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Post carbon cities in Europe.
Big challenges - small steps

Dr arch. Magdalena Baborska-Narożny

Brown coal mine and power plant Turów, Poland, photo:J. Purej

Low-carbon town or city add for CABE, UK national campaign

Eco-village, Stockholm, Sweden, photo:MBN

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Sequence of Talk

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Faculty of Architecture, WrUT

RoSE Centre, WrUT

Wrocław's small steps towards POST CARBON CITIES

Recent Carbon related project

Two FP7 Projects currently under evaluation

Key Challenges

Wrocław University of Technology

One of the best in rankings:
The best Polish university in innovation category 2012
2nd place among all Polish technical universities 2012
37 projects conducted under 7th Framework Programme
Research results:
5 118 publications in journals on the ISI Master Journal List
4 575 publications in JCRI indexed journals
4 612 patent applications including utility models
scientific journals
Science and research centres, among others:
Wrocław Center for Technology Transfer
Research Centre for Sustainable Built Environment
Accredited research laboratories
Cooperation with Industry

Integrated Education Centre, Wrocław University of Technology, 2008
Manufaktura Nr1/dr arch. Bogusław Wowrzeczka, Candidate for Mies van der Rohe European Union Prize 2009

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Basic facts:

26 professors
106 doctors
ca. 1600 students
105 PhD sudents

The Challenge:

To seek ways to prepare a city for post carbon economy. In Poland the fastest growing carbon emissions are low emissions from transport sector. Urban sprawl being one of the reasons...

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Our approach:

the technology is ready for Post Carbon Cities
...our cities are not

...to prepare them we must tailor strategies to existing contexts of structures, cultures, climates and economies through smart interventions

architecture and good design come first
...and so does the user; each and every user

invention and technologies to come will solve many of today's problems in an unpredictable way

don't stick to one solution – check out other possibilities

don't trust the label – check out the performance

photo. J.Łątka

photo. P. Hawrylak

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International Research Co-operation

Institut für Gebäudelehre und Entwerfen, Braunscheig, Germany
Institute for Theory and Design in Architecture
School of Architecture, Lincoln University, Lincoln, UK
Fachhochschule, Kaiserslautern, Germany
Building and Design Faculty, Applied Science University

Represented in:

AESOP (Association of European Schools of Planning)
dr arch. Iza Mironowicz, Secretary General
ICOMOS (International Council for Monument and Sites)
prof. arch. Ewa Łużyniecka, Vice-President of Polish Committee
Polish Academy of Science
prof. arch. Zbigniew Bać, President of Division of Architecture and Urban Planning
SARP (Association of Polish Architects)
dr arch. Maciej Hawrylak, President of Wrocław Branch
Wrocław City Development Office

Current EU funded project: Leonardo da Vinci 2012
2012-1-GB2-LEO04-08241 5
Architecture Vocational Learning Network
Coordinator: dr arch. J. Jabłońska

UN-Habitat 1st European Urban Summer School (EUSS), Faculty of Architecture, WRUT

LabDigiFab – model for advanced parametric design techniques - 2012

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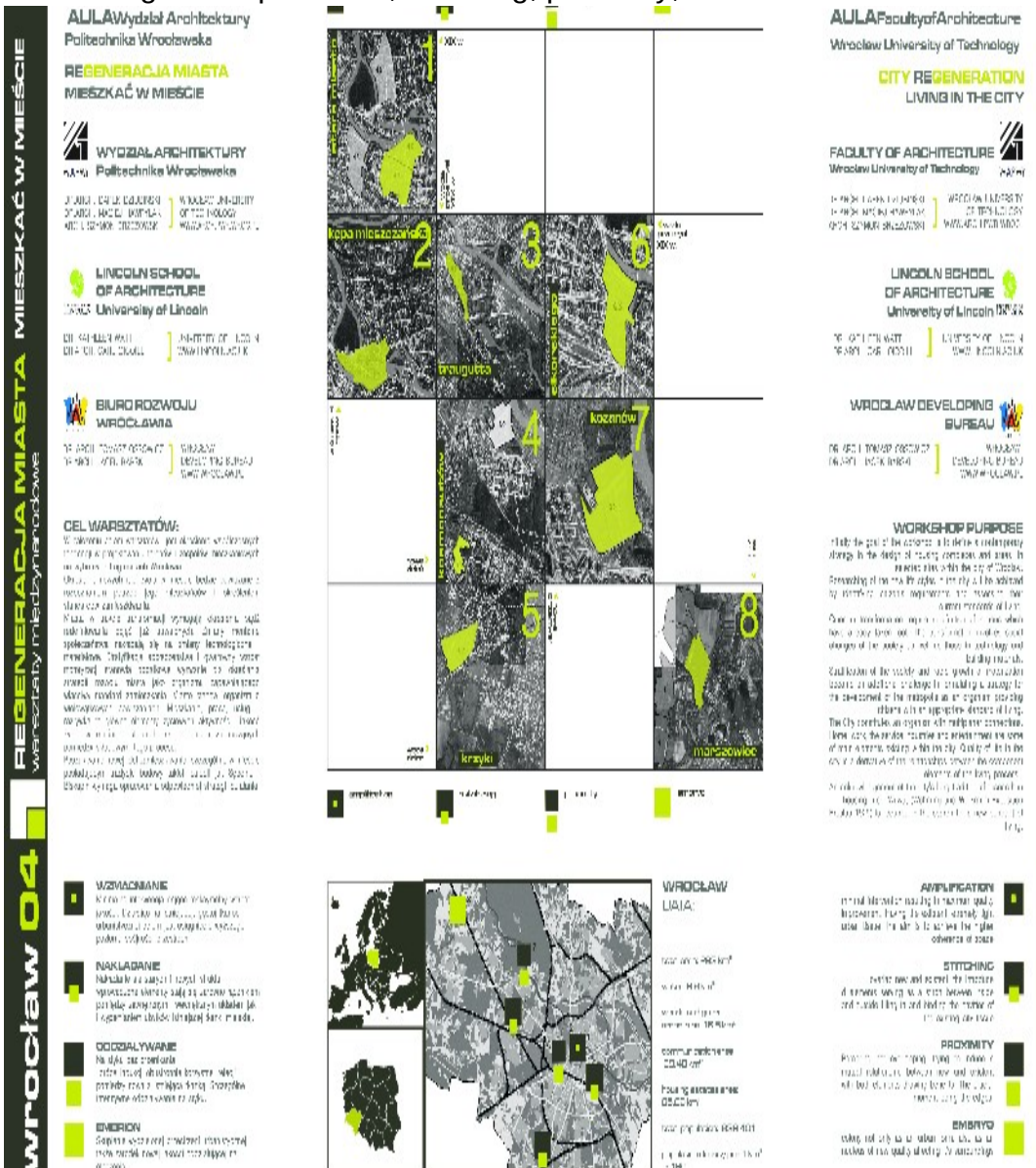
Learning by doing – **Inclusive architecture** national workshop

Paper as architectural fabric-City Enviroment Humanisation Student Research Organisation Exhibition

International Workshop “Niskie łąki” - **city regeneration: living in the city;** various contexts – different strategies: amplification, stittching, proximity, embrio



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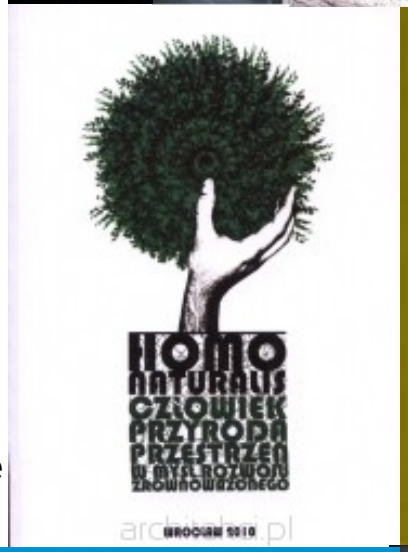
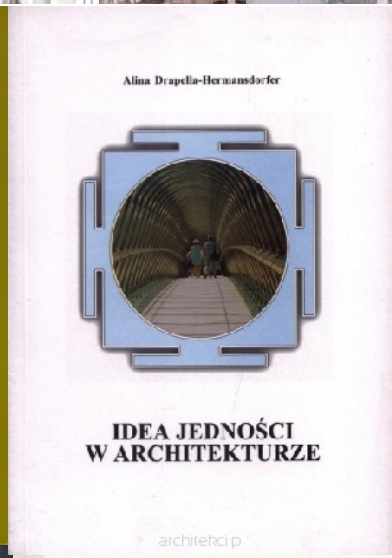
Research output:

ca. **170** international and national **publications** yearly

Architectus

open access research journal published in English twice a year, on Polish Ministry of Science and Higher Education List – 4 points, listed by Penrose Press - in International Directory of Design, Urban Planning & Landscape Design





Selected International and National Scientific **Conferences**:

Annual International Ergonomics Conference Man-Science-Environment – this year 10th MSE'2012 Coordinator: prof. J. Harytonowicz

Europe's Landscapes

Coordinator: prof. A. Drapella-Hermansdorfer

Annual International Conference Habitat: Social Architecture 2012

Coordinator: prof. Z. Bać

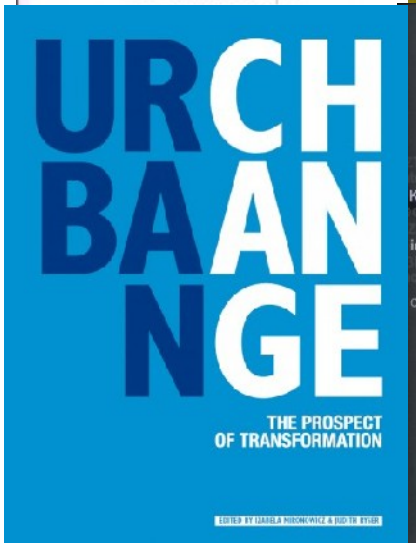
Architecture without borders: Citie's Culture – City in Culture 2012

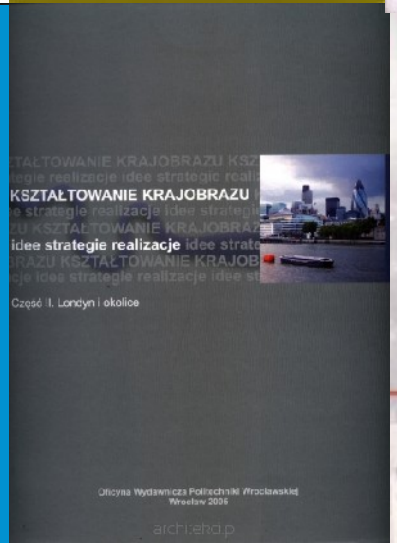
Coordinator: prof. E. Przesmycka

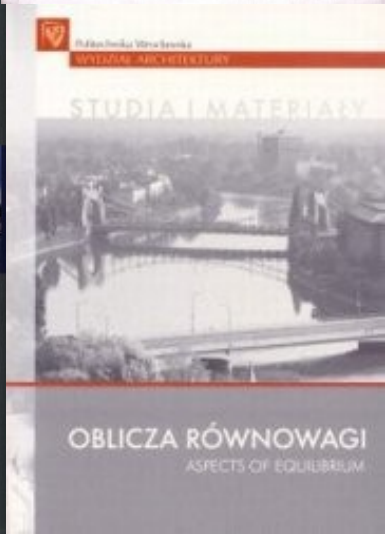
Lower Silesian Energy-Efficient House 2011

Coordinator: prof. J. Kasperski

Faculty of Mechanical and Power Engineering







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National and International Prizes for Sustainable Research and Design Student Competitions

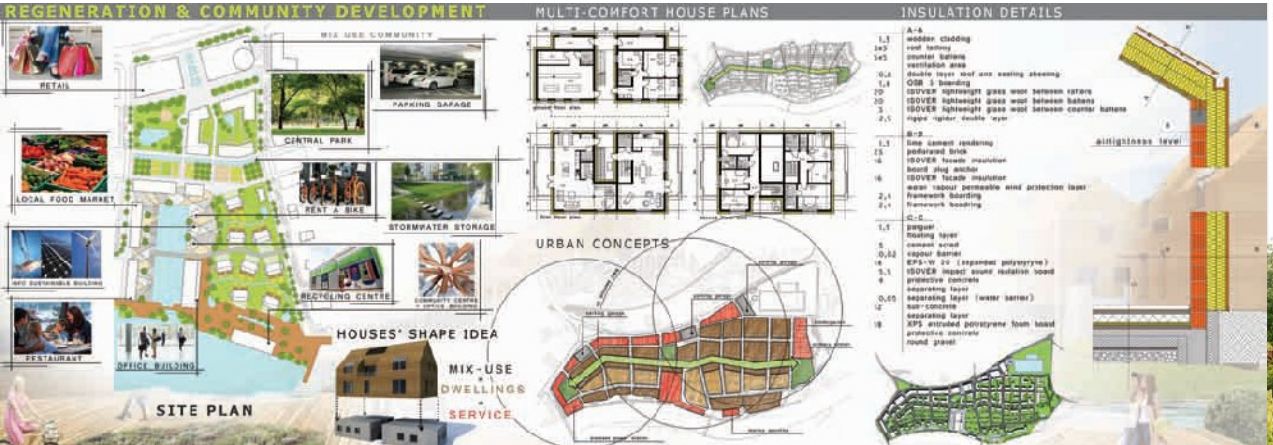
8th ISOVER Multi-Comfort House Students Contest 2012, **IIIrd Prise** at National Stage
Zuzanna Góra, Alicja Haczyńska, supervisor: dr arch Anna Bać

7th National PFRON Competition for thesis or PhD research on disability issues, “Open Door” 2010 **Ist Prize**
Ecological School without Barriers, Natalia Ratajczak, supervisor: dr arch. Anna Bać

National SARP Master Design Competition, honourable Mention 2011
Eco Village Wrocław-Biskupin, Marcel Matusz, supervisor: dr arch. Ada Kwiatkowska

EAAE/AEEA International Competition for Students in Architecture: PRESENT - Architecture's Challenge, Bucharest 2008, honorable mention
Butterfly's Effect – Structures XYZ, Maciej Siuda, supervisor: dr arch. Ada Kwiatkowska

Concrete Architecture 2011, honourable mention
Post industrial site regeneration: **Micro-Macro: Structure in River Harbour, Wroclaw**, Piotr Jarczyński, supervisor dr arch. Ada Kwiatkowska



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Research Centre for Sustainable Built Environment RoSE

Faculty of Architecture

passive buildings, green architecture, urban regeneration and conservation, urban development modeling, public spaces, sustainable city policies, participative design, universal design, sustainable landscape design, usability, education for sustainable cities

Faculty of Environmental Engineering

RES, energy audits, HAVAC systems, zero-carbon city models, sustainable water sewage system

Faculty of Civil Engineering

innovative construction materials, technologies and systems, earth sheltered sustainable buildings, building's physics, civil engineering

Faculty of Mechanical and Power Engineering

innovative technical solutions: heating schemes, heat pumps, public transport

45 researchers from **4 faculties** joining for:

Fostering research on sustainable built environment

Knowledge Dissemination

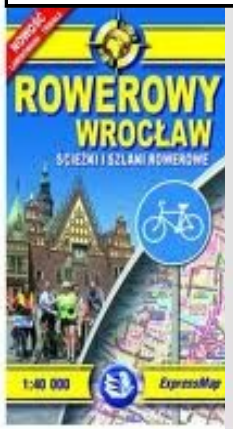
Initiating collaboration and exploiting the existing potential of WrUT

Wrocław – small steps in the **POST CARBON CITY** direction:

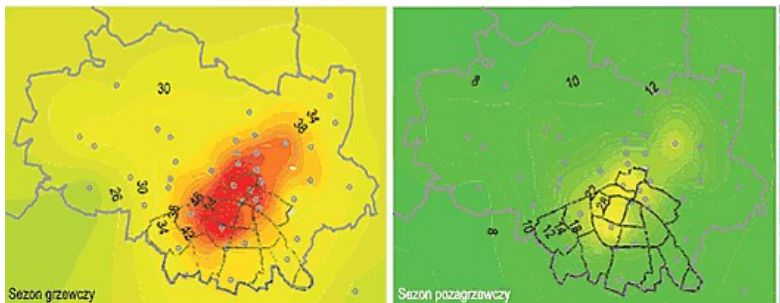
Retrofit program for municipality owned historic tenement houses – **'100 tenement houses'** – **mitigating low emission** through thermo-modernisation and exchange of individual coal space and water heating for co-generation.
Urban bikes for rent + 150 km of **biking routes** in the city
10 electric scooters for the city guards
Flood protection programm “Wrocław for Odra River”
Energy audit for public schools and **energy-efficiency improvement program** for public buildings implemented in stages
One public building – a school commissioned to make use of **Renewable Energy Sources**.
Constantly improved public transport within the city
Municipal waste segregation, special electronic waste and used bateries collection
“**Wrocław for the Climate**” - report commissioned by the City at McKinsey and EiT+ Wrocław Research Center co-operating with WRUT to indicate strategies for CO2 emissions abatement – to be put to public soon

Faculty of Architecture and the City

Cooperation within **URBANACT** EU funded city regeneration project
Expertise on the city's strategic development documents and masterplans
City funded invitation of the **world leading researchers** visiting the Faculty and giving open, public lectures



Rozkład stężeń dwutlenku azotu na terenie Wrocławia w sezonie grzewczym i pozagrzewczym 2003 r. na podstawie pomiarów metodą pasywną



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Recent cutting carbon research

Comparison of design intentions and construction solutions delivered to enhance environmental performance, minimize carbon emissions, maximize health and well-being of a public school at Suwalska Str., Wrocław

The first, and so far the last, public school built in Wrocław in the year 2009, to make use of **renewable energy sources**

Design: Grupa Synergia, dr arch. A. Bać, K. Cebrat

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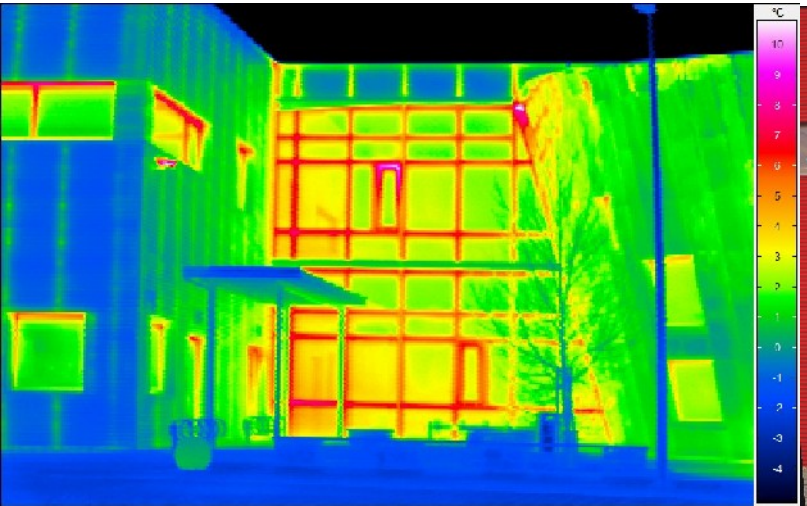
Results:

good, highly individual design is very much appreciated by the pupils, becoming less prone to vandalism, and increasing “forgiveness factor” for some inconveniences in the school's environment

acoustic ceilings provide **necessary comfort** in a school environment

commissioning stage, handover, fine-tuning of all the systems integrated into a building and their **maintenance** are **particularily important** for the occupants full satisfaction with a **high-tech green architecture**

Thermograph view taken at outside temperature -5 oC, inside +19 o C, wind 1 m/s, at 11 p.m. on 27 Feb.2012, low moisture, dry surfaces



The building's total energy consumption and CO2 emissions as compared to two other schools in Wroclaw:

The school proves it's **excellent quality in terms of energy efficiency** and at the same time **relatively high CO2 emissions due to coal-fired electricity covering 100% of the building's energy demand**. Retrofit school heated by gas, though consuming almost three times more energy, produces 32% less CO2 emissions than the analyzed building heated by ground heat pump.

The school at Rumiankowa Str. is a recently retrofit building from the seventies of the XX century, heated with local gas heating. The school at Aleja Pracy is a historical building, not yet retrofitted, heated with co-generation.

School complex at:	2009	2010	2011	Average
1. Suwalska Str. 5800 m^2 450 pupils	1626 kWh (Sep-Dec) (5.8 GJ)(*)	182,817 kWh (658 GJ/pa)	252 130 kWh (908 GJ/pa)	0.12 GJ/m^2/ pa
Annual CO_2 emissions	1320 kg CO_2/pa	148 371 kg CO_2/pa	204 625 kg CO_2/pa	**26 kg CO_2/m^2/pa**
2. Rumiankowa Str. 5000 m^2 407 pupils	1842 GJ	1813 GJ	1286 GJ	0.33 GJ/m^2/ pa
Annual CO_2 emissions	143 555 kg CO_2/pa	139 027 kg CO_2/pa	110 797 kg CO_2/pa	**17.6 kg CO_2/m^2/pa**
3. Aleja Pracy 3567 m^{2}165 pupils	2 744 GJ	3 478 GJ	2 721 GJ	0.84 GJ/sq.m/pa
Annual CO_2 emissions	298 478 kg CO_2/pa	348 kg CO_2/pa	365 278 042 kg CO_2/pa	**88 kg CO_2/m^2/pa**

Reference carbon emissions for electricity production in Poland is 0,812 Mg CO2/MWh = 225.44 kg CO2/GJ, for co-generation heat: 93.97 kg CO2/GJ, and for gas: 55.82 kg CO2/GJ

FP7 Projects currently under evaluation:

Marie Curie Actions, Call: FP7-PEOPLE-2012-IEF Intra European Fellowship

BuPESA

Building Performance Evaluation for Sustainable Architecture

Understanding the gap between designed and real performance

Applicant: dr arch. Magdalena Baborska-Narożny
Supervisor: prof. Fionn Stevenson
Host Institution: School of Architecture, Sheffield University, UK

Aims:

1. To focus on innovative socio-technical aspects of building performance evaluation (BPE) linking usability and social learning in order to identify key lessons for industry in relation to the procurement, design, construction and use of sustainable housing, and developing two related BPE tools.
2. To develop an enhanced BPE Framework and Service, transferable across the EU.33.
3. To undertake a comprehensive BPE of two innovative housing developments which includes innovative sustainable and renewable construction technology and procurement processes, in order to demonstrate and refine the new Framework, Service and tools:

    LILAC – Modcell sustainable co-housing scheme in LEEDS

    SAXTON – urban regeneration project

BuPESA case study post-occupancy project: **LILAC: Low Impact Living Affordable Community**, Leeds, UK
Architect: White Design Associates, construction technology: timber and straw – Modcell System

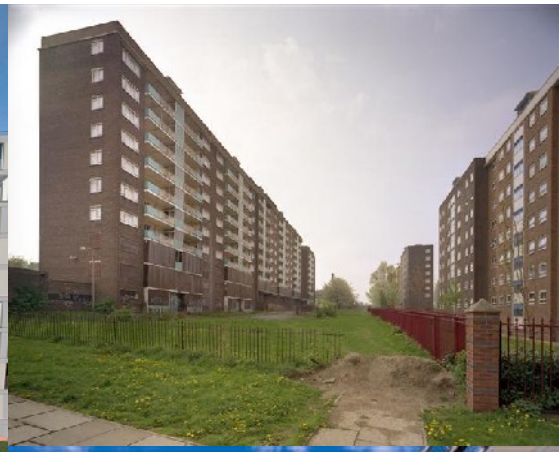
Siteplan sustainable solutions:

Bicycle storage – rack also for visitors
Productive gardens: garden plots for each of 20 flats + 5 plots available for the local community
Daytime public access to green areas
Native woodlands and biodiverse understory enhancement planting
Existing railing to be retained
Nature pond and attenuation basin with marginal and emergent native planting

A fragment from environmental commitment:

"22% of energy produced globally is used to make and move new construction materials. We are committed to using as little cement and concrete as possible as around 7% of global Co2 emissions are generated from cement production. We are also committed to good design to reduce the need for energy input. 15% of all Co2 in the west is generated from heating and cooling homes!"

BuPESA case study POE project: **urban housing regeneration Saxton**, Leeds, UK
architect: Union North Architects, developer: urbansplash
Housing Design Award 2012, RIBA Regional Sustainability Award 2012, Civic Trust Award Winner 2012



WROCŁAW

Gaj before and after termomodernisation
Photo: archive of ProArt Konopka

LEEDS

Saxton before and after regeneration
Photo: archive of Urbansplash

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FP7 Projects currently under evaluation:

Collaborative Project, Call: FP7-ENV-2012-13 two stage

Work Programme Topics adressed: ENV.2013.6.2-3 Transition to sustainable. Low carbon societies

Zero Footprint Parks

Coordinator: De Montfort University, UK, Dr Graeme Stuart

Partner: Wrocław University of Technology, Poland

Faculty of Environmental Engineering, dr Łukasz Szałata

Faculty of Architecture, dr arch. Magdalena Baborska-Narożny

16 Partners altogether from 9 countries

The “Zero Footprint Parks” is a research project aimed at developing new knowledge regarding the values, policies and mechanisms behind societal transformation, specifically in the context of STPs. The project will create a Roadmap (a strategic plan) to achieve a model for monitoring and continuous improvement, which can lead to sustainable management and zero local emissions in STP communities.

To develop this Roadmap, it is necessary to focus on the main issues that affect ecological footprint: **technology, biodiversity and social innovation**. It is crucial that these topics be addressed together, as each relates to one another.

Wrocław Science and Technology Parks

Wrocław Technology Park

Wroclaw Technology Park, photo: WTP archive

WROCŁAWSKI PARK TECHNOLOGICZNY

Wrocław Research Centre EiT+

Wrocławskie Centrum Badań EIT+

Key challenges for **architectural research** that would bring the vision of POST CARBON CITY closer to reality:

Tracing good practices examples of efficient policies promoting zero-cabon cities at different levels: state, regional planing and municipality – and research on the possibility to adjust and implement them in different economic and cultural local contexts

Developing local answers for urban sprawl prevention and low carbon, user friendly retrofit of existing structures

Applied research on the usability and performance issues of zero-carbon architecture

Enhancing embedded energy and life cycle cost models for the construction, maintenance, refurbishment and deconstruction stage of “high-tech” zero-energy buildings compared to “low-tech” energy-efficient ones

Developing strategies and guidelines for making green lifestyles and green architecture applicable, efficient and appealing

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Photo: K.Nowak

Thank you.
Any Questions?