



# Report for the Marshall Plan foundation

Topic: Research on the advanced use of renewable energy systems in  
retrofitting existing urban neighborhoods

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## INTRODUCTION

Within this report, an overview of the research stays at Cornell University from 11/07/2016–10/01/2017 will be given. Methodology of the work shall be described and results compared to the European case studies previously undertaken for this PhD (Austrian cities and their experiences) and sets of motives and certain preliminary results of this.

An introduction to U.S. case study of the post-industrial city of Utica, New York will be given and parts of the general report on its sustainable redevelopment made by the team at Cornell, presented.

For better understanding of the project in Utica, a historic overview of its development, missed opportunities in city planning and urbanization as well as architectural heritage that needs to be preserved, shall be presented within the introductory part of the case study explanation. It is also important to touch on theories of planning and their comparative relevance to Utica and European cities. For these purposes, a current state of the art in Austrian cities, their genesis and treatment of the problem of redevelopments and green thinking is provided in the report's second section.

Finally, preliminary results of individual expert interviews will be presented and compared. Important to note is the context of the whole research within the general knowledge on urban planning and latest developments in the field. Therefore, learning and outcomes of the conferences attended during the stay will be discussed along with suggestions for further material and the raising of research questions subsequent to the Cornell stay. The value of the stay relative to international and inter-field cooperation in contemporary urban renewal projects will be emphasized.

*Thanks*

*I would like to thank my supervisors for their help with my stay and for reading this report and giving their valuable commentaries and suggestions. I also wish to thank my PhD peers at the Energy Institute for giving me friendly advices on the Utica project, on the presentations of my work and Cornell University's helpful staff and faculty for making my research possible, as well the University itself for hosting me and assisting me in accessing high quality literature resources and valuable lectures throughout the campus.*

*I also thank the engineers at City of Utica Town hall for organizing my presentation, all interviewees for giving me their opinions and last but not least, Marshall Plan for supporting my stay at Cornell.*

# 1. PREVIOUS CONCLUSIONS ON EUROPEAN CASE STUDY CITIES EXAMINED PRIOR TO U.S. Case study analysis

Within a period of approximately one year before starting research in the U.S., there was an initiation of research on Austrian towns and cities and their historic and current use of geothermal resources and other sustainable energy and development initiatives. The aim of the research is to understand the current state and, importantly, understand more fully the complexity of challenges and problems these cities are facing as they plan their sustainable urban renewal and development futures. Within this chapter, an overview of the results obtained to date will be given.

## 1.1. Geothermal use in Austria

There are two sides of geothermal use in Austria—district heating and heat pump use. The focus of this chapter presents the district heating supply of towns and cities, while heat pump use, which was not covered in this research phase, will be analyzed in the latter case study of Utica, in the U.S.

Regarding DHS (District Heating System)<sup>1</sup> or GDHS (Geothermal District Heating Systems) utilizations in Austrian towns, a significant number of towns in the Upper Austrian basin currently employ this option for their heat energy supply. They include Altheim, Ried im Innkreis, Simbach/Braunau and Geinberg. In the Styrian basin DHS or GDHS is also used, although mostly for balneology purposes, in Bad Blumau and Bad Waltersdorf. It is also used for facilities' district heating systems and energy production in Bad Blumau and for greenhouse production in Bad Waltersdorf. Radkersburg and Loipersdorf. Proposed use in larger cities like Graz or Vienna has proven to be currently not possible either due to lacking geothermal potentials and/or due to failure to justify, for economic and technical reasons, projects on such a large scale. While larger scale projects are costlier and technically complex, bigger cities with higher and more densely settled populated areas, stand to benefit the most from the use of central heating and cooling. Such cities have high heating and cooling loads, for example, and could be covered by geothermal with high efficiency. (Bucher, 2015) This is the aspect that would need to be further investigated in the planning of the cities. In smaller communities in Upper Austria, where the connection to the geothermal grid is possible and more economically viable, more people are willing to connect and when the community itself is willing to think consciously about its environment and long term future plans. The same applies to large cities, like Vienna, where there is an additional advantage of being part of the larger scale

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<sup>1</sup> DHS stands for District Heating System in general and GDHS for Geothermal District Heating System

structure. In this sense, different neighborhoods could benefit from each other's energy use patterns, by examining energy supply and demand within different neighborhoods. This means a lot of coordination and thinking in terms of the smart city projects, as shown in case studies about energy use in Vienna's new development district (U. Mollay, 2016).

## 2. UTICA CASE STUDY

### 2.1. Historical circumstances and their connection to the urban development of Utica

The city of Utica, NY is an urban environment that has a long history of architectural and urban evolution. Its first non-native settlers were recorded in the 1780s and included pioneers from New England who began moving west into the Mohawk Valley at that time. The population grew to 2000 in the early 1800's but was still lagging behind other settlements that had the necessary hydropower for industrialization purposes. This is why Utica's early history is principally based on the craftsmanship of its inhabitants and the trade and exchange of goods and services. Following education establishment, and the Erie Canal construction had begun and this important canal, with its Utica-Rome navigable segments in operation by 1819 and the entire 363-mile-long canal connecting the Hudson River and Lake Erie complete in 1825, figured prominently in Utica's urban development and expansion (Donald F. White, 1998) (City of Utica, Scenic and historic preservation commission, 2003).

### 2.1. Determination of the architectural values for sustainable re-development of Post-Industrial cities- Mainstream of modern planning present in NYS cities

There is hardly any other city in central New York where the genesis of different architectural styles could be examined and explained. In terms of planning, Utica has dramatically evolved from a place surrounding the Old Fort Schuyler to expanding along the Erie Canal, Oriskany Street and Genesee Street to a city with an extensive Olmstedian park system. It is unfortunate that the period of urban renewal and the building of highways— the NYS Thruway and north-south Arterial in particular— both stimulated urban sprawl and development outside the city, but also disturbed and destroyed much of the inner city itself. Surrounding Utica nowadays are “strip-developments” and malls while the downtown, albeit well-poised and showing signs of renewal, is merely a shadow of its former self. The impacts of many decades of decline are everywhere visible and an enduring mentality biased towards cars and automobile dependency compounded with underused, underpopulated and inactive downtown core, presents challenges to revitalizing the city core. Disused and disturbed urban areas, with gaps and vacancies in the urban fabric, lack urban integration and interconnectivity, appear unfriendly

pedestrians and cyclists, and are experienced as unwelcoming and unsafe. Utica, like many other American cities and some in Europe as well, post WWII, bears the burden of a complex set of dynamics that contributed to its decline and loss of economic, social and environmental vibrancy and vitality over many decades.<sup>2</sup>

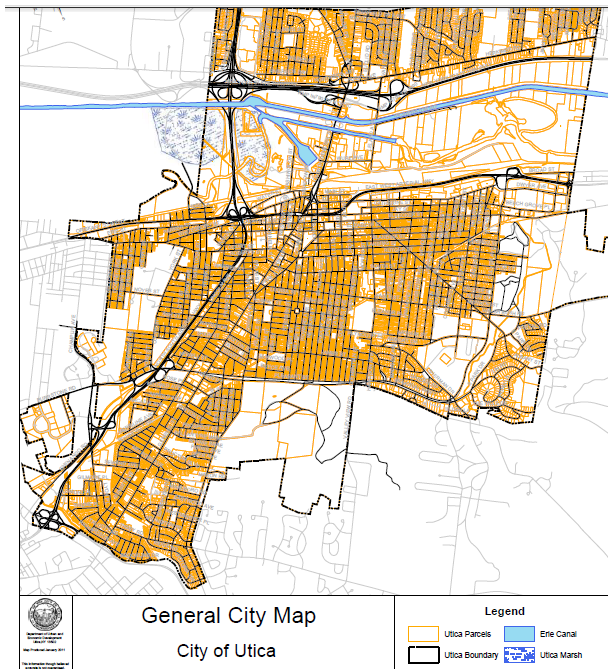


Figure 1 General City Map of Utica, City of Utica, [www. http://www.cityofutica.com](http://www.cityofutica.com) , assessed 1/8/2017



Figure 2 Stanley Theater, one of the buildings included in the redevelopment suggestion made by the team at Cornell

<sup>2</sup> Urban strip developments are mentioned usually in a negative context and being criticized by contemporary urban planning literature, and are especially contradictory to planning that favors green thinking in cities, mixed use and that promotes urban diversity, rather than segregation and strict zoning with mono-uses of land, that lead to urban sprawls and mistakes cities are faced with by incorrect urban processes

## 2.2. UTICA's response to urban renewal changes

### 2.2.1. Project report: an adaptive approach and analysis to sustainably transform Utica's Urban Core

Decades of urban sprawl<sup>3</sup> and focusing on suburbs and Greenfield's as prime areas for development and settlement, by planners, developers and the culture itself, helped secure the abandonment of and the turning of attention and investment away from the inner city of Utica. In spite of its losses, Utica has endured and today is witnessing an upturn in its population as indicated by the last census where the city's population actually grew for the first time since the 1950's when its population began its downward trend. Growing numbers are a positive indicator that people are seeking for urban lifestyles and what a city has to offer. As a United Nations refugee resettlement city Utica has become known, it's the last 30 years, as a city accepting and supporting refugees escaping from war ravaged countries. New immigrant populations are on the rise in Utica due to influxes of people from Somalia, Bosnia, and other African and Latin American countries. The Mohawk Valley Resource Center for Refugees (MVRRCR) is a significant agency and center of refugee resettlement in Utica and the neighborhoods and area around the center in downtown Utica, are seeing revitalization related to housing and small business development in particular. The population's diversity is a contributing factor to changes, as the new immigrant populations are also seeking and taking advantage of the services and amenities urban life provides—education, transportation, jobs, housing, cultural and civic resources— as well as the communities and support systems—churches, religious and social groups— they desire and rely on to become integrated in the community. Affordable properties and access to social services are also providing new opportunities for immigrant populations.

The project report that addressed these and other options for urban renewal of Utica, has been compiled by the Cornell Team (A. George, 2016) consists of two parts: Analysis of Sustainable development potential and suggest models for the next 5 years that can be further elaborated, in the second part. In this report, a short outline of the first part of the work group report will be given, as it contains important input for the qualitative analysis carried out within the expert interview chapter and for getting current information for my own research and contribution to the team at Cornell University.

I was part of multidisciplinary team of researchers at Cornell University from different fields (Systems, Chemical and Mechanical Engineering, Landscape Architecture, Biological and Environmental Engineering, Geological Sciences, City and Regional Planning and Architecture). A key goal of the team was to develop a system model for feasible urban development of Utica. This was done by suggesting a representative, small-scale initial project in the city center, in the area that includes Stanley theater(Landmark), Baptist Church, vacant parking spaces around it and a couple of commercial objects and individual housing (one-family). This multi-block area was the subject of the analysis. The overall objective was to design (1) systems for solar and geothermal energy capture, (2) a district heating system, and (3) green infrastructure projects, that could be implemented to enhance the sustainable

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<sup>3</sup> Urban sprawl refers to a phenomenon of cities spreading uncontrolled, consuming large land surfaces and by this process creating large commuting areas and inefficient and large infrastructure needs, that could otherwise have been stopped by careful planning, diverse neighborhoods with mixed-use and to some extent, densifications

aspects, attractiveness of the inner city including its economy and serve as a model for re- development of the city's core.

### 2.2.2. Conducting an LEED-ND Audit comparable to other standards in Europe

Another aspect that was analyzed in the Utica project, was how LEED- Neighborhood Development (ND)<sup>4</sup>, supports the idea of urban renewal. The emphasis was on:

- Smart Location and Linkage (SLL) and neighborhood pattern and design(NPD), both of which deal with: walkability, public transportation and other alternatives to car use, access to diverse services, spaces for recreation and community gardens etc.
- Green infrastructure and Buildings (GIB). This includes upgrade of green infrastructure in Utica (parks, remediation of a huge number of vacant parking lots) and refurbishments of the deteriorated and unused buildings to save energy. It also includes the use of natural resources and energy, reduction of the urban island effect<sup>5</sup> and storm-water runoff.
- The social paradigm within LEED-ND is that sustainable communities and neighborhoods significantly contribute to the formation of sustainable cities and societies in general, because they have an inviting character, with public spaces, favorable modes of transit options, access to pedestrian and bicycle infrastructure and ease of move-in and out of their urban matrixes

It is important here to mention the way in which a LEED-ND project was audited. There are metrics in each of the categories mentioned above. They are summed up with specified weighting factors to give a final project score. Based on a predetermined point system, certified projects score ranged from 40-49, Silver projects from 50-59, old projects from 60-79 and Platinum from 80-106.

The reason for using this evaluation system for Utica, is the belief that redevelopments in the city can have larger impact and be targeted to specific aspects, if they can be compared to some preconditioned criteria. These criteria are given by LEED-ND in its concept and this methodology was used throughout the analysis. Several previous models of neighboring cities to Utica have been used to pre-assess the possibility of using LEED-ND in Utica, which proved to be adequate for this type of cities (post-industrial heritage Rust Belt cities in decline).<sup>6</sup>These earlier reports show that the urban cores of the neighboring cities show significant potential for improvements of urban life, sustainability and livability, even though they currently do not meet even the minimum scores required for LEED-ND certification.

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<sup>4</sup> Standard developed by the U.S. Green Building Council and that is comparable with many European standards, such as BREEAM (UK). They all share similar strategies for addressing sustainable urban neighborhoods' role as key factor in urban renewal of neighborhoods within cities

<sup>5</sup> Urban island effect is created around the cities when pollution contributes to the level of CO<sub>2</sub> and where temperatures are measured that tend to be high in comparison to its suburbs. The so called "heat" island forms, that influences the city's microclimate and livability by reducing quality of the living environment

<sup>6</sup> SALT (Syracuse Art Life and Technology) District in Syracuse, NY, neighboring city in NY to Utica, was precedent for the analysis. It was done in 2008 (Raimi+Associates, 2011)



As a starting point of our study, Utica also lacked LEED-ND certification. Initially we evaluated which aspects, and progressive measures would be most effective, in order to achieve a maximum possible number of points in the future. An area of 19 ha in downtown Utica was chosen, because it is a representative downtown section of the city, that could be a catalyst for urban transformations in the city's core. An increase in downtown activity demonstrates the capacity to build on the larger scale projects and city's planning rethinking, which the city needs. If done correctly, redevelopment should increase the LEED-ND score.

According to our analysis, in the Smart Location and Linkage, project acquired 5 out of 28 points, on the basis of favorable terrain without slopes and floodplains, having low public transportation credits and no bicycling infrastructure, despite the proximity to services and shops. An opportunity for Infill development (housing and jobs proximity) was also noted as a way to contribute to achieving more LEED-ND credits in the future.

In the sub-category of ***neighborhood pattern and design (NPD)***, the points given were 12/41 possible. Notable was the presence of vacant lots and surface parking, even though the area had good housing diversity and higher density in comparison to other parts of the city, and had access to services, parks and communal and local food production markets and shops. The grey highlighted section of infrastructure can be improved, because even though pedestrian traffic is eased by sidewalks, car speeds are not regulated and signalization is often not adequate in the pedestrian street areas.

Bordering the area examined or within it, there are almost 5 ha of green recreational land, that contribute to the points given in the audit process. However, even though public recreational amenities within those parks exist, they are difficult to access by foot (poor roads, lack of sidewalks etc.). With 3200 sq. meters of food production dedicated space and vicinity of restaurants and the Farmer's Market Utica, the area performs well. The FAR (Floor Area Ratio)<sup>7</sup> for non-residential buildings is 1,02. There are 56 residential buildings and 39 non-residential ones. There is a high diversity score in housing.

Parking is important to analyze and understand, as it forms the way neighborhood design is addressed properly. For example, more public spaces could be achieved with re-organization of the existing ones in Utica. Increased public areas makes neighborhoods more attractive, and with well-articulated urban design qualities can go hand-in hand with the creation of safe environment for its inhabitants. This integrated feature is one of the prime postulates of LEED-ND auditing, mentioned and emphasized as a methodological approach by Cornell team's Utica project report. (A. George, 2016). Also, creating walkable streets adds to the overall quality in auditing requirements. Transit facilities, such as bus stops, serving different parts of the city, regularly and being located in the proximity of the analyzed area, play a significant role within auditing. Also compact development or re-developments of the existing areas are worth mentioning as a possibility for the future. Infills when possible are one way of achieving compactness. Another approach is to reengineer or rebuild poor housing and/or commercial vacancies for habitation and in this sense, lead to more people living downtown and enjoying the proximity of services as well as walkable streets and

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<sup>7</sup> Floor area ratio is determined by dividing square footage (included are all floors of the building structure) with the square footage of the site where the building is situated. <https://www.reference.com/math/calculate-floor-area-ratio-13c1cf1fd5fd1d39>

different amenities. Because such densely populated areas of NY State cities are commonly found, this approach could again serve as a model for the state.

**Green infrastructure and building (GIB)** principles used in the auditing process (LEED-ND), are of high importance for the aspect of urban analysis, which emphasizes renewable energy use, examined during my research stay. According to the report (A. George, 2016), only two points are achieved out of possible 28, in this category in Utica.

Green building certification is lagging considerably, as only few buildings in Utica have been certified by U.S. Green Building Council. Possible room for improvement exists here, whereas 5 points could be acquired in the future, instead of zero at the moment. Energy efficiency is one of the following criteria that needs to be addressed in the future in Utica. Luckily, Utica has strong building infrastructure and lots of vacant buildings, that can be transformed into dwellings or offices and used to an extent, where there should be no need for unnecessary new construction.

In the area where sustainable design is being promoted, there has been a strong potential for using more renewable energy. By coupling geothermal energy, district heating and solar energy resources in an integrated fashion, the potential for achieving energy independence is exploited. Additional value of the research is the tools and methodology being developed by the team at Cornell. These help in evaluating different scenarios for building retrofitting, while at the same time optimally locating and utilizing ground source, geothermal heat pump systems, district heating and solar panel technology. The results of our analysis can be applied in the future to other locations in Utica and the state that are in need of refurbishments and urban redevelopment, with minor adjustments of some parameters, such as solar irradiation, costs that may change during time, specific location climatic conditions etc. (A. George, 2016)

### 2.2.3. Conclusion and recommendations of the work-group Report on Utica

In our redesigned section of Utica, the total number of points given for all three major categories within LEED-ND audit, was 18, out of possible 98. As a result, there is still significant room for improvement. To achieve a more of sustainable neighborhood as measured by the LEED-ND, will require additional changes. In any case, using these principles as a guide for redevelopment the area will see a much brighter future. By strengthening the fabric of Genesee Street (main artery of the neighborhood and one of the most important streets in the city, especially for walkability and pedestrian and biking traffic). Furthermore, retrofitting the NEW Century Building using an energy efficient design serves as a model for other refurbishments of heritage buildings in the city. Increasing service densities in the area, allowing for transport improvements, contribute to people actually re-settling in the area. Then, next step would be, transformation of empty spaces, parking lots, to improve grey infrastructure to allow more bike lanes, increase walkability and livability of the city core area. Finally, reclaiming large park areas (Park Avenue), landscape projects (One World Garden) and connecting them to the existing neighborhood ideas, all support the above mentioned measures and can and should go hand-in hand with them. Increasing safety of traffic and pedestrian

movement within intersections is also important. In terms of social cohesion, providing different housing types (rental, municipal owned dwelling, privately owned housing) will create additional value.

The neighborhood's identity plays an integral part in urban renewal ideas. Creating urban identity is important for improving as well as maintaining the city's character. Many cities throughout the world have adopted similar approaches for their planning redevelopment. Making reference to them is important for understanding the benefits of development of these scenarios for Utica as well. There are things one can learn from analyzing the outcomes of this planning for the future of green cities in general as well. A good example is the city of Reykjavík (Iceland). The Master plan 2025 Reykjavik supports the ideas of mixed-use developments and densifications, as prime source of pollution in the city comes from negligence of the effects of the urban sprawl in the rapid development of the late 20th century Reykjavik.

*As mentioned in Reykjavik Municipal Plan 2010-2030 (City of Reykjavík, 2014), the plan sets out where future residential and employment areas would be, defines basic planning and design principles and encourages development of dynamic commercial activities in the city, being part of the capital region. Its propositions, especially encouragement for a necessity for Capital region of Reykjavik to encourage a diverse supply of housing and housing options are founded on studies and the facts. For example, the population of Reykjavik is set to be 143,000 in 2030, which is 39 % of the total estimated population of Iceland in this year. Because the growth of the population is going to take place and especially in the capital region and in the city of Reykjavík, more jobs would be needed and therefore more housing options that would be able to accommodate a changing population. It is estimated in the plan that this will affect the urban structure of Reykjavik as well. Some of the scenarios for the city are being developed, some of them thought to bear more responsibility to the sustainable development of the city than others and therefore are suggested as guiding principles in city's urban planning in the future and its development in the years to come.<sup>8</sup>*

In Utica, a master spreadsheet will be formed, to study "what if" scenarios, similarly to Reykjavik's master plan. The aim is to help different stakeholders in Utica (Planners, city hall officials, funding bodies and companies, to understand the best options for integrated redevelopment. The specific attributes that will be offered within these scenarios provide measurable economical, societal and environmental benefits nature for Utica.

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<sup>8</sup> For more information, smart city projects can be found on the websites: <http://www.smart-cities.eu/>

### 3. WORKING ON A PROBLEM AND EXPLANATION OF THE TOOLS USED: Methodology of the research within the U.S. case study (within the general frame of the dissertation and how Utica Case study is connected to it)

#### 3.1. EXPERT INTERVIEWS ON GEOTHERMAL ENERGY USE IN THE U.S.

##### 3.1.1. Interview sample

Eleven people interviewed in the U.S. (NYS)

City of Utica:

- two (2) interviews in City Hall (engineer and economist/economic development specialist)
- two (2) interviews in the Resource Center for Independent Living-RCIL- (NGO) and private brewing company (commercial)

Mohawk Valley Region surrounding Utica:

- one (1) regional development official, based in the neighboring city of Rome (NY)

State of New York:

- (3) Three interviews on geothermal practical utilization from companies based in New York State
- (1) One expert interview with a geothermal company specialist, outside of NYS (based U.S. wide)

Cornell University | Academia:

Three expert interviews at Cornell University (academic person (1) and facility manager of the heating/cooling system (1)) and one guest speaker from Iceland (1) who was cross questioned by the students on geothermal energy utilization technology, case studies and its relation to grey infrastructure and building use aspects from his/her experience as an engineer from the leading geothermal company in the world.

All totaled there were 12 (twelve) interviews completed with 11 conducted in person and 1 being a shared brainstorming on geothermal. Mixed backgrounds of the interviewees is present (biomolecular engineering, mechanical and environmental engineering, civil engineering, economics and civil engineering, public administration specialist (educated in Utica), conservation specialist (architectural faculty), public accountantship specialist (educated in Utica, working as CAO<sup>9</sup>), degree in business (industry specialist, based in Utica)).

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<sup>9</sup> CAO Chief Administrative Officer

### 3.2. Lectures on geothermal attended/ Information that go over the frames of the PhD gathered

The stay was fruitful, as Cornell hosted a leading geothermal expert (Thorleikur Johannesson) on October 16<sup>th</sup>, 2016<sup>10</sup> who offered two sets of lectures and workshops with students attending.

His company Verkis<sup>11</sup>, involves geothermal experts from and is a top company in the world that has extensive experience with geothermal energy utilization. It was valuable to participate in these sessions and engage in the dialogue and questions that emerged on geothermal energy aspects. Such benefits would not have been derived a single talk. In summary, learning and main conclusions derived from these events includes the following:

China is the largest world dominating geothermal energy user. One lecture given by the expert mentioned above deals with geothermal projects in China. The lecture was about how Chinese cities are newly being build and developed and/or are being refurbished with the use of geothermal. New cities, being made from the ground up, are being designed with geothermal for district heating energy supply. Several factors have played a decisive role in China's move to adopt geothermal throughout their country. Among the key reasons for geothermal is the need for pollution reduction, a problem that is facing many Chinese cities including Beijing. China's growing economy and its rapid growth of cities is requiring it to cut down on CO2 emissions and this is a second reason given for adopting and developing geothermal energy. CO2 emissions are becoming a serious economic factor and their reduction and elimination is also being recommended by various World protocols. The implications are valuable for further research on the topic, beyond the PhD frames at TU Graz and the Cornell research stay.

Knowledge dissemination beyond NYS and Cornell's academic environment was another important part of the research stay. Together with my supervisor Jeff Tester, we decided to plan two trips that would support my research. The first trip was to Rochester, NY (October 6<sup>th</sup>, Dutton Properties Geothermal Project presentation, Factory District Rochester) and involved my attendance at a geothermal press conference, where NY State's Senators addressed the issue of geothermal utilization taxation and its implication for geothermal experts in the state. A petition was signed, directed to NYS Governor Andrew Cuomo for the continuation of the geothermal tax waiver in NYS.<sup>12</sup> The experts with whom contacts were made at the conference included mechanical engineers and owners of commercial projects that have started using geothermal in their buildings for cooling and heating. Participation in this convening helped me to begin building a network of interviewees and to confirm my research's relevance with the sample.

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<sup>10</sup> More about these events can be found at Cornell's presentation, available at: <http://phys.org/news/2016-10-nixing-coal-iceland-green-geothermal.html>

<sup>11</sup> This information was gained in one of the first lectures at Cornell University on geothermal energy given by Thorleikur Johannesson. [www.verkis.is](http://www.verkis.is)

<sup>12</sup> More about the petition and the joint initiative by geothermal companies can be found at : <https://www.nysenate.gov/newsroom/press-releases/robert-g-ortt/state-senators-geothermal-installers-and-advocates-call>

While doing first interviews with experts, it was not clear if that what they were telling me about taxation, politics has anything to do with my consideration of geothermal for cities. However, after going deeper into understanding the way a city like Utica functions, I saw the relevance of the first interviews taken and have similar views by almost all of the experts,

The results of the interviews can be found at the end of this report, in the expert interview section. The second trip to a conference in Toronto, Canada is discussed in the following section.

### 3.3. Conferences/ Interaction with stakeholders and experts outside of given methodological approach

One conference participation with the poster on geothermal energy use in cities with discussions from the experts from Austria, Europe- ARIT 2016

As mentioned in the expert interview/introductory part of this report, there has been lack of sample from Europe, as it was not clear what is the current state of things in Austrian projects in other parts of the world. There was a poster presentation<sup>13</sup> entitled “Geothermal energy as a generator of urban re-development of the cities in Europe and in the U.S. “, made by the author at the Austrian Research and Innovation Talks (ARIT 2016) in Toronto, Canada (October 21<sup>st</sup>-October 22<sup>nd</sup>, 2016 at the Burroughs, Design Exchange and the Hart house of the University of Toronto). The poster was supported by the research group’s professors at Cornell, with the purpose of:

- 1) Presenting results of the research of all four case studies (Utica, Nis, Braunau/Simbach/Altheim and Reykjavik) to Austrian scientists in the U.S and in Canada
- 2) To gain feedback and information on the actual problems and issues in the Austrian scientific world
- 3) To gauge interest in the topic of geothermal and identify areas for further explorations during the stay at Cornell University

There were several conclusions drawn from the conference and poster presentation. First, the Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT) has been involved in several projects in Chinese cities that include geothermal utilization and innovative technology. There is a growing market, where Austrian and American know-how can be exported, as mentioned by the experts from the ministry. Katja Schechtner (professor in the field of culturally sensitive use of data and technology), from the MIT Media Lab in Boston, Massachusetts, spoke about the role of social sciences in urban planning and big data issue. (Schechtner, 2016) In a personal communication at the conference with the author, she pointed out towards the modeling the urban redevelopment of cities as the only possible aspect that can be done at the moment by science, with practical applications of the theories to be transferred in to real life projects, still to come in not so distant future for cities.

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<sup>13</sup> /<http://www.ascina.at/poster/> More about the whole event available at: <https://arit2016.splashthat.com>



Figure 3 Part of the panel discussion with Katja Schechtner talking about the problem of data within holistic methods 'realm, her lecture at ARIT 2016 and my exchange of opinions with one of the representatives of Open Austria, source: [ox.com/sh/kcba4tynsb9tk9a/AACPeb7zrkW4YxyZ-Of1HhkPa/02\\_ARIT%202016%20-%20ARIT%20Conference?dl=0&preview=ARIT-0018.JPG](https://ox.com/sh/kcba4tynsb9tk9a/AACPeb7zrkW4YxyZ-Of1HhkPa/02_ARIT%202016%20-%20ARIT%20Conference?dl=0&preview=ARIT-0018.JPG)

Another important aspect that can be integrated into research on cities, is the “Big data” issue, which was the main topic at the conference, attended by various eminent professors from the fields of humanities, social sciences, technology and economics and by other non-academics from the business, governmental and institutional sectors in Austria. Data generation is very important and much needed and apart from already existing GIS methods, there is the need for new involvement by social sciences in data management and resources management. Finally, relevant to the topic of cities, qualitative research is going to lead the way in the dissemination of new technology applications and management.

## Online conferences attended while staying at Cornell with online participation

Apart from participating as a presenter at the ARIT conference, it seemed necessary to take advantage of being at Cornell by attending conferences from other fields and seeing how those other fields are addressing and engaged in the topics of city and technology. The first conference attended was an online conference organized by the National Academy of Sciences, Engineering and Medicine, in Washington D.C, with the topic: *Data-Driven City Planning and Policy*. The conference moderator was Katherine B. Ensor from Rice University and the presenting speakers were:

- Constantine Gatsonis, Professor and Chair of Computational and Applied Statistics (CATS) at Brown University
- Stephanie Shipp, Deputy Director, Bio Complexity Institute, Virginia Tech University
- Marta González, Hum Net Director, Massachusetts Institute of Technology (MIT). Topic: “Urban Planning in the Information Age”
- Martin O’Malley, Governor of Maryland 2007-2015, Senior Fellow at Metro Lab
- Constantine Kontokosta, Center for Urban Science and Progress, New York University (NYU), topic: “Urban Informatics and Data-Driven Decision Making”

Conclusions drawn from the conference are elaborated below:

Strong governance seems to be a driving factor in sustainable urban planning. Data management and technology use can help in the decision-making process. Social sciences are insufficiently involved with the ways in which huge data in cities will be processed and used. It is one of the questions raised by the audience.

Urban planning in contemporary times is influenced by smart demand management, transit systems, user data, digitalization levels that help get useful data for city planning. Case studies of large cities were investigated, in terms of “big event feasibility” in order to implement these principles for the air quality in congested cities. To transmit the transportation policy to pollution prevention policy of big cities. (Chinese cities, Beijing is an example). The role of affordable housing placement based on the big data analysis and processing into information suitable for planning was examined as a case study mentioned by M. González. This example is large enough to be a large city in Central America, which advocates the importance of proper urban planning with all means available. Modeling was the prime goal, whereas optimization still remains an issue and will be considered in future research. In addition, the researchers hope to generate a unique data management system (search engine) that can be beneficial both for use by governmental institutions that run and manage cities as well as by citizens and private companies. Public-private partnerships can help ameliorate the sprawl, proven to be negative by this data analysis method’s presentation (National Academy of Sciences, Engineering & Medicine, 2016). The models described in this work should be applicable for both American and European urban planning.





## Panel Discussion: Part 2

More from Data-Driven City Planning Symposium

Figure 4 Print screen from the conference: Data Driven City Planning, Panel discussion with questions addressed at former Governor O'Malley, source: <https://vimeo.com/album/4304169/video/195397739>

Another lecture concerning urban planning and policy was given by M. O'Malley, ex-governor of the State of Maryland and ex-mayor of Baltimore, Maryland. He spoke about the policies that he was involved with while Governor and how these policies related to planning. He spoke about how data connects to practical applicability and decision making and what problems he faced as a governor, interested in the promotion of sustainability as a driver of change in cities. Per him, a decentralized view on governance is important for Americans, as they do not always trust changes on the federal level.

### *Implications of the conference conclusion on my research*

Using geothermal energy and other renewable resources locally, when they are available, can help these processes of city's rethinking and the energy issues that arise with the new millennia, in terms of energy management at the city level and last but not least, speed-up the process of urban redevelopment that follows sustainability standards, for the sake of the global environment. The ultimate conclusion of the conference is that stewarding resources, whether natural or man-made and even digital ones, is important for the future of cities.

### *Utica City hall presentation on geothermal energy research*

On 27.10.2016, approximately at midway through the Cornell stay, I traveled to Utica, NY and explored the city and site where the Sustainable Communities Project and One World Garden is to be developed in the future. Also, we had an overall city journey and visited the city's urban districts in need of future redevelopment or where projects are underway. The area investigated for redevelopment scenarios, containing the Stanley Theater, Tabernacle Church and surrounding city-owned parking lots, is representative of typical urban areas in Utica's downtown that are in well poised for sustainable redevelopment. In addition to seeing the city, the purpose was to visit extant geothermal sites and

applications, to meet with people at those sites, and to also meet with and interview experts in City Hall. As part of the visit I also prepared to give a presentation in City Hall on Day 2.

At City Hall, on Day 2 of the visit, I presented to a group of City Council members and staff representing departments including engineering, planning & development, parks and public works. The presentation profiled my research gathered on geothermal energy use happening in European cities and particularly in Iceland and Austria. This information was possible on the basis of my thorough research on the use of geothermal in Upper Austria and Iceland, finally Serbia, which I had done during my previous PhD research through KUWI program. One aspect emphasized during the presentation was redevelopment with geothermal and the potential to, on a large scale, reimagine cities and city planning around geothermal and green energy infrastructure. While giving information on the state of technology available, a back and forth discussion occurred, where city hall engineers, Cornell Professors and Rust to Green<sup>14</sup> Program experts, were informed on the preliminary results of my expert interviews

The presentation and ensuing discussion allowed the knowledge of the experts and general public, politicians, city hall engineers and different departments in city hall involved in economic development planning, to be acquired and further used during my stay. And most importantly, I gained insight into what other people to contact in order to get the best sample, from New York and the U.S, on the state of geothermal use in cities. After having heard about the geothermal applications in Austria and Iceland the option of geothermal use in the snow-melting was also discussed and suggested by the head of the Department of Parks and Public Works.

### 3.4. The process of research methods' validation at Cornell (IRB)

In order to be able to start the expert interviews in the US and to ensure that the research was ethically correct, a review by Cornell University's Institutional Review Board (IRB) was initiated and submitted. Cornell's was informed about the research methods and materials planned to be used to ensure that they complied with ethical requirements regarding -human subjects. The process lasted almost one month, with e-mails and phone call exchange with the IRB committee. In the end, it was verified that the methods used, even though dealing with human participation as stated<sup>15</sup>, were exempt and did not present the "real interaction with human subjects" in terms of Cornell ethical policies, so it was possible to move on to the next step: data collection, classification and data comparison between the new and previous case studies' data (obtained earlier in Europe).

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<sup>14</sup> R2G or Rust to Green, is a project done by Cornell University, that supports old industrial cities of the United States from the so called Rust belt area, once industrially very active, now with a decline of population and decrease in economic growth, to make them more sustainable and appropriate for living and to draw attention to the use of green technology to do so, more information is available at: <http://www.rust2green.org/utica.php>

<sup>15</sup> IRB defines interaction with human subjects made at or by Cornell staff and students. They have to fulfil criteria of ethical conduct with humans. Even though this was not the case in the preliminary inquiry by the interviewer to the committee, it had to go through the process of validation, so that results could be used by Cornell University

### 3.5. Meetings within the “Utica group” at Cornell University

Every Wednesday for a period of six months, meetings were held with other members of the working team which included Andrea Aguirre (PHD student, civil and environmental engineering), Paula Horrigan (landscape architecture professor), Norm Scott (biology and natural systems professor emeritus), Jeff W. Tester (biomolecular engineering professor and top geothermal research expert in the U.S.), followed by Al George (mechanical engineering professor and an expert in system’s thinking), Sivan Sud (mechanical engineering degree student, involved in calculations of solar systems). There were also several lectures by Michal Moore (economics professor) that were attended by the PhD students, which were followed by notes given to the team by this expert, on how to include economics in the process of project development in Utica and the necessity of cost determinations and pre-calculations for the successful outcome of the project. These opinions given by the expert and analyzed by the team were highly valuable in a team of engineers that do not have the economics background. They helped to better understand the feasibility of the proposed theories on the urban interventions that were discussed for the city.

### 3.6. Earth Energy Seminar participation

Over the course of 12 weeks, I attended and participated, along with students from Snee Hall’s Department of Earth and Atmospheric Sciences and other engineering departments, in the *Earth Energy Seminar* hosted by Cornell’s Energy Institute. A requirement of participating in this seminar was that each of the PhD students affiliated with the Energy Institute was required to deliver a short presentation on his/her PhD research outlining the topic, approach and preliminary findings. Each presentation was then followed by a discussion involving the professors and other colleagues from different fields, mostly connected with geothermal energy utilization. My presentation took place on the 9th of November, 2016, towards the middle of my research stay. I presented the geothermal case studies from Iceland, Austria, Serbia and the U. S. and gained valuable feedback on both the research content and the overall presentation itself.

The seminar was fruitful, because normally architectural research is shared solely among artistic and planning peer groups and PhD candidates at my University. By interacting with mechanical engineering, geological sciences and other technical fields, I was able to exchange knowledge and ideas on the use of technology in urban redevelopment, possibilities for connecting levels of thinking in planning that were not being examined and emphasize the relations between these at a new, contemporary level of

information exchange.



*Figure 5 Earth Energy Seminar at Cornell University, with other PhD students in geology, mechanical engineering, environmental engineering and civil engineering, with professors in economy and geothermal utilizations*

## 4. PROSPECTS FOR GEOTHERMAL ENERGY UTILIZATION IN UTICA FOR THE FUTURE AND PROSPERITY OF THE CITY: OPINIONS BY THE EXPERTS BASED IN UTICA ON GEOTHERMAL USE AND REDEVELOPMENT OF THE CITY

### 4.1. Results of the interviews in the city of Utica (public and private companies)

While the potential is there, currently a low level of geothermal energy utilization is happening in Utica, NY. Only a few buildings are using geothermal heat pumps while others are still using other forms of technology for heating which is fossil fuel based. The law office of Hage & Hage, the Resources Center for Independent Living (RCIL) and the Matt Brewery (Saranac beer producer) are among those that use geothermal heat pumps. Each of them has other use of geothermal. Hage & Hage was the first to be involved in creating a passive design, Net Zero Energy Building refurbishment project in the area. They fully renovated a mid-century bank building into a LEED certified office building. Installing geothermal heat pumps was part of the whole “green building” rehabilitation process they took on. More data on this is pending, in order to understand more fully the rationales for using geothermal energy in these aforementioned projects.

Findings from Matt Brewery interviewees revealed that the company installed their geothermal heat pumps (GHPs) specifically to assist with the cooling of one of their industrial buildings dedicated to cold storage of beer. It was a new building within the industrial complex, therefore no savings in the use of old buildings could be determined. However, since the whole brewery is a connected complex of buildings, the older buildings were also refurbished within the whole concept and the geothermal project became the catalyst for a larger effort. For example, they implemented a set of anaerobic digesters for producing biogas that they used to generate electric and heat for use on site. Wastes from the digesters sold as animal feed. The project demonstrates industrial or commercial use of GHPs, energy efficiency and the use renewable biomass energy and is supporting business and economic development, which is key to urban sustainability.

Experts interviewed from Utica’s City Hall provided interesting insights into the Micro Grid Project which is one of the current initiatives underway in Utica being supported by a grant from the New York State Energy Research and Development Authority (NYSERDA)<sup>16</sup>. The Micro Grid Project is being designed to create a back-up energy supply system during critical power failures in Utica. It is being targeted to support Utica’s public buildings that are in need of uninterrupted power and heat for security purposes. It will include a CHP process<sup>17</sup>, so that energy waste can be minimized with thermal energy utilized in buildings for space and water heating. This is a very important initial step for Utica, as these and other

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<sup>16</sup> NYSERDA, New YORK STATE Energy Research and Development Association

<sup>17</sup> CHP Combined Heat and Power process, in this case means using the energy for power production, and the generated thermal energy, that would otherwise be lost in this production process, to be implemented in the cooling and heating supply for buildings. It refers to a distributed form of energy. The opposite case would be the central supply, where energy is produced in vicinity of the consumer’s location, for more information, see: <https://energy.gov/eere/amo/combined-heat-and-power-basics>

projects made by city government should incentivize future planning of infrastructure and support other similar initiatives for urban redevelopment with “smart city” principles.

Other aspects worth mentioning are connected to the area where Cornell is analyzing and exploring scenarios for the sustainable neighborhood redevelopment. Initial outcomes of the analysis for geothermal district heating suggest that it is not financially viable based solely on economic grounds in today’s energy markets in NY State. The network for geothermal district heating consists of three elements: (1) Geothermal wells (mostly located under parking lots), (2) boiler and heat pumps installations -- vacant parking lots to be transformed into buildings where control and heat pumps compressors and condenser/evaporators could be centrally co-located.) and (3) the end-users: existing houses and commercial buildings within and adjacent to the area’s boundaries. This aspect of the project still needs to be elaborated, and other buildings included, to get to the point where geothermal district heating is financially acceptable for the redevelopment projects and urban renewal models in Utica.

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