Virtual Technical Day 20/06/23

IEA Annex 73 „Towards Near Zero Energy Resilient Communities“

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Towards Near Zero Energy Resilient Communities- Challenge Beyond the Building Level

- **Near Zero Energy Resillient Communites** are highly relevant for the succesful energy conversion in the building sector. Recent progress in AI and IT- Structures allow for innovative prediction and operation methods which respond to the needs of users much more accurately.

- **Near Zero Energy Resillient Communites** require holistic and complex approaches which integrate and combine supply and demand side as well as efficiency and renewable approaches in order to achieve affordable, sustainable and robust solutions.

- **The High Complexity of both technical, business approaches** bear multiple risks and require strategic approaches which are accessable for politicians, decision makers, planers, ESCos, finance involved in the design process.

- **Annex 73 aims at** the development of a ctool set such as guidelines and computer based modeling tools which allow the target groups to set up the necessary technical, economical and organizational framework for setting up Net Zero Energy Resilient Communities.

The Annex 73 Team










Towards Near Zero Energy Resilient Communities (NZERC): Approach

Strategical NZERC-5 Stage- Approach Provides Robust Set- Up for High Complex NERC Design and Implementation Processes (ST D)

Step	Topic	Approach
Vision NZERC	Set up of Energy-, GHG- and Resilience Inventory	Collection of Utility Bills, GHB Conversion Factors
Base Case Scenario (BAU)	Set- Up of Base Case Model at Hand of Data Base.	Evaluation of Efficiency-, Renewable Potentials, Availability, Usage, Mission and Cost Structures; Selection of Model, Modeling and Model- Recalibration
Targets	Set- Up of Framing Goals for the NZERC	Energy- and Non-Energy, Sustainability, Resilience/ Availability of Components and Systems, Modeling of Scenarios, Finance, Decision Making, Communication
Local Energy Action Plan	Set- Up of Implementation Plan for Selected Scenario	Selection of Implementing Parties, Implementation of Financial and Business Model, User Activation, Implementation Design, Schedule
Implementation, Operation Monitoring	Implementation, Set- Up of Monitoring and Operation Structures, Monitoring and Adjustment	Implementation on Site According to Schedule, Adoption of Control Systems to the Modeling Parameters, Start of Operation/Adjustment, Monitoring of Prediction/Performance

Establishing Energy and Non- Energy Related Framing Goals (ST A)

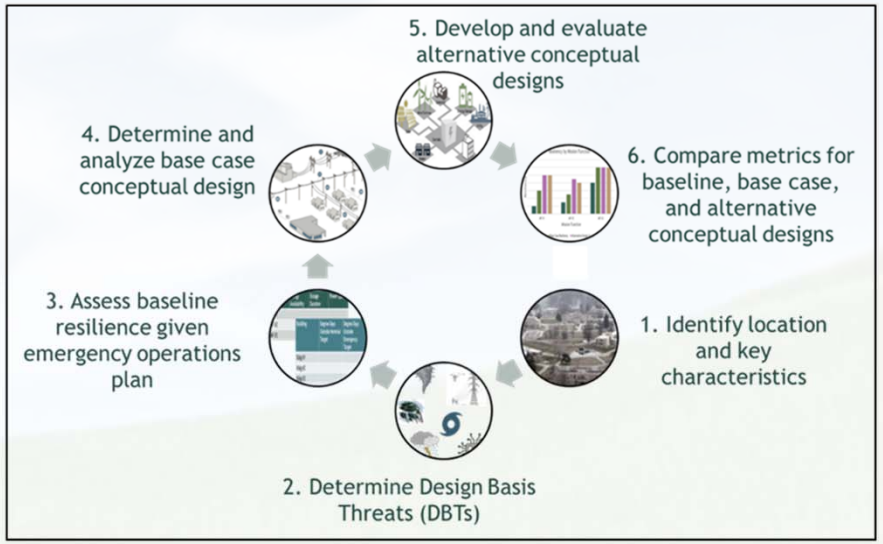
- Definition of specific decision making criteria for NZERCs the participating countries
- Develop a database of energy utilization indexes Academic, and Armed Forces building types
- Establish a database of representative building

Table A.1. Building Energy Use Maximums and Targets by Country[1]

Country:	United States	Australia	Austria	Denmark	Finland	Norway
Basis year:	2012	2019	2015	2018	2017	2017
Climate Zone	5A, 6A, 7		5A & 6A	5A	6A & 7	6A & 7
	Building Maximum Energy Use (kWh/m2 per year)[1]					
General Building Type	Total primary energy use[3]	Heating and cooling energy use	Heating energy use	Total primary energy use	Total primary energy use	Total net energy use
Office[2]	287-343	NA	47.6	41	100	115
School	251-429	NA	47.6	41	100	110
Apartment[2] (5+ units)	313-406	10.8-113	54.4	30	90/105	95
Dormitory	389-505	NA	54.4	30		
Hotel	342-384	NA	47.6	30	160	170

Set- Up of a Project Specific Resilience Strategy for NZERCs Increases Compononent and System Resilience

- Challenges for Supply and Distribution Systems have increased over the last years (e.g integration of renewables, man- and non- man made threats, age of components etc.)
- The vulnerability of existing supply and distribution systems requires a project specific resiliency strategy which responds to the individual situation.



Case Studies and Pilot Projects: Best- Practice Provides Valuable Data on Technical Solutions Costs and Decision Making Processes for Specific Use Cases

- **Data from 25 case studies in different climate zones and building standards:**
  - Australia: 1 case study
  - Austria: 3 case studies
  - Finland: 2 case studies
  - Germany: 4 case studies
  - Denmark: 8 case studies
  - USA: 7 case studies

- Evaluation, Lessons Learnt are collected in Case Study Book!

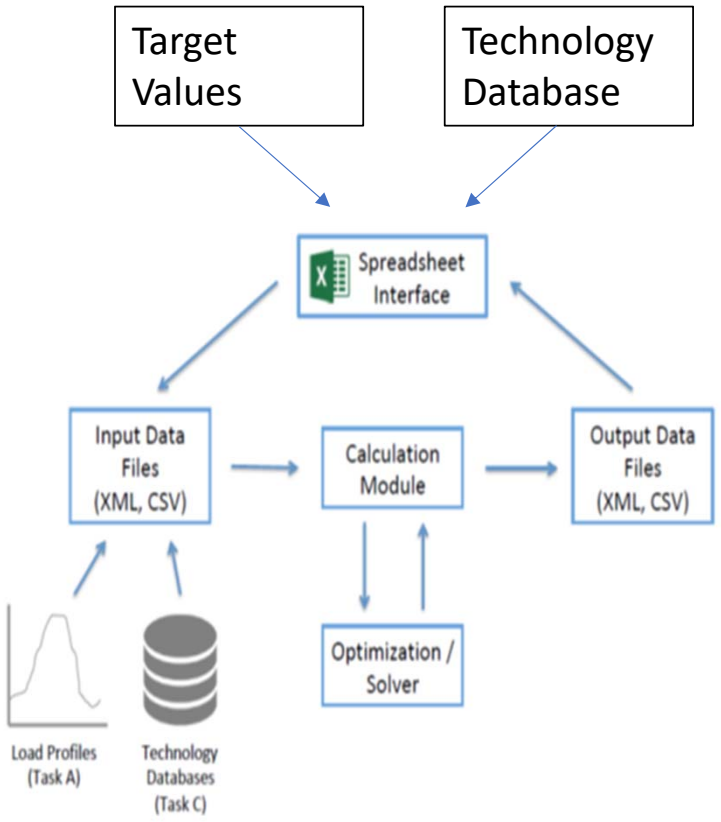
Technology Database Toolset Allows to Design Individual NEZC Solutions from a Preselected Database and Accelerate the Modeling and Decision Making Process

- **Technology Database and Energy Systems Architecture:**
- template describing different energy supply technology categories, their technical and cost data.
- Users may use default (preselected) solutions for specific use cases in different climate zones or
- Configurate own technical solutions to be used in the modeling process.

Annex 73 NZEC Modeling Tool Facilitates the Complex Planning Process Breaking Down Results in Technical and Economic Decision Making Criteria

- The NZEC tool:
  - standalone module focusing on supply, distribution and storage technologies,
  - addressing both thermal and electrical systems
  - providing performance and cost optimization
  - integrate resiliency analysis and results from Subtasks A, C and D.
- Reviewed existing modeling tools have been used:
  - NZI-Opt/ System Master Planning Tool (SMPL) developed by ERDC,
  - Energy Resilience Analysis Tool (ERA) developed by MIT Lincoln Laboratory,
  - Microgrid Design Toolkit (MDT)m developed by Sandia National Laboratory,
  - energyPRO developed by EMD International.

NZEC Tool Architecture

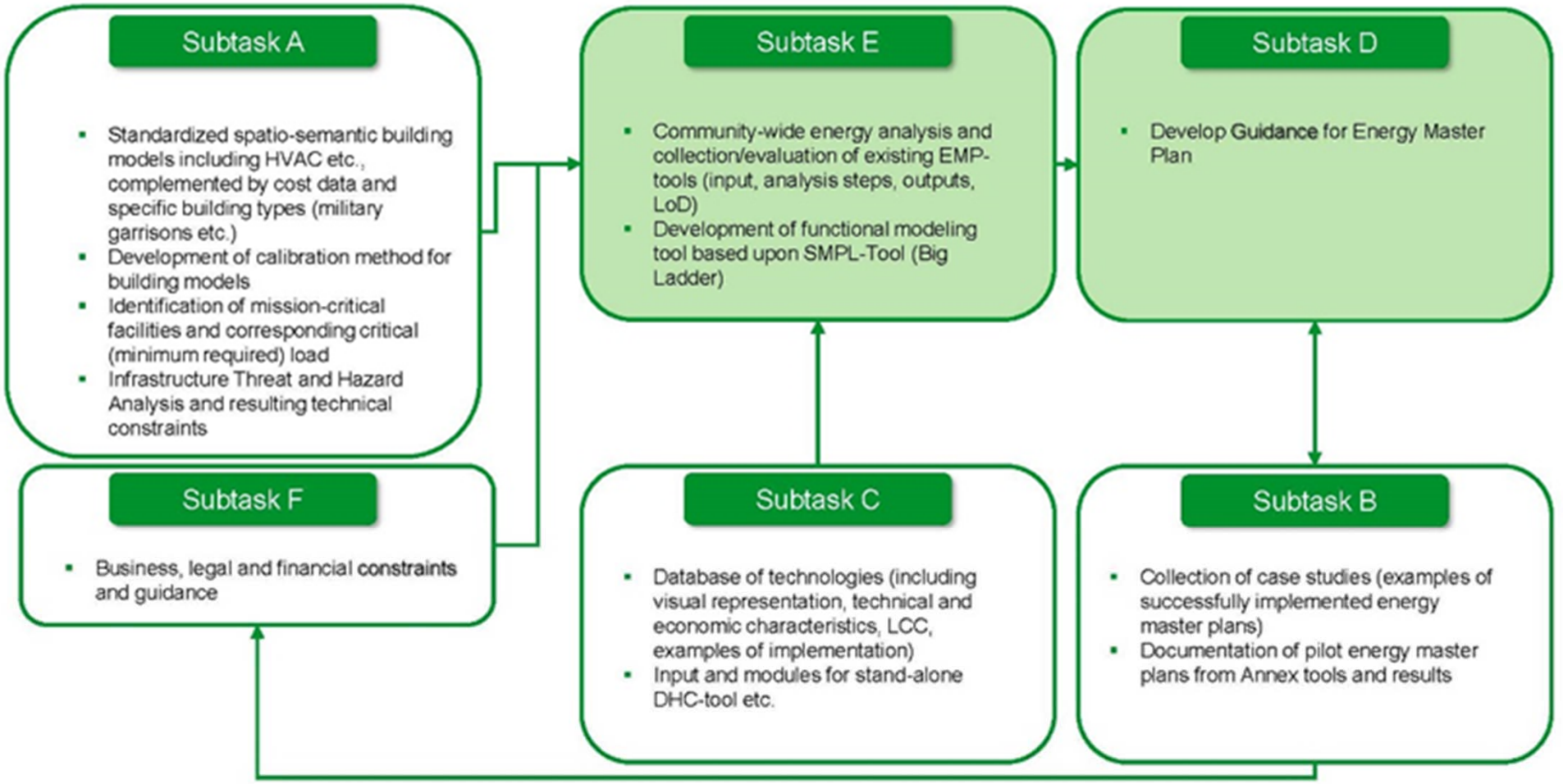


The Implementation of Complex NZERC Structures Require Energy Service Companies and Improved Business and Financial Models Which Reduce Failure Risks Dramatically

Two Major Challenges for NZERC from the Business Perspective:

- How to Improve Cost- Effectiveness?
  - Investment Costs by Least- Cost- Planning Approach to define Optimum of Efficiency, Supply and Energy Costs
  - Accountable Non- Energy- Benefits (reduced O&M Costs….)
- Business and Financial Model
  - De- Risking for Community
  - OPEX/CAPEX flexible Models
  - Performance Guarantee based Remuneration Systems

Appendix: Annex 73 Information Flow for Subtasks A-F



Appendix: Annex 73 Expected Deliverables and Timeline

- Deliverables:
  - A “Guide for Energy Master Planning in public building communities”
  - Enhancements for Energy Master Planning Tools
  - A Book of Case Studies and Pilot Projects (Examples of Energy Master Plans)
- Timeline:
  - Feb. 2018- Jan. 2021
- Questions:

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