

THE ACTION PLAN FOR ENERGY EFFICIENT HOUSING IN THE UNECE REGION

*NB: Preliminary draft circulated to forum participants for comments*¹

Abstract

This Action Plan provides a framework programme of work for UNECE Member Governments to improve energy efficiency of their housing sectors and thus to enable the housing sector to realise its potential in addressing environmental and economic challenges and satisfying social needs. Improved energy efficiency in housing is defined as reduced energy intensities in the residential services without compromising the levels of wellbeing of the residents or environmental conditions. The Action Plan specifies a comprehensive range of measures for removing barriers to so defined energy efficiency and for a progressive transformation towards a general aim of zero energy and zero carbon housing. It outlines three Policy Areas to act upon, including: (i) energy efficiency governance and financial infrastructure; (ii) energy performance standards and technology integration; (iii) access to energy efficiency and public housing. Each of the Policy Areas contains four Goals, which are supplemented by more detailed targets, suggested actions and timeframes for their implementation. Each of the Goals is also underpinned by an overall Vision of expected achievements by the year 2020.

A. Background

The housing sector is among leading priorities for the imperative to improve energy efficiency in the UNECE region. *Firstly*, housing is responsible for a substantial share of total energy demand in the region. According to the IEA data for 2006, 20% of total final consumption (TFC) of energy in the UNECE region and 25% in the UNECE region excluding the US and Canada are attributed to the residential sector. This share ranged from 14% to 46% in individual Member States and averaged 20-30% across all the countries. The corresponding carbon emissions of the sector are also substantial. *Secondly*, dwellings belong to the longest lasting and most expensive human technological infrastructure and have very long maintenance and replacement cycles and a high degree of inertia. Thus, measures taken today, or lack of same, will leave a substantial legacy for many decades. *Thirdly*, the housing sector remains characteristically wasteful across the UNECE region. While technology available provides a highly feasible potential to achieve drastically reduced energy use in housing, the sector generally maintains inefficient practices and is also one of the major factors driving energy demands towards even higher levels. As a result, much more energy is used than is justified from each and any of economic, technological and environmental perspectives.

The present Action Plan for Energy Efficient Housing seeks to respond to a number of challenges as highlighted in an ad hoc UNECE report entitled “Green Homes: Towards Energy-Efficient Housing in the UNECE Region”, which provides background material, including considerations about opportunities, barriers and prospects for these matters in the UNECE regions.² The report recognises that enhancing energy efficiency in housing is one of the prerequisites to fulfilling national and international commitments aimed at resolving today’s problems of climate change, energy security, economic development, and poverty. The

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² A pre-print draft of “Green Homes” is available online at:
<http://www.unece.org/hlm/sessions/docs2009/greenhomes.pdf>

following *benefits and opportunities* created from improved energy efficiency in housing are highlighted:

Environmental benefits. As it is energy production that is responsible for most of greenhouse gas emissions, improved energy efficiency alleviates pressure on global climate change. Housing energy efficiency also constitutes a climate change adaptation measure by reducing the exposure of households to adverse and unstable weather conditions.

Energy availability and energy security. Improving energy efficiency in housing permits more energy for alternative uses and for growing energy demands in the housing sector itself. It also helps alleviate the risks of political instability due to possible energy shortages or price inflation.

Economic benefits. Better efficiency offers savings on running costs for tenants, while service providers benefit from less loss in the delivery of energy services. The development of the sector also has positive influences on research and innovation, employment, investment, the development of SMEs, and provides an effective tool to stimulate economic growth.

Regeneration of the built environment. Retrofitting homes and using proper technologies for housebuilding can significantly improve indoor comfort and imply longer cycles of property repair. Comprehensive programmes also improve the aesthetics of domestic buildings, as well as that of surrounding public areas, making the urban environment in general more attractive.

Social effects. Energy efficiency interventions in housing improve living conditions and the state of public health, address the problems of energy affordability and, as a consequence, mitigate social exclusion and inequality thus fostering social cohesion.

Evidence suggests that in comparison with other energy end use sectors the residential sector offers one of the greatest existing potentials for energy savings. Moreover, investing in energy efficient homes provides a quicker and more economical effect than boosting the capacities of energy supply, while it also brings all the other attendant benefits as highlighted above. Most of the energy savings may be achieved by applying appropriate technological solutions, from the simple to the more advanced, such as, for example, plus-energy buildings. Plus-energy buildings produce renewable energy and deliver excesses over their own needs to the energy grid, thus using less energy over a year than producing. Even less sophisticated and yet cost-effective retrofitting projects across the UNECE region typically demonstrates up to 40% savings in energy.

Although some progress has been identified to date in the UNECE region, even those member states that are usually considered to be “advanced” in building and energy standards are still far from fully realising their potential. As a rule, investments in energy efficient housing are below the levels that may be considered “optimal”, thus contributing to the “energy efficiency gap” between the actual use of energy and the optimal use demonstrated by existing cost-effective methods and technology.

This situation is due to a number of *barriers and challenges* to the deployment of energy efficient technologies. One of the most common challenges is a low priority for energy issues versus alternative necessities for households and other economic agents. Efficiency products are usually more expensive and less familiar than alternatives, so that in the absence of proper regulatory requirements and other incentives and rewards, the technological chain involved in the design, production and maintenance of new houses tends to uphold the status quo rather than to engage with best available practices. The situation is even more formidable for existing homes, as retrofitting requires high up-front costs and involves varied “transaction costs”. Even if actors realise that such investments bring them operational savings, they may consider that the opportunity costs are too high (other “more interesting” opportunities exist) and that the payback period is too long “to be worth the hassle”. Furthermore, there are split incentives between

tenants, homeowners, and energy producers, while other common barriers include a lack of sufficient investment capacities for the agents of energy efficiency, uncertainties and risks of such investments, organisational barriers, technological lock-in and path-dependency, and a lack of information and/or awareness. Therefore, progress towards energy-efficient housing requires not only the development of technological solutions, but also *institutional infrastructure* for the active deployment and adoption of these solutions, including standards and regulation in the construction sector, incentives and capacities for modernising the existing housing stock, and know-how and awareness in housing management.

In short, policies should facilitate the deployment of energy efficiency in housing by creating a proper institutional environment for a good functioning of the “innovations-information-incentives-initiative-investments” system (following the five-“in” model of the conditions behind energy efficiency improvements as recognised the *Green Homes* report), while also ensuring that the housing sector fulfils its environmental, social and economic obligations.

B. The overall purpose and scope of the Action Plan

The present Action Plan presupposes that housing in the UNECE region must be purposefully and progressively transformed into an advanced sector that is well equipped to contribute to the resolution of both global environmental challenges and local everyday needs and to realise its full potential in the national economy. Improved energy efficiency is considered an essential element for such a transformation and represents the overall agenda of the present Action Plan.

Improved energy efficiency in housing is defined as reduced energy intensities in the residential services without compromising the levels of wellbeing of the residents or environmental conditions. The corollary of this definition is that the housing sector with its excessive energy consumption, environmental pollution and problems with energy affordability cannot be considered to be efficient. This definition thus recognises the links between energy efficiency and all the three elements of sustainable development - environmental, social and economic.

Following on from this definition, improved housing energy efficiency may be decomposed into eight elements or pillars, as follows:

1. Existing housing's retrofitting to excellent energy standards.
2. Excellent energy standards for all new-built homes.
3. Energy efficient utility systems providing services to housing.
4. Low-energy housing management systems and practices.
5. Replacement of inefficient appliances and lighting systems.
6. A minimised carbon footprint for the housing sector.
7. Environmentally-friendly building practices.
8. Housing energy affordability.

The main aim of this Action Plan is to establish the necessary institutional conditions for these pillars to be built or strengthened and thereby to achieve a sustainable transition to a low-energy housing sector (and eventually to zero energy and zero carbon housing). To this end, the Action Plan provides a policy framework for both individual member states' actions and international cooperation.

C. Guiding principles

A set of guiding principles inform the Action Plan and should also be considered in combination with its policy goals, targets and the programme of work:

Comprehensiveness. There is no one single measure alone to resolve housing energy efficiency. Policies should be comprehensive, thoroughly developed and integrative of a number of instruments. Simultaneous cross-sectoral multidimensional approaches are necessary. One-dimensional solutions may in fact lead to unwanted or even unexpected results.

Learning and flexibility. Policies should both encourage and internalise best practices and innovations emerging from research and development, informational exchange, demonstration and pilot projects.

Social responsibility. It is vital that energy efficiency policies are interlinked with social policies and ensure affordable access to energy, mitigation of social inequality and improved social wellbeing. To consider energy efficient housing in simple narrow technocratic terms is deficient from both a social and political point of view.

Context. There are large differences across the UNECE region with respect to the levels of economic development, legislative and organisational structures, the history and practice of the residential sector, and climatic conditions. While the Action Plan has a universal relevance for the UNECE region, national and local policies should take into account local socio-economic, institutional and geographical contexts.

D. Summary of policy goals

The Action Plan outlines three Policy Areas, each of which contains four Goals. These are then supplemented by more concrete targets and suggested actions for each target and timeframes within which each specific action should be fully incorporated. Each Goal is also underpinned by a vision or an overall expected achievement from its implementation by the year 2020.

The detailed action plan is presented in Section E; below in this section is a summary of the twelve Goals.

Policy Area I. Energy efficiency governance and financial infrastructure

Goal 1. Organisational leadership and energy planning: Designate administrative bodies responsible for improving energy efficiency in housing; develop energy planning, management and monitoring capacities.

Goal 2. Financial incentives: Develop financial mechanisms that will stimulate owners, tenants, construction industry, technology providers, and other stakeholders to invest in housing energy efficiency.

Goal 3. Housing management, maintenance and refurbishment: Develop the institutional capacities of housing management that lead towards energy efficiency improvements and establish programmes for housing retrofitting.

Goal 4. Utility services and energy pricing: Develop mechanisms for sustainable end-use management of energy in housing by improving utilities' efficiency, adjusting energy pricing systems, and providing incentives for energy suppliers.

Policy Area II. Energy performance standards and technology integration

Goal 5. Energy performance requirements in homebuilding and existing housing: Strengthen energy and carbon performance requirements for both new and existing homes.

Goal 6. Low-energy and zero-carbon technology: Promote innovative solutions in new and existing residential buildings, such as passive, zero-energy, and zero-carbon homes and enable conditions for micro-generation of energy.

Goal 7. Spatial planning, development control and district heating-cooling systems: Integrate energy efficiency into spatial strategies, urban planning and development practices; develop district heating and cooling systems.

Goal 8. Research, innovations and best practices: Stimulate the development of innovations and new techniques in the domestic buildings sector.

Policy Area III. Access to energy efficiency and public housing

Goal 9. Public housing sector: Ensure the transformation of the social/public housing stock towards greater energy efficiency.

Goal 10. Energy affordability and social integration: Ensure affordable access to energy efficiency and eradicate energy poverty.

Goal 11. Awareness and capacity-building: Provide capacity-building and education programmes for bringing about an energy aware culture and developing requisite skills.

Goal 12. Geographical access to energy efficient housing: Carry out additional measures in regions and areas with lower levels of development in the field and with more challenging climatic conditions.

E. Policies and actions

POLICY AREA I. ENERGY EFFICIENCY GOVERNANCE AND FINANCIAL INFRASTRUCTURE

Goal 1. Organisational leadership and energy planning: *Designate administrative bodies responsible for improving energy efficiency in housing; develop energy planning, management and monitoring capacities.*

Rationale: Enhancing EE³ in housing requires a dedicated process of decision-making, planning, coordination, implementation and control and therefore specific organisational units in governments must be established for this purpose. They must ensure that the housing sector is highly visible in the energy policy agenda. Furthermore, regional and local energy planning, of which housing must be integral part, should facilitate inter-departmental coordination, including that between housing and energy. Energy planning and governance systems must, in turn, be supported by reliable data to adequately assess the current situation and monitor policy impacts.

<i>Targets</i>	<i>Actions</i>
1.1. Introduce framework laws supporting institutional changes with respect to EE.	1.1.1. A framework law for EE transformations is introduced, containing provisions for the sector of domestic buildings. 1.1.2. Changes are being made to national and local legislation as necessary to support the policies outlined in this Action Plan.
1.2. Establish a national and local government structures responsible for energy use and EE in housing.	1.2.1. An ad hoc national organisational unit of high profile is charged with the responsibility for coordinating, monitoring, enforcing and evaluating EE measures in housing (this may be a key body within existing housing departments or a newly-formed structure). 1.2.2. The unit is delegated concrete functions and powers over other relevant national departments and regional/local governments, can draft policies and initiate laws. 1.2.3. If necessary in the national context, a multi-level structure of the unit is established (at the regional and local levels). 1.2.4. The unit establishes strong coordination mechanisms between housing, energy and other authorities and stakeholders 1.2.5. Each local administration is required to have its own body dealing with housing EE.
1.3. Design and implement action plans for EE in housing at the national and local levels.	1.3.1. National plans and strategies for energy efficient housing are developed by national governments in collaboration with relevant international and national stakeholders. 1.3.2. The national action plans are written into a subsidiary programme of work guiding local governments.
1.4. Build statistical indicators and databases for energy monitoring in the residential sector.	1.4.1. National statistical indicators and monitoring capacities are developed based on the cooperation between departments responsible for housing, energy and statistics. 1.4.2. Information database systems are set up at the regional and local levels to support decision-making with respect to EE. 1.4.3. In the long run: a complete energy performance database for all homes is created.
1.5. Develop a coordinated system of regional and local planning of energy resources.	1.5.1. A system of planning for energy resources is established. 1.5.2. Legal and administrative responsibilities over the system of energy planning are established. 1.5.3. Informational support for the system is deployed.

Goal1-Vision 2020: Dedicated and effective government leadership to steer the transformation of the housing sector towards increasingly lower levels of energy consumption and carbon emissions.

³ Hereafter EE = energy efficiency

Goal 2. Financial incentives: Develop financial mechanisms that will stimulate owners, tenants, construction industry, technology providers, and other stakeholders to invest in housing energy efficiency.

Rationale: A sound financial framework is necessary for stakeholders to be able to raise capital for retrofitting and investing in efficiency technology, and for new technologies to be able to establish market niches. This should include a transparent system of subsidies, grants, loans, public investment programmes, leasing, as well as self-financing funding sources.

Targets	Actions
2.1. Develop a system of subsidies for improved EE in housing.	2.1.1. Funds are strengthened in public budgetary systems allowing subsidies to EE (e.g. tax-based funds and revolving funds). 2.1.2. Grants/rebates and other subsidies to homeowners and tenants for the purchase and installation of energy efficient equipment and for homes' retrofitting to higher EE are expanded. 2.1.3. The above mentioned subsidies are only provided to solutions with high EE impact and only to existing homes which lack such solutions. 2.1.4. In the longer run, only holistic, comprehensive renovations satisfying requisite energy and environmental criteria are subsidized. 2.1.5. A publicly-sponsored system of interest-free and low-interest loans for EE retrofit and improvements is available (through partnering financial institutions). 2.1.6. Grants to low-income households and affordable housing providers allow them to improve EE.
2.2. Improve tax incentives (tax credits, reductions and exemptions)	2.2.1. The system of tax instruments such as tax credits and tax deductions on EE investments is reviewed and strengthened. 2.2.2. Exemptions on property tax are introduced for new homes built to much higher efficiency standards than present building codes (limited to a certain property value and a certain number of years). 2.2.3. Property tax exemptions are introduced for all existing high-energy demand residential buildings converted to performance standards in accordance with the codes for new homes or better (subject to audit and certification). 2.2.4. Tax incentives for certain newly commercialized technologies are introduced (e.g. tax reductions or VAT exemption for efficient boilers, heat pumps, solar collectors, thermal insulation).
2.3. Introduce tax on inefficiency.	2.3.1. In combination with EE subsidies, an energy <i>inefficiency</i> tax on property is introduced, which is based on energy performance certification and depends both on energy performance and the size of a property (absence of certification leads to a maximum taxation for a given size; low-income homeowners are exempted).
2.4. Introduce systematised informational portals about existing financial incentives.	2.4.1. Nationwide information about available financial resources is systematised and accessible from a single user-friendly portal. 2.4.2. Model investment schemes are developed and available.
2.5. Stimulate the development of EE practices within financial institutions.	2.5.1. Legal provisions are made for the collaterals, guarantees and insurance that banks can use to create credit facilities for EE projects. 2.5.2. A system of public guarantees for loans to cover investments in improved EE in housing is developed. 2.5.3. Financial institutions are required to prove their expertise at appraisal and risk assessment of EE projects in order to participate in public-private partnership EE programmes. 2.5.4. Detailed instructions are provided to financial institutions so that financial institutions incorporate EE in their business models.

Goal2-Vision 2020: The financial system raises stakeholders' incentives and investment capabilities to the levels necessary to close the "energy efficiency gap" in the housing sector.

Goal 3. Housing management, maintenance and refurbishment: *Develop the institutional capacities of housing management that lead towards energy efficiency improvements and establish programmes for housing retrofitting.*

Rationale: The residential sector requires continuous maintenance and renovation in order to satisfy the modern requirements of quality, comfort and EE. There must be a system of clearly defined responsibilities in place for housing management and maintenance, which should integrate EE into its operational practices. Furthermore, the problem of ‘split incentives’ between landlords and tenants obstructs EE investment and needs to be resolved.

<i>Targets</i>	<i>Actions</i>
3.1. Develop institutional capacities for housing management.	3.1.1. Legal provisions are established for setting up and operation of collective homeowners bodies in apartment buildings (e.g. homeowners associations) on which legal obligations for housing maintenance are imposed. 3.1.2. Responsibilities are defined for the maintenance of common areas. 3.1.3. Decision-making process of the collective homeownership is clearly defined. 3.1.4. Collective homeowners bodies have maintenance funds that can finance EE projects (as part of maintenance activities) and can act as a capital borrower. 3.1.5. Collective homeowners bodies have powers of enforcement over apartment owners who are not willing to take part in maintenance schemes or unable to fulfil their obligations. 3.1.6. Non-owning tenants’ rights and responsibilities are secured (i.e. security of tenure is established).
3.2. Professionalize housing management	3.2.1. A transparent market for housing management companies is established (involving SMEs). 3.2.2. Training programmes and other capacity-building initiatives in housing management are widely available at the local level (with participation of educational institutions and interested NGOs.) 3.2.3. Special mechanisms are created that provide low-cost technical assistance to homeowners in the field of EE renovation. 3.2.4. Portfolios of model EE investment schemes are available.
3.3. Develop publicly-sponsored programmes for housing retrofitting.	3.3.1. EE retrofit is integrated into all government housing regeneration strategies and programmes. 3.3.2. Special programmes for EE improvements with regard to most problematic parts of dwellings are provided (e.g. for glazed areas). 3.3.3. Separate programmes are developed where necessary for comprehensive retrofitting of existing low quality and low energy-efficient homes.

Goal3-Vision 2020: The system of housing management acts within a strong framework of capacities and incentives to deliver better EE.

Goal 4. Utility services and energy pricing: *Develop mechanisms for sustainable end-use management of energy in housing by improving utilities' efficiency, adjusting energy pricing systems, and providing incentives for energy suppliers.*

Rational: User fees for delivered energy are important for stimulating EE behaviour. Therefore, a suitable energy pricing scheme should be in place. However, households must have full control over their own energy use and make informed use decisions, while utility companies and energy producers should be required to improve end-use EE.

<i>Targets</i>	<i>Actions</i>
4.1. Develop technological capacities for sustainable energy management in the housing sector.	<p>4.1.1. Dwelling-level energy metering and adjustable controlling systems are fully provided (i.e. for electricity, gas, heating and hot water).</p> <p>4.1.2. Targets are established for replacement of traditional meters with smart meters with real-time information (including prices)</p> <p>4.1.3. Capabilities for bi-directional electricity flows allow on-site generation from renewable sources to be transmitted to the grid.</p> <p>4.1.4. Energy utility distribution networks are maintained and updated to high technological standards.</p> <p>4.1.5. End-users can choose different suppliers, including those of renewable generation.</p> <p>4.1.6. New homes are required to be equipped with intelligent integrated controls systems for energy and indoor climate (temperature, humidity, ventilation, etc).</p>
4.2. Establish an adequate and responsible energy pricing system for the housing sector	<p>4.2.1. Fixed-cost payment systems for energy services are eliminated and users pay for amounts used.</p> <p>4.2.2. Progressive tariff systems are introduced so that end-users are charged more per unit of energy after certain thresholds.</p> <p>4.2.3. Differentiated energy tariffs, which take into account the time of day and the season, are introduced (based on smart metering which provides two-way communications).</p> <p>4.2.4. Households are paid for energy microgeneration at preferential tariffs irrespective of whether they use it on-site or feed into the grid where judged necessary for this technology to develop.</p>
4.3. Incentivize and optimize energy suppliers and utilities.	<p>4.3.1. Utilities are obliged to send informative energy bills. Utilities are also obliged to inform customers about both everyday energy-saving measures and possible efficiency investments and financial incentives available.</p> <p>4.3.2. Energy suppliers are obliged to spend extra incomes received from the higher energy tariffs bands for EE.</p> <p>4.3.3. Electricity suppliers are obliged to source a certain proportion of electricity from renewable micro-generation (in addition to "regular" renewables).</p> <p>4.3.4. Provisions are made to reward utilities for end-users energy savings (that they contribute to) and for low-carbon energy supplied.</p> <p>4.3.5. A system of tradable energy saving certificates (e.g. 'white certificates') is developed.</p> <p>4.3.6. Institutional conditions necessary for energy performance contracting (EPC) and energy services companies (ESCOs) are developed.</p>

Goal4-Vision 2020: The housing sector is connected to intelligent energy grids based on digital technology and user-friendly control systems; utilities deliver renewable energy to households and efficiently redistribute energy generated by homes themselves.

Goal 5. Energy performance requirements in homebuilding and existing housing: Strengthen energy and carbon performance requirements for both new and existing homes.

Rationale: The system of mandatory standards for energy performance of buildings (as per their design and system for heating, hot water, ventilation, cooling, lightning and related control) belongs to the most effective instruments to increase EE of new buildings and must be further advanced. It is also important to develop mechanisms for improving energy performance of existing buildings, as they will constitute the vast bulk of the housing stock for many decades.

Targets	Actions
5.1. Improve the dynamic and mandatory system of energy and carbon performance standards for domestic buildings.	5.1.1. Building codes are mandatory and cover the whole country. 5.1.2. Energy standards are regularly raised to higher levels; future targets are known in advance in order to give the industry time to adjust. 5.1.3. Differentiated energy requirements are introduced dependent on climatic zones (e.g. stricter u-value requirements for cold regions). 5.1.4. Differentiated EE requirements are introduced dependent on size of the project and status of the developer (e.g. larger developments and public sector projects are required to meet more challenging standards faster). 5.1.5. In medium term, standards become inclusive of energy and carbon performance during the full lifecycle of the building (e.g. take into account energy used in the manufacturing of construction materials and during the construction phase). 5.1.6. In the medium term, energy performance standards require all new buildings to be built to passive standards and in the longer run to net zero-energy standards (see Target 6.1).
5.2. Introduce mandatory energy certification for all residential buildings.	5.2.1. A universally regulated system of energy audit and certification is introduced at the national level. 5.2.2. Certification is based on a system of integrated environmental assessment of buildings and includes both energy and carbon indicators. 5.2.3. All new homes are required to have energy performance certificates. 5.2.4. This also applies to existing homes where they participate in market transactions or demand tax reductions or subsidies. 5.2.5. Certification is part of the housing EE databases (see Target 1.4). 5.2.6. As the system of certification and audit is well established, mass energy assessment of all residential buildings is conducted.
5.3. Develop energy performance standards for existing housing.	5.3.1. Certain levels of EE are an obligatory condition for issuing building permits for extensive renovation and reconstruction. 5.3.2. EE standards are introduced for existing homes. They may take account of building year of construction and heritage value and initially only play an advisory role (e.g. for subsidies or renovation priorities). 5.3.3. After a transitory period, the energy standards for existing housing are made mandatory, so that homes must be retrofitted if not in compliance with them or considered unsuitable for occupation. 5.3.4. The date is known when energy standards require existing buildings to be renovated to zero-energy or zero-carbon standards (see Target 6.1).
5.4. Ensure the enforcement of mandatory standards.	5.4.1. Mechanisms to control and enforce the implementation of mandatory codes are strengthened (including heavy penalties for non-compliance).
5.5. Include EE as a condition for all public-assisted housing projects.	5.5.1. Government investments in housing and public procurement require high levels of EE; subsidies to projects with low EE are phased out. 5.5.2. EE is among selection criteria for providing public subsidies to residential construction projects.

Goal5-Vision 2020: Low efficiency residential buildings have been retrofitted to high levels of energy efficiency or demolished in a sustainable way and replaced by high-performing homes; all new homes and all new retrofits are made to zero-energy zero-carbon standards.

Goal 6. Low-energy and zero-carbon technology: Promote innovative solutions in new and existing residential buildings, such as passive, zero-energy, and zero-carbon homes and enable conditions for micro-generation of energy.

Rationale: Improved energy efficiency in housing is to a large degree a function of the availability and application of technological solutions. Their diffusion must therefore be cultivated and facilitated. Appropriate national targets and measures should promote low-energy and zero-carbon technology in anticipation that this technology will have to become a requirement in the residential sector. Renewable energy should be promoted, as should be fuel switching to less carbon intensive fuels.

<i>Targets</i>	<i>Actions</i>
6.1. Promote low-energy, zero-energy and carbon-neutral buildings solutions.	<p>6.1.1. National targets are established for a step-by-step transformation towards zero-carbon, zero-energy and plus-energy buildings technology; these targets take into account the differences between regional climatic zones.</p> <p>6.1.2. Universal definitions and design standards for zero-energy or positive energy buildings are developed, which integrate energy and other environmental and health requirements (such as for indoor air quality).</p> <p>6.1.3. New buildings are required to be built to passive building standards.</p> <p>6.1.4. In the medium term, building codes require new homes be built to net zero-energy or positive energy standards.</p> <p>6.1.5. In the long run, building codes require existing homes to be renovated to net zero-energy standards.</p> <p>6.1.6. Policies ensure the integration of these standards into energy performance standards (Goal 5) and their coordination with financial stimuli (Goal 2).</p>
6.2. Develop on-site renewable energy generation capacities.	<p>6.2.1. National action plans consider measures for popularisation and dissemination of on-site generation technologies for renewable energy.</p> <p>6.2.2. Bi-directional flow and net-metering are enabled (see also Target 4.1).</p> <p>6.2.3. In the longer run, mandatory solar collectors are required in all new and renovated houses (subject to climatic considerations).</p>
6.3. Promote off-site renewable and low-carbon energy supply to households (see also Targets 4.3 and 7.4)	<p>6.3.1. Utilities are incentivised to provide renewable energy to households.</p> <p>6.3.2. Carbon intensities of energy supplied to the residential sector are continuously reduced (e.g. switching from oil to gas and to biomass pellets, developing on-demand district heating and cooling, etc).</p>
6.4. Promote low-energy lightning and appliance standards.	<p>6.4.1. National action plans consider measures for improving the performances of household appliances and lightning.</p> <p>6.4.2. Minimum energy performance standards are established and gradually reviewed for the design of household appliances and lightning.</p> <p>6.4.3. Local producers of low-energy appliances get support.</p> <p>6.4.4. Programmes are introduced to phase out low performing appliances and equipment and incandescent bulbs;</p> <p>6.4.5. Technologies allowing reduced use of energy for lightning and appliances are integrated into building management.</p>

Goal6-Vision 2020: At least 10% of the UNECE population live in zero-energy zero-carbon homes; microgeneration in the sector of domestic buildings is a significant contributor to the primary energy production.

Goal 7. Spatial planning, development control and district heating-cooling systems: Integrate energy efficiency into spatial strategies, urban planning and development practices; develop district heating and cooling systems.

Rationale: It is not only the technological attributes of buildings that contribute to reductions in energy use, but also spatial organisation and density attributes of cities at large. Certain levels of residential density, mixed-used developments, good public transit provision, and integrated district heat-cooling-electricity systems are important considerations for EE and reduced GHG emissions.

<i>Targets</i>	<i>Actions</i>
7.1. Integrate residential EE considerations in planning process.	7.1.1. Urban plans take into account measures aimed at reducing residential areas' energy use and carbon footprints. 7.1.2. Urban plans take into account energy resources planning. 7.1.3. Definitions of, and planning support for, eco-towns (sustainable residential settlements) are established. 7.1.4. EE considerations are an integrated part of any activities involving comprehensive regeneration of neighbourhoods.
7.2. Integrate residential EE considerations in development control.	7.2.1. Building permits are only issued for residential projects that are optimized spatially to reduce energy consumption (e.g. density and transport considerations, best advantage of natural heating, cooling, lighting and shading potentials). 7.2.2. Residential projects with certain levels of energy efficiency are ensured fast track planning permit application process. 7.2.3. A fast track planning application is available for microgeneration.
7.3. Apply holistic approaches to the assessment of EE and environmental standards in residential projects.	7.3.1. The integrated design of whole buildings is considered for the assessment of their EE. 7.3.2. The life cycles of buildings (all stages from energy use in manufacturing of construction materials to demolition and recycling of same) are optimized in order to reduce overall carbon footprints.
7.4. Develop district heating and cooling systems.	7.4.1. Demand-driven district heating systems (each building takes heat and hot water from the system according to their needs) are developed. 7.4.2. In the longer run: integrated district heating-cooling systems are developed.

Goal7-Vision 2020: Cities and other settlements are low-energy and on their way to become carbon-neutral.

Goal 8. Research, innovations and best practices: Stimulate the development of innovations and new techniques in the domestic buildings sector.

Rationale. Best practices and innovations that emerge from research and development, demonstration or pilot projects must find real-life applications and stimulate a continuous transformation of the buildings sector towards new technological frontiers. It is not, however, that energy-efficient solutions and innovations have always to be based on “high-technology” or to be expensive; affordable solutions should be prioritised.

<i>Targets</i>	<i>Actions</i>
8.1. Support research and development capacities.	8.1.1. A national competitive framework for the selection of promising projects for public support is established (such as EE trusts). 8.1.2. Special public funds assist the R&D sector in developing new low-energy and energy exchanger technologies and techniques for residential sector (e.g. heating, ventilation, and air conditioning systems, heat pumps, solar collectors, cogeneration, efficient construction materials, prefabricated methods, appliances, etc). 8.1.3. Pilot projects in innovative areas receive support and assistance.
8.2. Stimulate the development of affordable solutions, especially those using local materials.	8.2.1. Public research grants are provided for the development of technologies suitable for particular geographical conditions. 8.2.2. Public grants are provided for the development of affordable technology for low-energy, low-carbon and passive buildings, especially using local materials. 8.2.3. Special funds assist high-risk yet promising innovative R&D.
8.3. Support the transition of EE products from R&D to commercialization.	8.3.1. Communications between R&D and commercial sectors are improved. 8.3.2. Special public-supported agencies are set-up to work as intermediaries for better dissemination of technologies and information to stakeholders. 8.3.3. Grants assist promising technologies to achieve their market niche. 8.3.4. Locally-available construction materials are promoted. 8.3.5. Innovative design tools are available. 8.3.6. New technologies are incorporated into product lines. 8.3.7. SMEs take an active role in commercialisation of new technologies.

Goal8-Vision 2020: Next generation technologies (including unknown at the moment) for the EE transformation of the domestic buildings sector are available and being deployed.

POLICY AREA III. ACCESS TO ENERGY EFFICIENCY AND PUBLIC HOUSING

Goal 9. Public housing sector: *Ensure the transformation of the social/public housing stock towards greater energy efficiency.*

Rationale: Specific policies should target the public/social housing sector, where from an institutional point of view particular opportunities are present. Public/social housing in some countries already delivers better standards of energy efficiency than average private homes; among other advantages this helps tackle fuel poverty. There should be special programmes of investing in retrofitting of the existing public stock and stricter requirements for better energy efficiency performance of new homes. As the organisation of public/social housing varies considerably across the UNECE region, different combinations of financial and legal measures should be provided dependent on local contexts.

<i>Targets</i>	<i>Actions</i>
9.1. Develop special EE policies for the public/social housing sector.	9.1.1. Develop action plans for the EE transformation of the public/social housing sector. 9.1.2. Include EE considerations in all related documents and procurement contracts. 9.1.3. Combinations of financial and legal measures are provided for the public/social housing sector dependent on national contexts.
9.2. Develop comprehensive retrofitting programmes for public/social housing.	9.2.1. Comprehensive retrofitting programmes are introduced for public/social housing, starting with the most problematic areas and gradually extending to the whole public/social housing stock.
9.3. Enable the conditions for new public/social housing to adhere to stricter requirements for EE performance than other housing definitions (see also Target 5.1).	9.3.1. New public/social housing is required to meet new (stricter) energy codes quicker than other homes. 9.3.2. Existing public/social housing is required to be retrofitted to high standards for energy efficiency and to use the best available technologies and solutions. 9.3.3. New public/social housing is required to incorporate renewable energy micro-generation. 9.3.4. In the longer run, all new built public/social housing and retrofits are made to zero energy (carbon neutral) standards.

Goal 9-Vision 2020: All public homes have initiated action to become carbon neutral; public/social housing is at the forefront of the EE revolution and offers an example for the rest of the housing sector.

Goal 10. Energy affordability and social integration: Ensure affordable access to energy efficiency and eradicate energy poverty.

Rationale: Even in most developed UNECE countries a considerable portion of the population live in energy poverty (i.e. spend more than 10% of household income on energy in order to heat their homes to a minimum standard of warmth). Since it is also typically the same groups that are unable to afford EE, the vicious cycles of energy poverty can worsen. Furthermore, technologies and measures that may be considered “affordable” in some areas are not necessary affordable if implemented in less wealthy regions.

<i>Targets</i>	<i>Actions</i>
10.1. Develop interdepartmental social policy framework for energy affordability.	10.1.1. Energy affordability considerations are integrated with social policies and safety net provisions. 10.1.2. A special organisational body is responsible for energy affordability issues and for interdepartmental cooperation in the field. 10.1.3. Criteria are developed to what percentage of the household income may be spent on energy before targeted subsidies are provided.
10.2. Eradicate energy poverty.	10.2.1. A complex set of financial measures is introduced to tackle energy poverty, including assistance with energy bills. 10.2.2. Low-income residents are provided with subsidies and grants to improve EE performances of their dwellings, including for retrofitting purposes. 10.2.3. In the longer run: energy subsidies are replaced by more generous assistance to improve EE (i.e. so that less energy is consumed for acceptable levels of comfort). 10.2.4. Low-income households are also provided with grants and subsidies to purchase new energy efficient major appliances. 10.2.5. The information about EE assistance is easily available and application procedures are simplified for vulnerable groups.
10.3. Ensure that low-income groups are not negatively affected by higher building efficiency standards.	10.3.1. Dynamic building codes are coordinated with a dynamic system of public subsidies to low-income and other vulnerable groups. 10.3.2. Local affordable energy efficiency construction materials are made available and promoted (also see Target 8.2).

Goal 10-Vision 2020: Energy poverty is eradicated; energy efficiency solutions are affordable for the majority of the population.

Goal 11. Awareness and capacity-building: Provide capacity-building and education programmes for bringing about an energy aware culture and developing requisite skills.

Rationale: A lot can be achieved through increased public awareness. Informational instruments positively affect energy efficiency by promoting informed choices and contributing to behavioural change. It is particularly in those societies where energy efficiency and environmental concerns are at the levels of everyday public discourse that relevant policies receive public support and commitment.

<i>Targets</i>	<i>Actions</i>
11.1. Make energy efficiency more visible for consumers.	11.1.1. Residential buildings' energy rating is mandatory (see Target 5.2). 11.1.2. Residential building's energy rating is informative and clear. 11.1.3. The system of independent energy rating and labelling of construction materials, windows, and appliances is mandatory. 11.1.4. Energy bills include detailed information about energy use and options for improving existing energy efficiency potential (also Target 4.3).
11.2. Support the establishment of multi-party partnerships/associations for EE in the residential sector.	11.2.1. Multi-stakeholders associations are established at the national and local levels for ensuring coordination between business development and public initiatives, combining initiatives and capacities and promoting EE in the residential sector. 11.2.2. Voluntary energy standards and labelling are offered public financial incentives. 11.2.3. Contests are organised between neighbourhoods/cities for government excellence prizes in EE and grants (they also improve local public-private cooperation).
11.3. Strengthen campaigns for raising public awareness.	11.3.1. Information campaigns use a variety of multimedia to emphasise the importance and benefits of energy efficient homes and to suggest EE measures. 11.3.2. Targeted campaigns are provided for specific groups of stakeholders. 11.3.3. Relevant public policies are disseminated widely and transparently, with much use of the national and local mass media. 11.3.4. Organisational and information assistance is provided to campaigns and information days organised by interested NGOs and other stakeholders. 11.3.5. Informational handbooks of good practice are available. 11.3.6. Energy efficiency calculators are widely available and have user-friendly and "interesting" ergonomics.
11.4. Support the establishment of local energy centres and demonstration projects.	11.4.1. Publicly-funded local energy centres provide advice to homeowners and other stakeholders. 11.4.2. Demonstration projects are available and supported (e.g. technical, commercial and integrated projects).
11.5. Develop educational programmes in EE.	11.5.1. Energy-awareness courses are introduced in primary and secondary schools. 11.5.2. Training programmes, degree and non-degree, are developed for different groups of stakeholders, including continuing education for professionals and policy experts. 11.5.3. Proficiency in energy efficiency is an essential requirement for qualification as an architect or as a town planner.

Goal 11-Vision 2020: Housing energy efficiency is part of the everyday practice, business relationships, and has achieved an entrenched understanding and culture.

Goal 12. Geographical access to energy efficient housing: Carry out additional measures in regions and areas with lower levels of development in the field and with more challenging climatic conditions.

Rationale: Many countries in the UNECE region remain relatively isolated from state of the art developments in the field of energy efficiency in housing. Moreover, the status of EE development may vary significantly between different areas within national boundaries. Such geographical asymmetries result in vicious circles of energy inefficiency traps and pose barriers to achieving common benefits from reducing climate change risks across countries. Furthermore, there is a great difference in the UNECE region with respect to climatic conditions. At the extremes (i.e. the coldest and hottest climates and areas expected to be most exposed to adverse effects of climate change) achieving zero-energy and other building sustainability targets may require larger capital investments and stricter performance requirements. Necessary policy measures should compensate for geographical differences.

<i>Targets</i>	<i>Actions</i>
12.1 Adjust policies to specific climatic conditions.	12.1.1. Assessments are made for specific local requirements in the field of housing energy efficiency in different climatic zones. 12.1.2. Special funds assist EE transformations in areas that require greater capital investments for future compliance with zero-energy standards (e.g. in cold climatic areas).
12.2 Anticipate the effects of the climate change and adjust policies.	12.2.1. Regional climate change adaptation strategies are drafted and are incorporated into energy efficiency measures in the housing sector. 12.2.2. Specific adaptation policies are envisaged for areas most exposed to negative effects of climatic changes.
12.3 Ensure a better diffusion of EE technologies and techniques across sub-national areas.	12.3.1. National programmes of organisational support and financial assistance to less developed areas and regions are developed. 12.3.2. Special funds are created that assist lagging areas. 12.3.3. Improvement of energy performance in their areas is one of the conditions for awarding of grants to sub-national governments for the housing sector.
12.4 Participate in international activities that improve access to energy efficient housing across countries.	12.4.1. International research estimates the contextual requirements of lagging countries as well as transferability and adaptability of international experiences and best practices to the local context in a sustainable manner. 12.4.2. International funds provide assistance to support national programmes of EE improvements in the housing sector. 12.4.3. Targeted international support is provided for lagging countries, including technological support and training.
12.5 Maximise synergies from international cooperation.	12.5.1. International organisations accumulate and exchange knowledge and experiences with regard to residential energy efficiency. 12.5.2. International organisations facilitate the mutual recognition of relevant EE standards and qualifications. 12.5.3. International organisations advocate a principal role for the housing sector in climate change mitigation and adaptation strategies. 12.5.4. UNECE Member States cooperate closely with the UNECE CHLM to ensure the implementation of this Action Plan.

Goal 12-Vision 2020: Balanced geographical development of housing energy efficiency is achieved and advancements in the field are evenly accessible across the UNECE region.