	0	0	2
2: Zero Hunger	0	1	0	0	0	1	0	0	0	0	2	0	1	1	0	0	1	0	0	0	0	3	-1	-1	0	0	0	1	0	0	0	0	-1
3: Good Health and Well-being	1	1	3	0	1	0	0	1	3	3	13	1	1	3	0	1	0	0	1	3	1	11	-3	-1	1	0	1	0	0	-1	-1	-1	-5
4: Quality Education	0	0	0	1	0	3	3	1	1	0	9	0	0	0	1	0	3	3	0	1	0	8	0	0	0	0	0	1	1	0	0	0	2
5: Gender Equality																																	
6: Clean Water and Sanitation	1	1	1	0	0	0	0	0	1	1	5	0	1	1	0	0	0	0	0	1	1	4	-1	-1	1	0	0	-1	0	0	-1	-1	-4
7: Affordable and Clean Energy	0	0	0	3	1	1	0	3	1	1	10	0	0	0	3	0	0	0	0	1	0	4	0	0	1	-3	0	-1	0	-1	1	0	-3
8: Decent Work and Economic Growth	0	1	1	1	3	3	3	0	0	0	12	0	1	1	0	3	3	1	0	0	0	9	-1	0	1	0	1	3	1	0	3	0	8
9: Industry, Innovation and Infrastructure	1	1	0	1	3	3	1	0	-1	1	10	1	1	0	1	3	3	0	0	-1	0	8	-1	0	0	-1	3	3	0	0	0	0	4
10: Reduced Inequality																																	
11: Sustainable Cities and Communities	1	3	3	3	1	1	3	3	3	3	24	0	3	3	3	1	1	1	1	3	1	17	-1	1	1	-1	-1	-3	-1	-3	-3	-1	-12
12: Responsible Consumption and Production	0	3	1	1	0	1	3	3	1	1	14	0	1	1	1	0	1	1	1	1	0	7	0	0	0	-1	-1	-3	-1	-1	-1	0	-8
13: Climate Action	0	3	3	3	0	0	3	3	3	3	21	1	3	3	3	0	0	1	0	3	1	15	0	-3	-3	-3	0	-1	-1	-1	-1	-3	-16
14: Life Below Water	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	-1	0	0	0	0	-1
15: Life on Land	3	1	3	0	-1	0	0	0	1	3	10	1	1	1	0	-1	0	0	0	1	1	4	-3	-1	-3	-3	-1	-1	0	0	0	-3	-15
16: Peace and Justice Strong Institutions																																	
17: Partnerships to achieve the Goal																																	
Most beneficial / Beneficial / Neutral / Detrimental / Most detrimental																																	
SUM	8	16	15	13	8	14	16	14	13	16	133	4	13	14	12	7	13	7	3	13	6	92	-12	-6	-1	-12	2	0	-1	-7	-3	-9	-49

SDG's most effected by scenarios

Scenario sources

The intent of this project was to develop a future scenario for a sustainable LUH campus, starting with ideas and proposals for future development that have already been proposed. The projects and policies used in the scenarios have been derived, for the most part, from the following sources:

- "Masterplan Stadt und Region|100% für den Klimaschutz" (Klimaschutzleitstelle Hannover, Fachbereich Umwelt und Stadtgrün, 2014): that addresses the implementation of the Energy Transformation that affects the sectors: power supply, space and mobility, energy efficiency of buildings, economy, regional economic cycles/waste management and climate neutral everyday.[1]
- "Integriertes Klimaschutzkonzept (IKSK)" (LUH, 2017): which focuses on the energy infrastructure, approaches for saving CO^2 emissions and three potential future scenarios.[2]
- Postulations (FridaysForFuture Hannover, 2019): twelve demands addressed to the city and region of Hannover in August 2019. They address factors of the city traffic, energy, buildings, nutrition and agriculture, education and participation as well as the economic system.[4]
- "Masterplan Mobilität 2025" (Landeshauptstadt Hannover, Baudezernat, 2011): that gives a concept for the development for mobility sector in the city of Hanover by 2025. Value targets are road safety and integrity, integrated and sustainable city and traffic development as well as mobility opportunities for everyone.[5]
- "Klimaschutz im Überblick. Klimaschutzbericht der Verwaltung der Region Hannover" (Region Hannover, Klimaschutzleitstelle, 2018): which is the climate protection report for the region of Hanover, that surrounds the city. Therefore, it gives a bigger scale of view on future development, especially on the climate scenarios.[3]


Photo: Barty Warren-Kretzschmar


Photo: Barty Warren-Kretzschmar

Non Adopter Scenario

The 'Non Adopter Scenario' does not implement any of the innovations to become climate neutral. As a result, climate protection goals will not be reached.

Current demographic trends will lead to reduced household size, increase of living space per person and the migration of people to the city.[4] In response, for new buildings in urban areas will have to be built, which can cause a decrease green spaces and a negative impact on habitat networks.
The future trend is towards a service and knowledge society.[4] For an aging population, new institutions for retirement and health will be needed. Only few buildings will use renewable energy.
Individual motorized transport increases, because needed investments in public transportation and non-motorized transportation systems are not made. For the LUH, this means an expansion of car parking spaces, no shift to electric cars and no development of bicycle networks and unmotorized passenger transport.
Technical measures reduce GHG emissions from agriculture.[1], but not as much as needed for climate neutrality, and carbon emissions are not compensated. Even though more frequent flood events are predicted.[5], the necessary flood protection will not take place.

Conclusion

To conclude, the scenarios illustrate the urgency of acting as soon as possible in order to achieve the SDGs and develop a sustainable LUH campus. Acting early could also raise awareness about climate-related measures and motivate more people and companies to start acting more sustainably. However, the positive changes found in the 'early adopter' Scenario require that everyone, including the industry, work together.

- BIKE and TRAN can play a major role in connecting the campuses and reducing emissions that is needed to tackle climate change. A low-emission public transport network is indispensable.
- AGR, CARB and GRN will play an important role at protecting biodiversity and compensating the effects of climate change on both a local and regional level.
- ENE will define how we produce energy in the future and how sustainable we can make it to meet climate change issues.
- WAT will show how well we can cope with consequences of climate change that are in full effect already, like a higher risk of floods.
- IND, RES and INST will show new ways on how to make working, business, learning, researching and living even smarter than we would know for now.

Sources:

1. ARFF,R. et al.,2013:Endbericht.Masterplan 100 % für den Klimaschutz.Auf dem Weg zu einer klimaneutralen Region bis 2050.REGION HANNOVER und LANDESHAUPTSTADT HANNOVER(Hrsg.),136S.,Hannover: Region Hannover.
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3. REGION HANNOVER,2018:Klimaschutz im Überblick.Klimaschutzbericht der Verwaltung der Region Hannover.Nr. 154 - Beiträge zur regionalen Entwicklung.107S., Hannover: Region Hannover.
4. STUDENTS FOR FUTURE HANNOVER, 2019:Anträge von Students for Future Hannover an die Studentische Vollversammlung.35S.,Hannover
5. van ZADEL,E.,LEIDINGER,T.,GERSTENBERGER,T.,2011:Broschüre-Masterplan-Mobilität-2025.BAUDEZERNAT LANDESHAUPTSTADT HANNOVER(Hrsg.),81S.,Hannover:Landeshauptstadt Hannover

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