

## WP4.3. Retrofit strategies: guideline and application cases

### Design and implementation of large scale retrofit program at municipal level

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Built in the 60's -70's, the New City of Onex (suburb of Geneva) comprises about 600'000 m<sup>2</sup> of residential buildings, with an annual heat consumption of 80 GWh. Aware of the urgent need to increase the energy efficiency of these buildings, the City of Onex and the State of Geneva have decided to launch a pilot project, entitled « Onex Remove », which aims to facilitate the participation of building owners and managers in a large-scale energy renovation program. To achieve this, we have developed a five-step approach in collaboration with private and public partners, providing support to the building owners involved in this program, as well as facilitated administrative procedure for renovation.

In this context, the main purpose of this study is to provide methodological support for this project, including a building typology study and an overview of the energy consumption of the Onex building stock (Fig.7). More generally, the aim was to provide guidance to the municipality on:

- i) how to realize the huge potential of energy savings in households over the coming decades through the implementation of deep energy retrofit programs;
- ii) how to identify and evaluate alternative technical solutions per building typology;
- iii) how to group them into cost-benefit standard packages of measures;
- iv) how to develop implementation strategies and identify possible barriers to deep renovation and options for overcoming them (e.g. simplified incentive and administrative procedures), as well as organize stakeholder involvement.

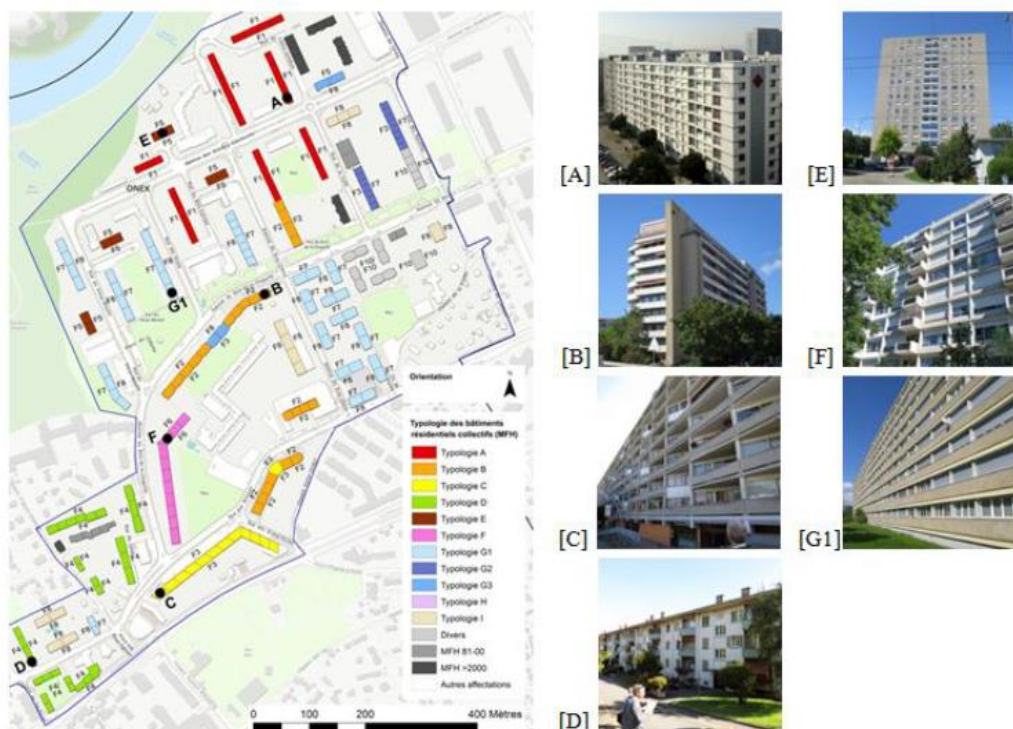


Figure 7: Typology analysis of the building stock of New City of Onex.

These findings will allow facilitating the process of energy retrofit from the investor's perspective and disseminating best practices. It should serve as a basis for determination of optimized building retrofit strategies per building category. The study concludes with a discussion regarding the impact of massive energy renovation of the Onex buildings on the mix heat delivered after the connection of the two main district heating networks CADIOM (waste heat) and CADSIG (natural gas) in Geneva.

## Publications

- Khoury J., Hollmuller P., Lachal B. (2016). Energy performance gap in building retrofit : characterization and effect on the energy saving potential. In: 19. Status-Seminar «Forschen für den Bau im Kontext von Energie und Umwelt». Zurich, 8-9 September 2016.  
Link: <http://archive-ouverte.unige.ch/unige:86086>
- Khoury J., Hollmuller P. (2016). Performance gap in building retrofit. In: Fact Sheets, Swiss Energy Research Conference 2016, Swiss Federal Office of Energy SFOE. Lucerne, April 2016.  
Link : <http://archive-ouverte.unige.ch/unige:88397>
- Khoury, J. (2016). Assessment of Geneva multi-family building stock: main characteristics and regression models for energy reference area determination. Technical report. SCCER Future Energy Efficient Buildings & Districts (CTI). Geneva  
Link : <http://archive-ouverte.unige.ch/unige:88423>
- Schneider S., Khoury J., Lachal B., Hollmuller P. (2016). Geo-dependent heat demand model of the swiss building stock. Sustainable built environment regional conference. SBE 2016, Zurich, June 15-17 2016. Link: <http://archive-ouverte.unige.ch/unige:84240>
- Khoury, J. (2014). Rénovation énergétique des bâtiments résidentiels collectifs: état des lieux, retours d'expérience et potentiels du parc genevois, Thèse de doctorat, Université de Genève. Institut des Sciences de l'Environnement et Institut Forel.  
Link : <http://archive-ouverte.unige.ch/unige:48085>
- Khoury J., Lachal B., Hollmuller P. (2015). Analyse typologique et énergétique des bâtiments de la Cité nouvelle d'Onex : dans le cadre de l'accompagnement méthodologique pour la mise en place d'un programme de rénovation thermique de la Cité d'Onex. Projet pilote ONEX RENOVE. Université de Genève. Link: <http://archive-ouverte.unige.ch/unige:78639>

### In preparation:

- Khoury J., ALAMEDDINE Zeinab, Hollmuller P., Lachal B. (in preparation). Understanding and bridging the energy performance gap in building retrofit. In: CISBAT 2017, 6-8 September 2017, EPFL, Lausanne, Switzerland.
- Khoury J. et al. (in preparation). COMPARE-RENOVE – Du catalogue de solutions à la pratique réelle. Evaluation, amélioration et diffusion des pratiques innovantes dans la rénovation thermique des bâtiments, basées sur des retours d'expérience. Research project OFEN 2013-2016.
- Schneider, S. et al., (in preparation). Invited paper for Building Research & Information (BRI).
- KHOURY, J. (in preparation). Assessment of Geneva multi-family building stock: retrofit potential and policy recommendations. SCCER Future Energy Efficient Buildings & Districts (CTI). Geneva.