Towards Net Zero Energy Public Communities

Proposal for New IEA ECB Annex

First Preparatory meeting
September 12, 2016
Washington, DC
Discussion Outline

• Background
• Scope
• Objectives
• Subtasks
• Proposed deliverables
• Receptors
• Brief description of Subtasks

• Alignment with EBC strategy plan
• Benefit to participants of international participation
• Duration of Annex
• Discussion
  • Operating Agent and Subtask Leaders
  • Participants
  • Task Shared /Joint Fund
  • Technology Readiness Assessment
A Net Zero installation:
Applies an integrated approach to management of energy, water, and waste to capture and commercialize the resource value and/or enhance the ecological productivity of land, water, and air.
Background

• Until recently, most planners of public communities (military garrisons, universities, etc.) addressed energy systems for new facilities on an individual facility basis without consideration of energy sources, renewables, storage, or future energy generation needs

• Building retrofits of public buildings typically do not address energy needs beyond the minimum code requirements. Energy demand reduction using energy performance contracting models typically address mechanical and lighting systems and their controls; and electrical energy savings from these projects range between 20% and 40% from the pre-renovation baseline

• Significant additional energy savings and increased energy security can be realized by considering holistic solutions for the heating and cooling needs of the buildings

• The status quo in planning and execution of energy related projects will not support attainment of current energy goals (EPBD in Europe and 10CFR-433 in the U.S.) and minimizing costs for providing energy security

• Armed Forces in North America and Europe are major real estate owners in their respective countries and can demonstrate by example how to meet energy goals in the public sector
Background (Cont)

• Experience gained from Annex 51 and various demonstration projects using the Net Zero Planner (NZP™) tool developed by the US Army’s Engineering Research and Development Center showed that additional work needs to be done with respect to
  • Definition and valuation of energy goals
  • Adding new military specific building types, thus improving benchmarks and the data base of energy efficiency building models complying with the current EPBD requirements
  • Adding advanced energy supply, distribution, and storage systems for district heating and cooling for the standalone campus or as an integrated part of a nearby city.
  • Incorporation of thermal distribution modelling tools into various planning tools such as the NZP™ to make them applicable to a broader spectrum of users.
Background (cont)

• The project concept has been discussed during the NATO Net Zero Energy Water and Waste Advanced Training Course in Wiesbaden (April 2016) and during the European Defence Agency Consultation Forum in Dublin (June 2016)

• The European Defence Agency has reviewed pre-proposal and expressed their support to this project

• US Army ERDC (USA) in collaboration with Office of Assistant Secretary of the Army (USA) and KEA (Germany) have prepared the project proposal, which has been presented at the IEA EBC Executive meeting in Oslo (June 2016) and approved for the preparation phase

• This project is intended as a collaborative effort by European countries, the United States, Canada, Israel and Australia, to be executed under the umbrella of the International Energy Agency (IEA) Energy in Buildings and Communities (EBC) program.
Scope

• The Scope of the Annex is the decision-making process and a computer based modeling tools for achieving net zero energy, water and waste at public owned communities (military garrisons, universities, etc.)
Objectives

• Assess existing case studies and develop representative buildings energy benchmarks

• Develop a database of energy /water utilization indexes (EUI) of Public, Academic, and Armed Forces building types

• Develop Energy/Water Targets: definitions, matrix, monetary values

• Summarize, develop and catalog representative building models by building use type, including mixed-use buildings, applicable to national public communities/military garrisons building stocks

• Develop Guidance for Net Zero Energy /Water Master Planning

• Develop functional description of the role of modeling tools in the Net Zero Energy /Water Master Planning Process

• Collect and describe business and financial aspects and legal requirements and constraints for NZEW master planning for public communities in participating countries

• Provide dissemination and training in participating countries
Receptors

• Decision makers, planners, building owners, architects, engineers and energy managers of public-owned and operated communities e.g:
  • National Armed Forces through their Infrastructure Components, military garrisons,
  • University and high school campuses,
  • Hospitals and housing which are responsible for all costs related to new construction, renovation and O&M.

• Industry, energy service companies, architects, engineers and financiers supporting public communities
Subtasks

A. Assessment of existing case studies and development of representative buildings energy benchmarks

B. Energy/Water Targets: definitions, matrix, monetary values.

C. Develop, catalog, database of representative building models by building use type, including mixed-use buildings, applicable to national public communities/military garrisons building stocks.

D. Develop architecture and models of modern central energy systems (power and thermal)


F. Develop functional description of the role of modeling tools in the Net Zero Energy /Water Master Planning Process

G. Business, legal and financial aspects of Net Zero Energy /Water Master Planning

H. Dissemination and training.
Subtask A. Assessment of existing case studies and development of representative buildings energy benchmarks

1. Collect case studies and analyze completed Net-Zero or Near-Zero buildings and communities in the military sector, commercial campuses and academic campuses. Evaluate technical measures and their bundles implemented in these case studies with regard to the building usage types, climate zones, specific investment costs, impact on carbon footprint; develop energy consumption and cost benchmarks for certain technologies and technology bundles;

2. Develop a database of energy/water utilization indexes (EUI) of Public, Academic, Private Industry and Armed Forces building types: EUIs are a necessary requirement for efficient energy management and for establishing energy targets. The EUIs will be collected from available metering data for buildings, from existing Commercial Buildings Energy Consumption Surveys and from existing standards (ASHRAE Std 100, German VDI 3807, Switzerland SIA 380.1 etc.).
### TABLE 7-2: Building Activity Energy Targets (EUIs) (GJ/Unit)\(^2\)

<table>
<thead>
<tr>
<th>No.</th>
<th>Commercial Building Type</th>
<th>EUIs by Building Type by Climate Zone (GJ/m²-yr)</th>
<th>ASHRAE Climate Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admn/professional office</td>
<td>443 456 446 472 372 440 379 518 449 445 475 446</td>
<td>460 508 536 657 921</td>
</tr>
<tr>
<td>2</td>
<td>Bank/other financial</td>
<td>628 648 633 670 528 625 527 735 637 651 777 633</td>
<td>864 761 932 1307</td>
</tr>
<tr>
<td>3</td>
<td>Government office</td>
<td>553 570 556 589 464 550 471 646 560 572 683 592</td>
<td>759 699 820 1147</td>
</tr>
<tr>
<td>4</td>
<td>Medical office (nondental)</td>
<td>377 389 390 402 317 375 322 441 382 390 466 404</td>
<td>380 518 457 559 784</td>
</tr>
<tr>
<td>5</td>
<td>Mixed-use office</td>
<td>512 528 516 546 430 509 438 695 519 530 633 549</td>
<td>516 704 620 760 1065</td>
</tr>
<tr>
<td>6</td>
<td>Office</td>
<td>428 441 431 456 359 425 366 500 433 443 529 458</td>
<td>431 588 518 634 982</td>
</tr>
<tr>
<td>7</td>
<td>Laboratory</td>
<td>2025 2011 1939 1988 1687 1873 1806 2199 1908 2029 2374 2123 2555</td>
<td>2631 2399 2830 3759</td>
</tr>
<tr>
<td>8</td>
<td>Distribution/shipping center</td>
<td>170 187 227 171 212 201 163 306 256 248 463 340</td>
<td>271 558 458 682 1280</td>
</tr>
<tr>
<td>9</td>
<td>Nonresidential warehouse</td>
<td>68 86 90 110 59 98 79 148 124 120 195 164</td>
<td>131 170 221 330 619</td>
</tr>
<tr>
<td>10</td>
<td>Convenience store</td>
<td>1528 1657 1538 1727 1442 1577 1606 1882 1700 1783 2027 1837 1898</td>
<td>2198 2032 2308 2987</td>
</tr>
<tr>
<td>11</td>
<td>Convenience store with gas</td>
<td>1231 1335 1239 1393 1161 1270 1294 1516 1370 1436 1633 1489 1529</td>
<td>1770 1637 1907 2407</td>
</tr>
<tr>
<td>12</td>
<td>Grocery/food market</td>
<td>1273 1381 1282 1439 1201 1314 1339 1508 1417 1486 1639 1531 1582</td>
<td>1831 1693 1979 2649</td>
</tr>
<tr>
<td>13</td>
<td>Other food sales</td>
<td>386 418 388 436 364 398 405 475 429 450 511 463 479</td>
<td>554 513 597 754</td>
</tr>
<tr>
<td>14</td>
<td>Fire/police station</td>
<td>746 737 714 732 614 600 665 810 725 747 874 782 757</td>
<td>970 883 1042 1384</td>
</tr>
<tr>
<td>15</td>
<td>Other public order and safety</td>
<td>679 672 651 667 560 629 606 738 660 681 797 613 690</td>
<td>884 905 950 1262</td>
</tr>
<tr>
<td>16</td>
<td>Medical office (diagnostic)</td>
<td>380 366 369 364 341 365 398 360 346 320 346 337 319</td>
<td>351 342 348 397</td>
</tr>
<tr>
<td>17</td>
<td>Clinic/other outpatient health</td>
<td>570 549 554 546 512 548 456 540 519 480 518 506 478</td>
<td>530 514 522 595</td>
</tr>
<tr>
<td>18</td>
<td>Refrgerated warehouse</td>
<td>784 775 751 770 646 726 700 852 762 786 920 823 799</td>
<td>1020 929 1096 1346</td>
</tr>
<tr>
<td>19</td>
<td>Religious worship</td>
<td>266 263 255 261 239 246 237 280 259 267 312 279 270</td>
<td>346 315 372 494</td>
</tr>
<tr>
<td>20</td>
<td>Entertainment/club</td>
<td>264 261 253 259 237 244 235 286 256 264 309 277 268</td>
<td>343 312 369 490</td>
</tr>
<tr>
<td>21</td>
<td>Library</td>
<td>696 688 667 684 574 644 621 750 677 698 816 731 707</td>
<td>905 825 973 1293</td>
</tr>
<tr>
<td>22</td>
<td>Recreation</td>
<td>300 297 287 295 247 278 268 325 292 301 352 315 350</td>
<td>390 356 420 557</td>
</tr>
<tr>
<td>23</td>
<td>Social/meeting</td>
<td>313 309 300 307 258 290 279 340 304 314 367 329 318</td>
<td>407 471 438 581</td>
</tr>
<tr>
<td>24</td>
<td>Other public assembly</td>
<td>321 317 307 315 264 297 286 348 312 321 376 337 326</td>
<td>417 380 448 595</td>
</tr>
<tr>
<td>25</td>
<td>College/university</td>
<td>701 697 683 709 509 661 571 817 682 734 888 740 739</td>
<td>1028 882 1125 1668</td>
</tr>
<tr>
<td>26</td>
<td>Elementary/middle school</td>
<td>429 422 408 424 345 395 353 463 460 410 479 418 401</td>
<td>525 465 556 818</td>
</tr>
<tr>
<td>27</td>
<td>Wash school</td>
<td>512 508 491 518 372 482 418 596 488 516 648 540</td>
<td>530 750 644 821 1217</td>
</tr>
</tbody>
</table>
Example of National Military Energy Targets

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Existing³</th>
<th>New Construction</th>
<th>Major Renovation¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Site Usage</td>
<td>Source Usage</td>
<td>Site Target</td>
</tr>
<tr>
<td>Training Classroom</td>
<td>50</td>
<td>109</td>
<td>15</td>
</tr>
<tr>
<td>Barracks</td>
<td>85</td>
<td>129</td>
<td>27</td>
</tr>
<tr>
<td>Small Office</td>
<td>59</td>
<td>144</td>
<td>16</td>
</tr>
<tr>
<td>Mixed Office</td>
<td>52</td>
<td>120</td>
<td>16</td>
</tr>
<tr>
<td>Large Office²</td>
<td>118</td>
<td>318</td>
<td>16</td>
</tr>
<tr>
<td>Warehouse</td>
<td>37</td>
<td>70</td>
<td>5</td>
</tr>
<tr>
<td>Public Assembly</td>
<td>31</td>
<td>48</td>
<td>18</td>
</tr>
<tr>
<td>Recreation</td>
<td>73</td>
<td>117</td>
<td>19</td>
</tr>
<tr>
<td>Medical Clinic</td>
<td>85</td>
<td>206</td>
<td>32</td>
</tr>
<tr>
<td>Religious Worship</td>
<td>66</td>
<td>83</td>
<td>14</td>
</tr>
<tr>
<td>Shopping Mall</td>
<td>84</td>
<td>198</td>
<td>23</td>
</tr>
<tr>
<td>Library</td>
<td>50</td>
<td>108</td>
<td>16</td>
</tr>
<tr>
<td>Daycare</td>
<td>51</td>
<td>117</td>
<td>22</td>
</tr>
<tr>
<td>Convenience/Gas</td>
<td>94</td>
<td>309</td>
<td>65</td>
</tr>
<tr>
<td>COF</td>
<td>90</td>
<td>171</td>
<td>11</td>
</tr>
<tr>
<td>BGD/BN HQ</td>
<td>48</td>
<td>122</td>
<td>15</td>
</tr>
<tr>
<td>Cafeteria</td>
<td>521</td>
<td>808</td>
<td>170</td>
</tr>
<tr>
<td>Strip Mall</td>
<td>58</td>
<td>155</td>
<td>23</td>
</tr>
<tr>
<td>Reserve Center</td>
<td>---</td>
<td>---</td>
<td>12</td>
</tr>
</tbody>
</table>

* Major Renovation is classified as building work exceeding 25% of the facility replacement cost
** Buildings with high internal loads such as the DMDC shall have optimize building type EUI separately
Subtask B. Energy/Water Targets: definitions, matrix, monetary values

- Energy and water targets list, e.g.,
  - Site or end energy
  - Source or primary energy
  - Energy Efficiency
  - Energy Security
  - Energy Independence
  - Energy Resilience
  - Reliability of Energy Systems

- Definitions
- Matrix
- Monetary value
- Evaluate alternate units of measurement (per sq ft, per person, per hour of occupancy,...)
Site and Source Energy

• **Site energy:** The kWh or Btu net value of energy use at the point it enters the end user at the meter (building, building cluster, military installation, city or other community) sometimes is referred to as “delivered” energy. The site value of energy is used for all fuels, including electricity;

• **Primary or “source” energy** is an energy form found in nature that has not been subjected to any conversion or transformation process. It is energy contained in raw fuels, and other forms of energy received as input to a system. Primary energy can be non renewable or renewable. be non-renewable or renewable.
Net Site Energy Use Concept

Per American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 100-2015, Net site energy use = (1a+1b+1c+1d+1e) – (3a+3b+3c+3d+3e)
Site Vs Source Energy User Reduction

• There is often confusion between site and source energy in the definition of energy goals and net-zero energy community, and this difference defines technical approaches used to achieve these goals.

• **Community site energy reduction** - the emphasis is on energy efficiency of systems located inside community boundaries, thermal or electrical energy supplied to the community are treated equally (no consideration of inefficiency of electricity generation or distribution losses in thermal and power networks. May result in preferences to electrical heating, electrical cooling or ground-coupled heat pumps. Such approach will result in an increase in fossil fuel usage and GHG emission.

• **Source energy or fossil fuel based energy is a minimization parameter**: energy efficiency of the community systems may become of lesser importance. Communities connected to hydro power stations or to nuclear reactors will become fossil fuel neutral without any effort given to improvement of community energy systems. When electricity provided to the community is primarily based on fossil fuel, net-zero fossil fuel goal is becoming a challenge and requires improvement of community energy system efficiency along with reduced energy waste with power generation and distribution systems.
Energy Security

• **Surety** – Preventing loss of access to power & fuel sources
• **Sufficiency** – Providing adequate power for critical missions
• **Survivability** – Ensuring resilience in energy systems

Which means the following requirements for on-site generation and distribution systems:

• Uninterruptable
  • power to mission critical facilities,
  • heat to prevent freezing the buildings (leaving quarters),
  • steam to provide sterilization and operation needs for critical processes, and
  • cooling energy supply to food storage, data centers and other mission critical facilities
• Smart power and thermal grids + micro-grids
Energy Efficiency

**Energy efficiency** - percentage of total energy input to a process that is consumed in useful work and not wasted as useless heat. Analysis of energy flows and balances is a useful tool to identify energy waste and inefficiencies, which are potential areas of energy conservation. (Annex 46).
Energy Independence

Energy Independence relates to the goal of reducing imports of oil, natural gas, and other foreign sources of energy. Proposed matrix to be used: % of net energy imports against the total nationwide fossil-fuel-based energy consumption.
Resilience

- Resilience is the ability to provide and maintain an acceptable level of service in the face of various faults and challenges to normal operation (Wikipedia).

- Per Benjamin Sovacool (2011) resilience relates to “adaptive capacity” or the “ability for communities to respond to natural disasters” by maintaining:
  - Capacity margins
  - Reserve margins
  - Peak load to base load ratios
  - Generator profiles summer/winter
  - Emergency stockpiles for oil (days meet demand)
  - Emergency stockpiles for coal (days meet demand)
  - Emergency stockpiles for natural gas (days meet demand)
  - Availability of trained repair personnel
  - Availability of spare parts and supplies
  - Generation adequacy
  - System adequacy.
Subtask C. Develop, catalog, database of representative building models by building use type, including mixed-use buildings, applicable to national public communities/military garrisons building stocks.

• List MOD/University specific building archetypes
• Collect existing representative computer models of buildings to be used for master planning. These models need to be generic, but adjustable to include major EEMs; applicable for multiple climate zones; cover past and current building typology and construction practices.
• Develop common approach to calibration of building models to existing energy use data available from metering and sub metering
• Modify these models to address different levels of energy efficiency (e.g., baseline, minimum current energy codes, near zero energy building, etc..) and store these options in the database.
The Database Helps to Increase Facility Energy Use Calculation

- Energy Plus simulations run on server farm
- 1000’s of simulations can be queued
- ~ 100 run simultaneously
- Results are kept in database for reuse
Example of Buildings Database (ERDC NZP)

- Group by:
  - Type
  - Era of Construction
  - Physical Characteristics
- Designate
  - Existing
  - Planned
  - Demolish

Existing, Pre-1980
Planned ASHRAE 90.1-2010
Demolish Mid 20th Century
Map Area
Conditioned area & Construction/Retrofit Date
Subtask D. Develop architecture and models of modern central energy systems (power and thermal).

- Collect information on exiting and the state-of-the-art components and architecture of CEPs including those with co- and tri-generation, integrated RE sources and micro grids.

- Develop a database of important components (technical characteristics, useful life, first and operation costs) to be included into community-wide computer models.

- Correlate these systems with potable and non-potable water strategies

- Analyze existing models for generation and distribution systems and methods of their integration in the existing master planning tools
Selecting a Supply Architecture

The optimization process determines the best suite of equipment by ensuring that the demands for heat, cooling, electric, etc are fulfilled at each of the 8760 hours in the year, while satisfying the additional environmental and legislative requirements.
Sizing the Supply Equipment

Specific equipment pieces are sized and their interactions with each other are tracked throughout the year. The result is a complete “supply” solution that provides the sizing, initial cost, and operating cost of every piece of equipment in the lowest cost solution.

• Develop a formalized E(W)MP process to include
  • Project team composition
  • List of required inputs
  • Establishing base line and base case.
  • Tradeoffs between energy/water efficiency cost, RE costs and energy conversion/distribution costs.
  • Methodology to selection of a limited number of scenarios to meet energy goals.

• Develop inputs into National/agency guidance on E(W)MP (e.g., UFC for U.S. DOD.)
Example of Requirement for National Implementation

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (INSTALLATIONS, ENERGY AND ENVIRONMENT) 
ASSISTANT SECRETARY OF THE NAVY (ENERGY, INSTALLATIONS AND ENVIRONMENT) 
ASSISTANT SECRETARY OF THE AIR FORCE (INSTALLATIONS, ENVIRONMENT AND ENERGY) 
DIRECTORS OF THE DEFENSE AGENCIES 
DIRECTORS OF THE DOD FIELD ACTIVITIES

SUBJECT: Installation Energy Plans

The Department of Defense (DoD) continues to make progress toward reaching our energy goals with installation energy efficiency efforts contributing to DoD avoidance of approximately $1 billion in new operating costs since 2009. In today's resource constrained environment, the Department must continue to find creative ways to drive additional efficiencies in energy use and reduce costs. A larger coordinated effort is needed to gain synergy between current energy initiatives and future planned energy projects to maximize energy use and cost reductions. By leveraging improved access to meter and energy data, we can drive a more integrated and systematic approach to energy management through informed energy planning. Effective immediately, it is the Department's policy to require installation-level energy plans for all DoD Components to support this concept.

Currently, DoD Components are updating their installation master plans to meet the requirements of the Under Secretary of Defense (Acquisition, Technology and Logistics) memorandum, Installation Master Planning, of May 28, 2013, by October 1, 2018. The Installation Energy Plan (IEP) should be an integral part of this effort. Thus, within one year of the date of this memorandum, each DoD Component will brief my office on their prioritized plan for the implementation of this policy. Within three years of the date of this memorandum, energy plans, signed by the base commander, should be completed for installations that together compose 75 percent of each component's installation energy consumption. Attachments 1 and 2 provide a high-level overview of the suggested IEP development process and a general reference list of DoD energy management and master planning guidance documents.
Subtask F. Develop functional description of the role of modeling tools in the Net Zero Energy /Water Master Planning Process

• For each major step of the process, describe the inputs, analysis steps, outputs, and level of details for each.

• Collect information on existing modeling tools appropriate for E(W)MP and identify where each meets the analysis requirements.

• Identify gaps and needed steps to enhance exiting master planning computer tools.
Integrated process for energy, water, waste, storm water

This presentation focuses on energy.

1. Setup Site Data
   - Building
   - Geography
   - Utilities
   - Cost Data
   - Water
   - Waste
   - Greenhouse Gas

2. Minimize loads

3. Optimize and integrate all components across community of interest

4. Update plans with Justification & Documentation
   - EW2 Plan
   - Projects
   - Sequence
   - Schedule
   - Costs
   - Risk
   - DD1391

Supports

Execute, Track, Measure

Optimize and integrate all components across community of interest

Renewable Energy

Grid Energy

Installations

Greenhouse Gas

Solid Waste

Water
German Building Community Simulation Model

Maile, Fischer, Bazjanak, Stanford University 2007

Joe Clark, Strathclyde University
The Model Includes Urban context for shading, IR exchange, microclimate, network design

STANET program package for static and dynamic calculation of utility networks.

• Collect and describe:
  • Legal requirements and constraints for NZEW master planning in the participating countries;
  • Funding sources, their availability and limitations.

• Based on collected information and its analysis, develop recommendations for policy making and the project facilitation levels.

• The study will focus on single ownership communities (MoD, Federal estates, universities) and the typical funding sources used in participating countries, e.g., public, public- private and private funding sources; bank loans, or more specific approaches such as PACE, utility bill payments)
Subtask H. Dissemination and training

• On national levels the project will integrate participants from end users, academia and industry. That will allow for a solid data input into project tasks and dissemination of results as well as better communication between all parties involved in the project.

• Following previous experiences, the project progress will be presented at the major national and international forums, (e.g., ASHRAE and REHVA conferences) and published as a set of technical papers.

• Special training courses will be developed and taught to different industry segments (decision makers, master planners, ESPCs, designers and architects).

• Annex team will host its website describing the project and its progress.
Expertise or skills the project will require from participating counties

- Each National team will include experts representing end users from military or other public sector, R&D experts, engineers and architects and industry partners, which will result in solid research based practical deliverables.
- Energy Planners from MODs and Universities
- Community systems modellers and model integrators
- Cost estimators for advanced energy systems and their components
- System integrators for advanced energy systems
- Property value estimators
- O&M experts (to contribute to systems’ life and O&M costs)
- Community real estate developers and owners
- Experts in Energy Performance Contracting
Initial estimate for how long the project will take to complete

• For the preparation phase - one year starting July 2016
• For the working phase - 3.5 years
• For the reporting phase – 1.0 year
Suggested Deliverables

• A “Guide for NZE planning in public and military building communities,“

• Enhanced NZP Tool

• A book of Case Studies (Examples of Energy Master Plans, Results of several realized or partially realized projects)
Preparation Phase Time Schedule

- First preparation meeting – Washington, DC – September 12, 2016
- Draft proposal – October 2016
- Draft proposal will be presented at the IEA EBC Executive Committee meeting in Sydney – November 17, 2016
- Third preparation experts meeting location and time TBD (not later, than April 2017)
- Proposal presentation at the IEA EBC Executive Committee meeting – June 2017

The proposal package will include
  - Text of the proposal
  - List of participating countries supported by National letters of participation (providing assurance that national representatives will have funded project at a level at least 6 person-months a year)
  - National organizations and individuals participating in the project by Subtasks, Subtask Leaders, Subtask working plans
  - National teams with network having a relevant technical, industry, financial, and business expertise representation
Countries, which expressed interest in the Annex

- USA
- Germany (DE)
- UK
- Italy (IT)
- Latvia (LT)
- Sweden (SE)
- Denmark (DK)
- Austria (AT)
- Poland (PL)
- Estonia (ET)
- Norway (N0)?
- Australia (AU)?
- Spain (SP)?
- Israel (IS)?
- Canada (CA)?
<table>
<thead>
<tr>
<th>Subtask</th>
<th>Participation</th>
<th>Co-lead</th>
</tr>
</thead>
<tbody>
<tr>
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<td>G. Business, legal and financial aspects of Net Zero Energy /Water Master Planning</td>
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<td>H. Dissemination and training.</td>
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