

Digital Positive Energy Districts: A Scalable Strategy For Urban Heat and Power Transition?

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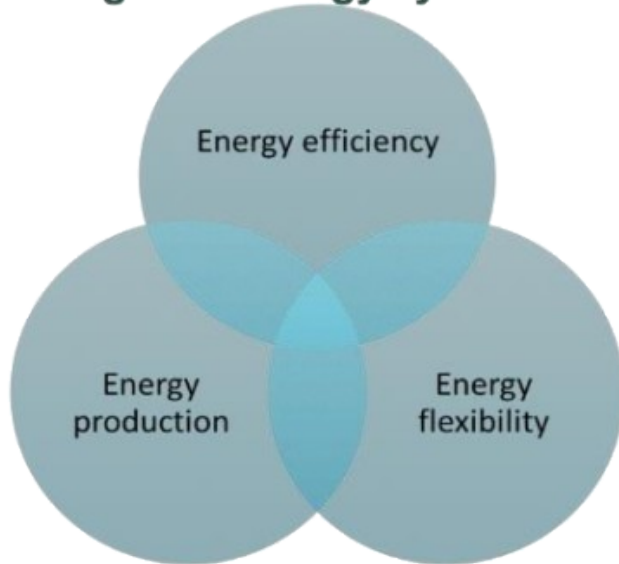
- **Innovationslehrgang** gefördert vom Bundesministerium für Arbeit und Wirtschaft
- Kompetenzaufbau zur nachhaltigen Entwicklung und Umsetzung **digitaler, lebenswerter PlusEnergie-Quartiere**
- Dauer: März 2021 bis Februar 2024
 - Workshops September 2021 bis September 2023
- Unterstützung von Unternehmen im systematischen Aufbau und der Höherqualifizierung des vorhandenen Forschungs- und Innovationspersonals.
- Intensivierung des Wissenstransfers zwischen Universitäten bzw. Fachhochschulen und Unternehmen, in beide Richtungen gleichermaßen.
- Beitrag zu einer stärkeren Verankerung unternehmensrelevanter Lehr- und Forschungsschwerpunkte an österreichischen Universitäten und Fachhochschulen.

Positive Energy Districts

What are they and why should i care?



PED Framework: Functions of PED/PENs in the regional energy system



Target:

Optimisation of the three functions of PEDs (energy efficiency, energy flexibility and energy production) towards climate neutrality and energy surplus by taking into account the guiding principles

Guiding principles:

- Quality of life
- Inclusiveness
- Sustainability

Enablers:

- Political vision and governance framework
- Active involvement of problem owners and citizens
- Integration of energy and urban planning
- ICT and data management



Source: ([JPU Urban Europe, 2020](#))

gefördert durch die FFG aus Mitteln des BMDW im Rahmen des Programmes Forschungskompetenzen für die Wirtschaft



Engineering and
Wirtschaftsstandort

WIEN



Herausforderungen und Chancen im Bauprozess:
Ankerung von Energieplanung



Externe Stakeholder

Projektentwicklung

- Projektentwicklung
- Intermediäre
- Raumplanung

Planung

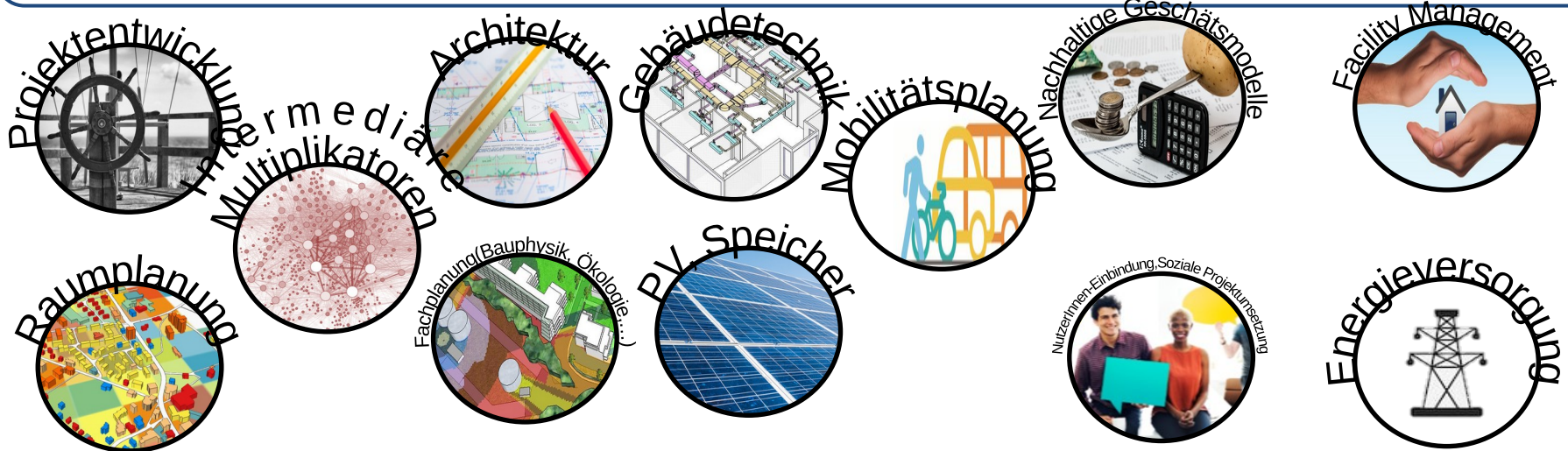
- Architekt
- Gebäudetechnik
- Fachplanung

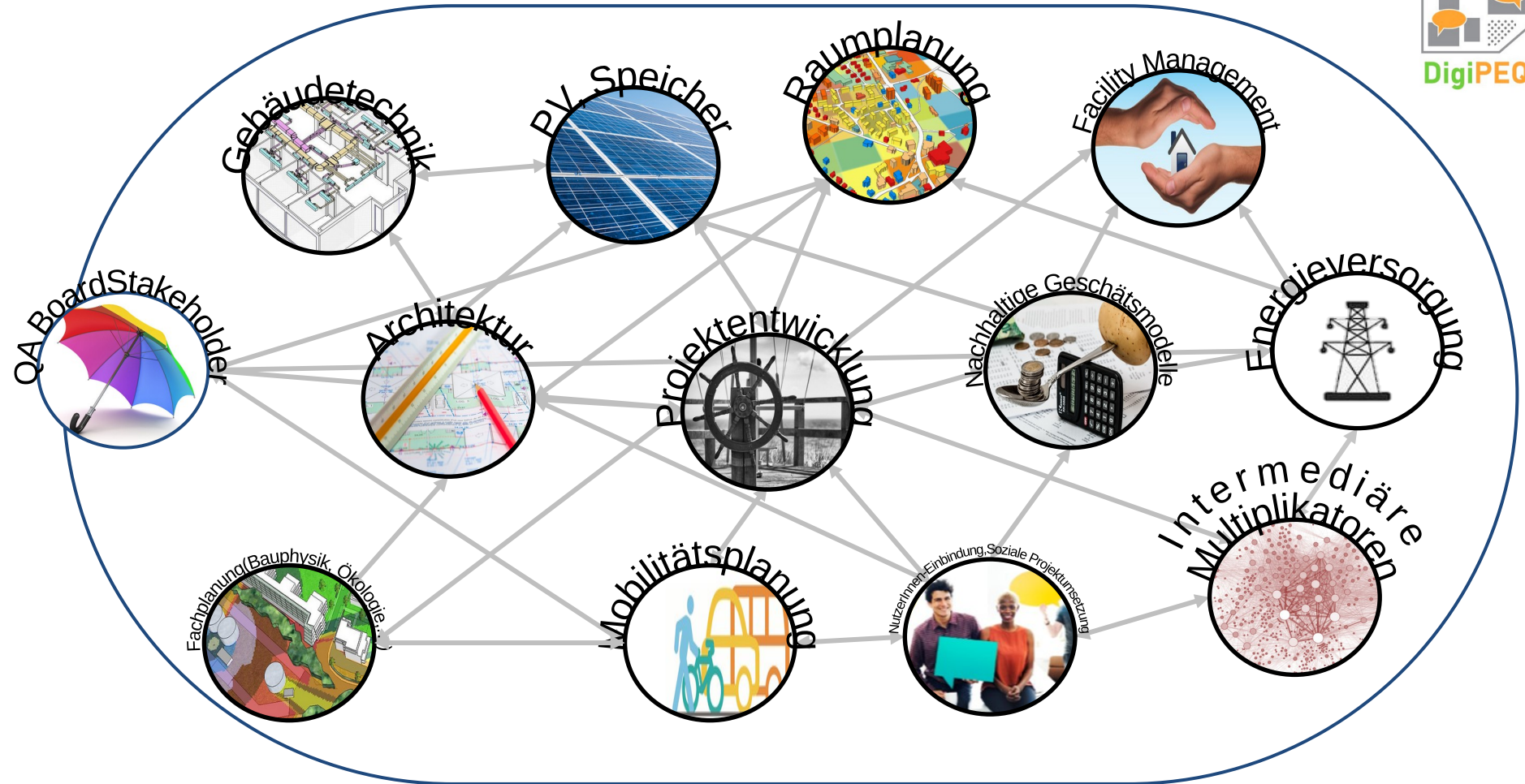
Ausführung

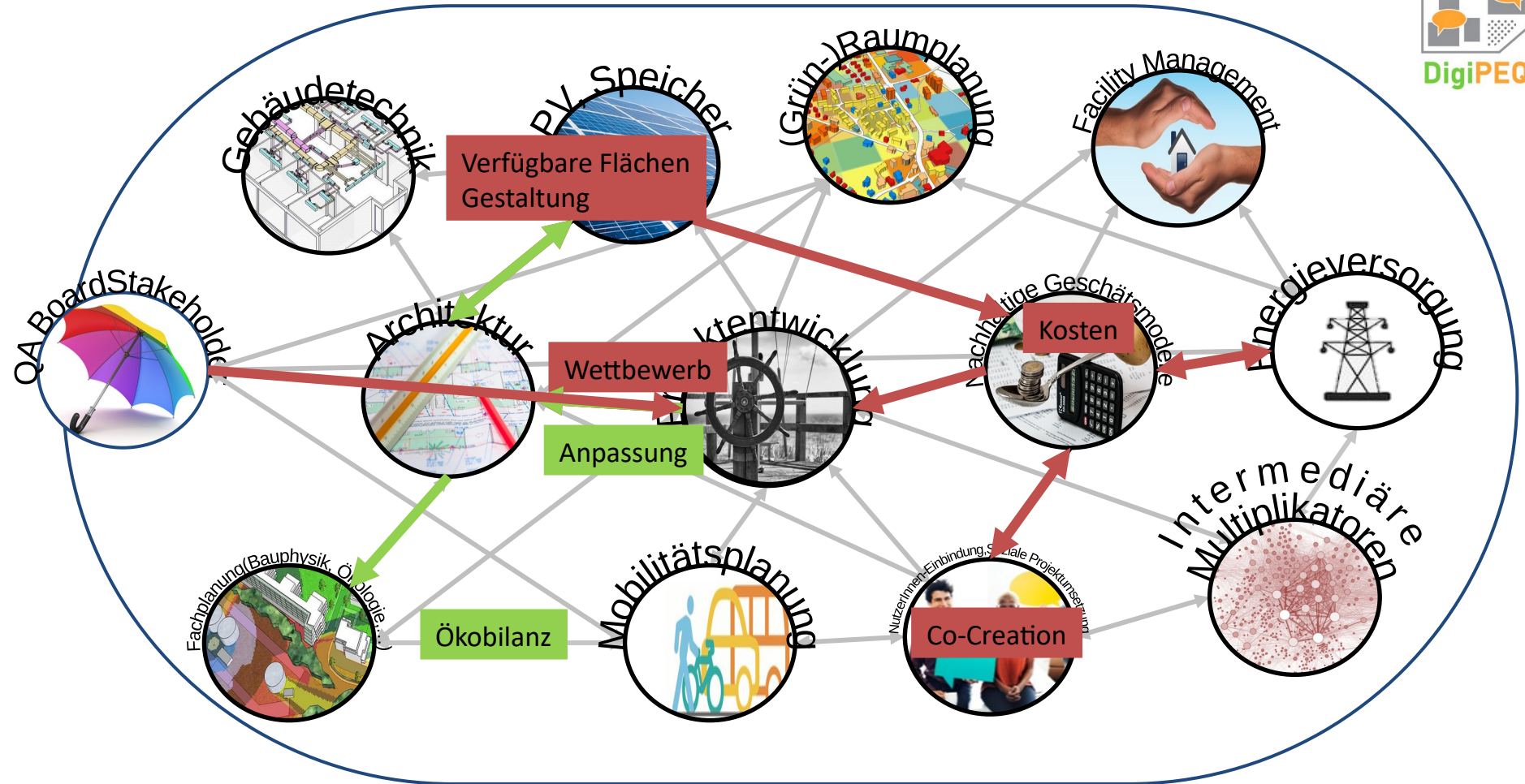
- Bauunternehmer
- Architekt
- Fachplanung

Betrieb

- Facility Manager
- Energieversorgung







Qualifizierungslücke

„Überschneidungswissen“, Praktiken,
Systeme werden geteilt



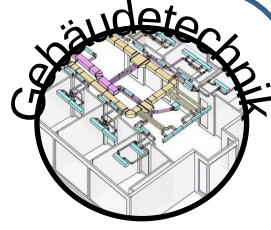
Baurechtlicher Rahmen,
Spezialbestimmungen
je Bundesland



Flexible Netztarife,
Einspeisung
Überschussstrom



Außen-
Gestaltung
Anforderung
Material,
Farbe



Entlüftungen
Dach, Einbauten,
Änderungen im
Planungsprozess



Verschattungsreduktio
n durch umgebende
Gebäude an Fassaden,
solaroptimierte
Masterpläne



Test
Funktionsfähigkeit,
Sicherung ohne
Beeinträchtigung



Synergie mit Pflanzen,
Wachstums-
bedingungen, Graue
Energie



Blendung,
Möglichkeiten e-
Mobilitätsdeckung,
zeitliche Profile



Formen
synergetischer
Nutzung in
Abstimmung mit
Detailnutzungsfläche
n



Speichernutzung
durch Netzbetreiber,
Netzdienlichkeit
durch intelligentes
Speichermanagement



Datenvisualisier
ung, Wünsche,
Energie-
sensibilisierung





- Ziele des Lehrgangs:

- Vermittlung der erforderlichen **interdisziplinären Kompetenzen** zur Entwicklung, Umzsetzung und Betrieb innovativer, digitaler PlusEnergie-Quartiere
- Erhöhung der **Forschungs-, Entwicklungs- und Innovationskompetenz** in den beteiligten Unternehmen
- **Vernetzung** und Etablierung nachhaltiger, über das Projekt hinausgehende Kooperationen im Konsortium über gemeinsam initiierte Forschungsaktivitäten, in Form einer Arbeitsgruppe oder zur Umsetzung von „PlusEnergie-Quartieren von der Stange“
- Einbindung der Ergebnisse **in die Lehre der Hochschulpartner** sowie Entwicklung eines akademischen Lehrgangs an der Technikum Wien Academy, um die erarbeiteten Inhalte dauerhaft verfügbar zu machen.



12 Themenfelder

36 + 14 Workshoptage

122 Workshops

24 Einheiten mit praktischen Übungen

8 Transferprojekte



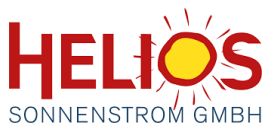
Die Unterstützer:innen – QA-Board

Das Quality Assurance Board



Letter of Intent

- Begleitung des Projektfortschritts
- Unterstützung bei der Verbreitung des Projekts
- 1 Workshop zur Einbringung ihres Know-Hows und Umsetzung in den weiteren Projektverlauf



Kleinregion
LAINSTITZTAL

MARKTGEMEINDE
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umweltbundesamt



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Ingenieure für Energieeffizienz und Komfort
Österreich

teamgmi



tatwort



SOMMENPLATZ
GRÜNBÄUEREI

POS
sustainable
architecture.

NIKKO
engineering

NHT

NEUES
LEBEN

Kleboth & Dollnig



IKB
Innsbrucker
Kommunalbetriebe



GRÜN
STATT
GRAU

FH
TECHNIKUM
WIEN

EPOOL

energie.kompass

Energie
Klagenfurt



Carplayee



amKurs
energie nachhaltig beraten

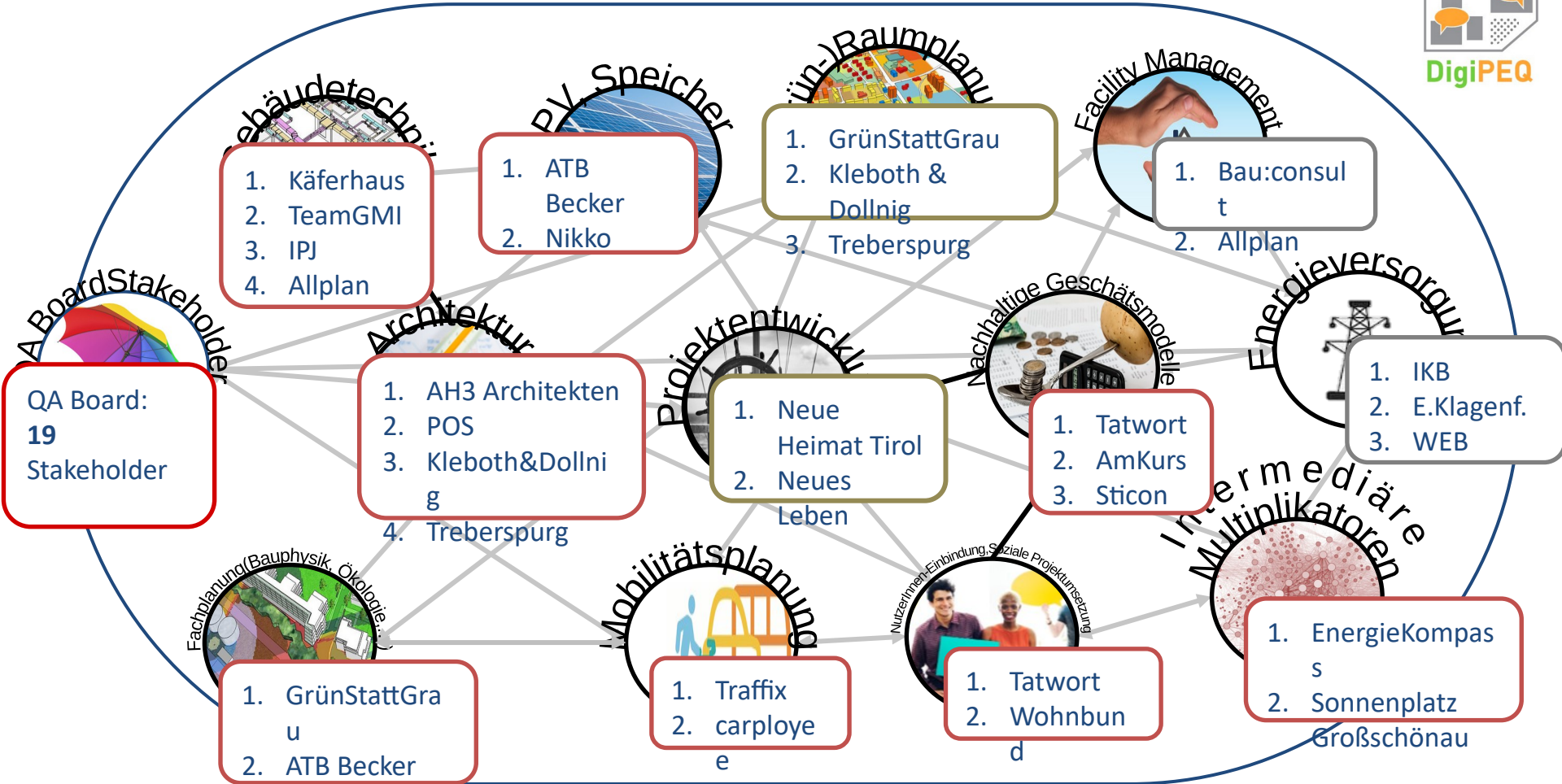


aha
ARCHITECTURE

wohnbund:consult
Büro für Stadt-Raum-Entwicklung

WEB
web.energy

Auswahl der TeilnehmerInnen

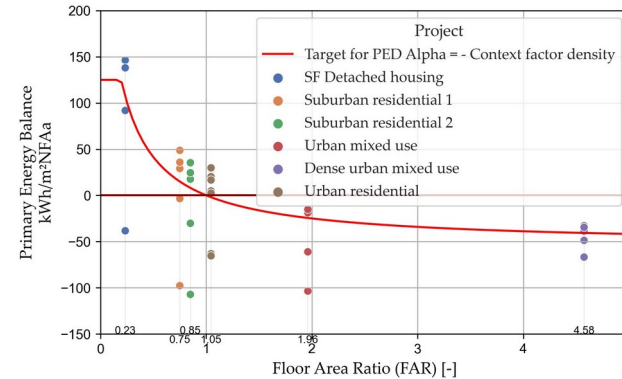
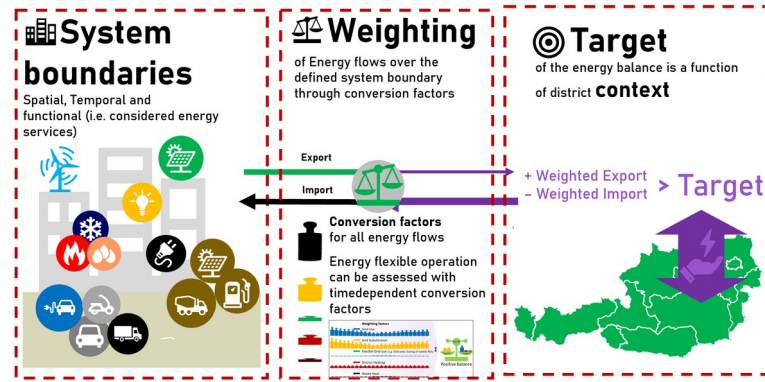


PED Performance Assessment

Through Energy and Emission balancing



- A standardized quantitative definition of „Positive Energy Balance“ is hard
- But, PEDs **can** connect national and municipal energy and climate goals to quantitative district targets
- PED energy target expressed as a function of density („context factor“) enables feasibility for all densities



[1]
S. Schneider, T. Zelger, D. Sengl, und J. Baptista, „A Quantitative Positive Energy District Definition with Contextual Targets“, *Buildings*, Bd. 13, Nr. 5, Art. Nr. 5, Mai 2023, doi: [10.3390/buildings13051210](https://doi.org/10.3390/buildings13051210)

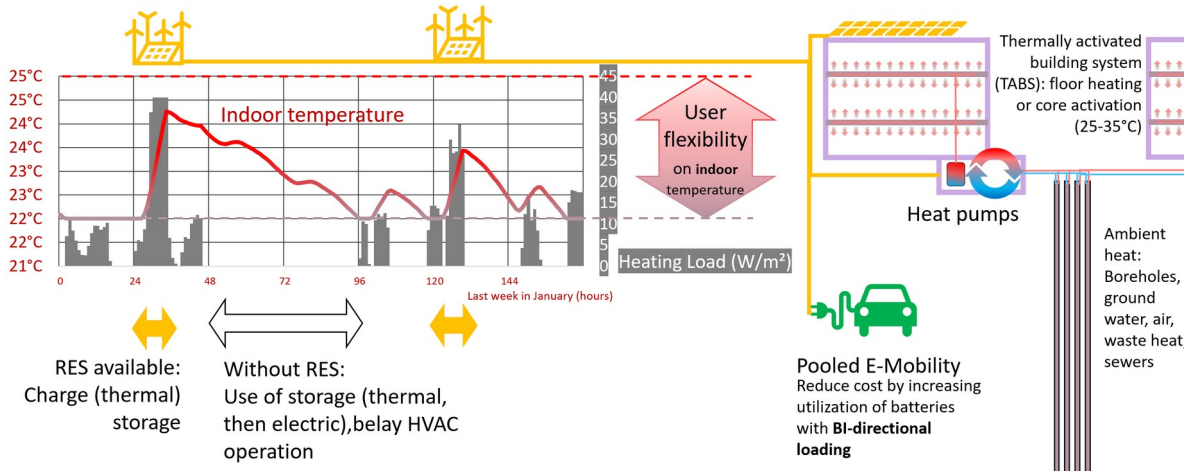
Energy Flexibility of Districts

An integral part of its design and assessment

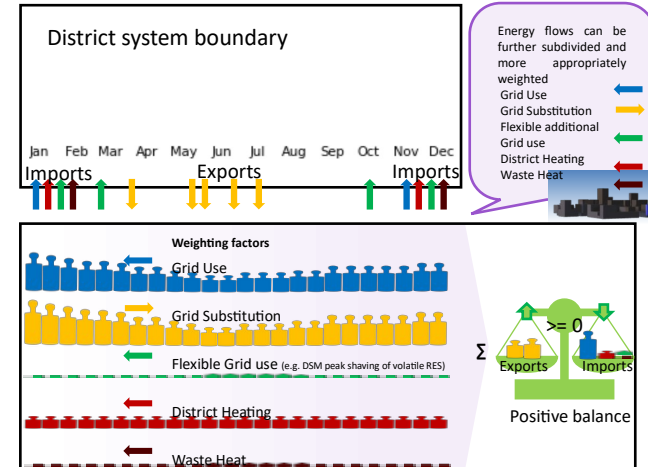


- PEDs can offer a wide range flexibility and storage options

Operation:



Assessment



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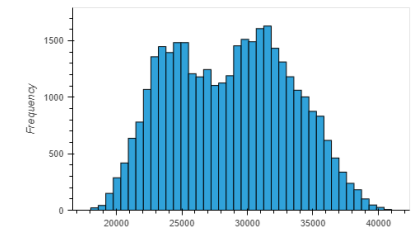
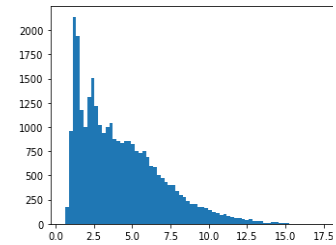
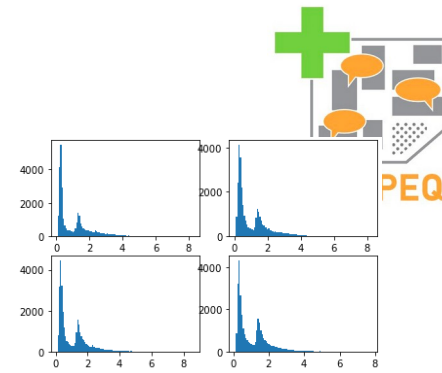


Bundesministerium Digitalisierung und Wirtschaftsstandort



Fine-grained prediction of load

- Alternatives for standard load profiles are hot topic among stakeholders.
 - Calculations of loads for individual buildings
 - Significant deviations found in buildings with similar social backgrounds
- Case study of a residential home complex performed
 - 30 apartments and 1 shop.
 - Based on smart metering data
 - Classification of housing units by # of inhabitants and life circumstances
- Tool for creating profiles for different flat usages developed
 - Used for ROI calculations like rooftop PV installations.
 - Added flexibility to include uncertainties in tenant structure
 - Significant influence for smaller installations such as renewable energy communities (REC)



Load profiles for single households (top), aggregation of 4 households (middle), fully integrated standard load profile over all users (bottom) (source: [26])

Signaling in PEDs and Energy Communities



- Consideration of grid capacity in automation and optimization algorithms.
- Need for mechanisms to maintain positive energy balance in districts.
- Anticipatory signalization for using volatile renewable energy sources.
 - Traffic light system for planning and optimization in 5-minute intervals
 - Minimal necessary information to act in a grid-friendly manner



red	green	blue	Interpretation	Response
0	0	0	no light ⇒ no signal received	act as usual
1	0	0	grid access is disconnected	island mode if possible
1	0	1	energy supply is scarce	insert more & use less now if feasible
0	0	1	energy is "expensive"	insert more & use less if convenient
0	1	1	ambivalent situation	act as usual
0	1	0	energy is "cheap"	insert less & use more if useful
1	1	0	green curtailment is enforced	insert less & use more now if feasible
1	1	1	ambiguous signal ⇒ ignore it	act as usual

Information Management and Use of Participative Design Approaches



- Co-creation with users for a sense of ownership and commitment
- Gamification and attractive information are critical strategies.
 - Gamification involves integrating game elements into non-game contexts to enhance engagement and encourage positive behaviors.
 - Creation of challenges, rewards and competitions in the design phase of an information management system (such as a digital building information board)
 - Enhance motivation and participation on the long run
- With the right challenges, rewards and competitions users are more likely to participate in sustainability initiatives and adopt environmentally friendly choices actively
- The use of AI-Generators to visualize personas quickly



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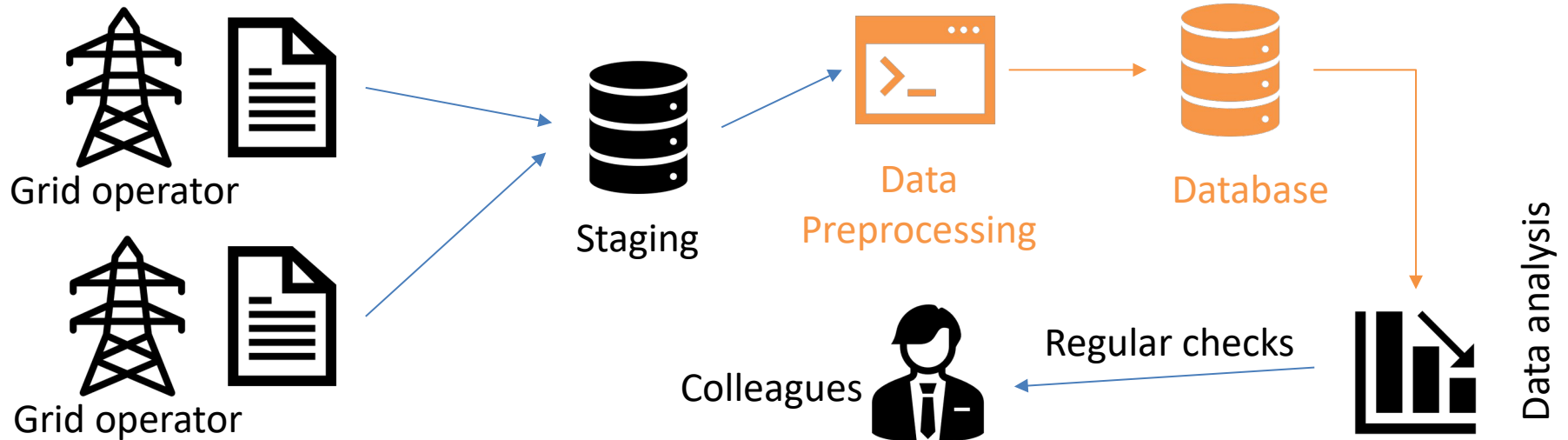


Consideration and Application Possibilities of New Digital Technologies



Lessons learned from transferproject on Dataquality Monitoring

- „There is nothing, a script cannot do“ (with the prerequisite, access rights and connectivity to data points is given)



Feedback from Practitioners












Rank	Ten best "New" Modules	Grade	Ten most "Interesting" Modules	Grade	Ten greatest "Take-Aways"	Grade
1	Green Financing	1,0	Übung "Raus aus Gas - Rein in PEQ"	1,0	"Raus aus Gas - Rein in PEQ"	1,0
2	"Raus aus Gas - Rein in PEQ"	1,3	Übung anhand Smart Block Geblergasse	1,0	Übung anhand Smart Block Geblergasse	1,2
3	Advanced Machine Learning	1,4	Flexibilität	1,1	Workshop Vernetzung u Reflexion	1,4
4	Exkursion Smart Block Geblergasse	1,5	Green Financing	1,1	Ökologische Bewertungsmethoden	1,4
5	Gruppenarbeit Usability	1,6	Impulsvorträge und Diskussion	1,1	(Tages)Lichtversorgung	1,4
6	Simulation mit IDA Districts/ICE	1,6	Gruppenarbeit Usability	1,2	Exkursion Co-living Seeparq	1,4
7	Vereinfachte Verfahren in der Quartiersimulation	1,6	Ökologische Bewertungsmethoden	1,2	Impulsvorträge und Diskussion	1,4
8	Smart Block Geblergasse	1,7	Energiemärkte im Umbruch	1,2	Energiemärkte im Umbruch	1,4
9	Inbetriebnahme-management	1,7	(Tages)Lichtversorgung	1,3	Verkehrsentstehung	1,4
10	Model Predictive Control	1,7	Erschließung von Flexibilitäten in aktiven Energiegemeinschaften	1,3	Exkursion Smart Block Geblergasse	1,5

Gaps and opportunities?

PED Transfer projects from theory to practice













	Transfer project	Description
	Supergrätzel	Designing a combination of energy communities and 'Supergrätzel' utilizing existing networks with a focus on social aspects (energy poverty).
	Anonymous Measured Profiles	Analysis of electricity consumption data from different households in a multi-family house as a basis for Plus-Energy planning.
	Energy Flow in Small Communities	Access to energy production and consumption data to create an energy flow diagram with a focus on heat consumption.
	Planning Data Pool	Collecting and recording electricity and heat consumption data to develop characteristic values for the planning and monitoring of Plus-Energy districts.
	From PED to AD (autonomous district)	Creating a roadmap for the development (or extension) of a simulation tool for Positive-Energy districts focusing on the degree of energy autonomy.
	Data Quality Monitoring	Checking data sets before they are used for further processing.
	OBENAUF - District with a Cherry on Top	Optimization of roof areas at the district level using an existing densification project (on the top, Währingerstraße) - measures and feasibility.
	Onboarding Tool EEG	Development of a user journey for the digital founding of a Renewable Energy Community for implementation on the team4.energy platform.
	Integral Planning Freudenau	Construction kit for a development concept for a future renovation district (Freudenau).

PED process in practice

”PEQathon” PED early planning process assessment catalogue



Task	Criterion	Weight
Task A: District and Neighborhood	 Achievement of quantitative PED Targets (Primary Energy Balance)	10
	 Design of the Development Process	5
	 Climate Resilience, Avoidance of Heat Islands, Rainwater Management	5
	 Energy Flexibility and Storage	5
	 Suitability for Integration of Digital Components	5
	 Sector Coupling and Grid Services	5
	 Fair Effort Sharing for the Transformation of the Entire District	5
	 Integration of Stakeholders and Users	10
	 Proof of PED Targets	20
	 Greening Concept	10



Cities TCP

Decarbonising Cities & Communities



Cities TCP
Decarbonising Cities & Communities

TECHNIKUM WIEN

Invitation to a Workshop on the
Preparation for IEA-Cities-TCP-Task "Climate-Neutral-Districts"

The University of Applied Sciences (TU) Wien (UAS)W, together with the IEA Cities Technology Collaboration Programme (TCP), invites researchers, entrepreneurs and policy makers to an online workshop aiming at shaping a new Task within the Cities TCP devoted to **shaping and connecting Climate Neutral Districts and Cities**. The Workshop takes place in parallel to IEA-Cities-TCP Events in Vienna.

WHEN? → 19th-October-2023, 09:00 – 12:00 (CET)

WHERE? → Online-Meeting (Zoom-Link)

FOR-WHOM?

International Researchers and experts in the field of decarbonising the built environment, climate neutrality, positive energy districts and related areas interested in international collaboration and knowledge exchange.

OBJECTIVES:

Brainstorming on and Preparation of a Task on Climate Neutral Districts within IEA-Cities-TCP. Task development will continue until Jun 23 with a second Workshop scheduled in Winter/Spring of 2024. Task is expected to be begin in autumn 2024.

The focus of the first workshops to identify possible research trajectories and areas of mutual interest. Possible activities should then be gathered, discussed, and if possible clustered to form a first draft of sub-tasks. Participants are encouraged to propose activities and indicate their disposition for taking on roles such as sub-task coordinators.

— Seltenunbruch —

Task 4 “Climate Neutral Districts”

2nd Task Preparation Workshop

10th April 2024

International research collaboration
<https://cities-tcp.org/tasks-tcp-cities/task-4-climate-neutral-districts/>

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Task Coordinator

