



*Empowered lives.  
Resilient nations.*

# UNDP ASSISTANCE IN PROMOTING ENERGY EFFICIENCY IN MUNICIPAL SECTOR

“Strengthening National Capacities of Urban Planning, Housing, Energy  
Efficiency and Disaster Risk Reduction”

UNECE Workshop

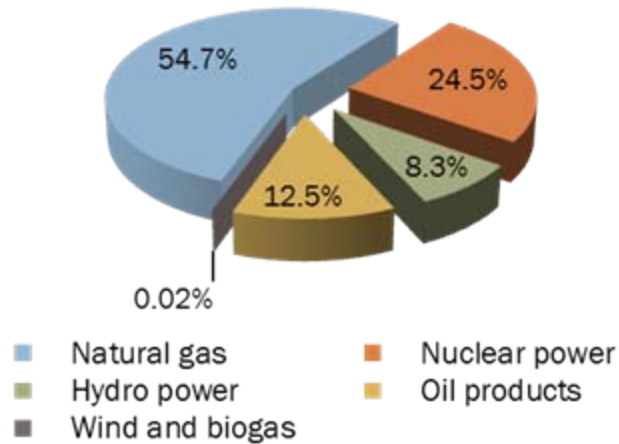
13-14 October, Yerevan, Armenia

**Diana Harutyunyan**  
**UNDP Climate Change Programme Coordinator**

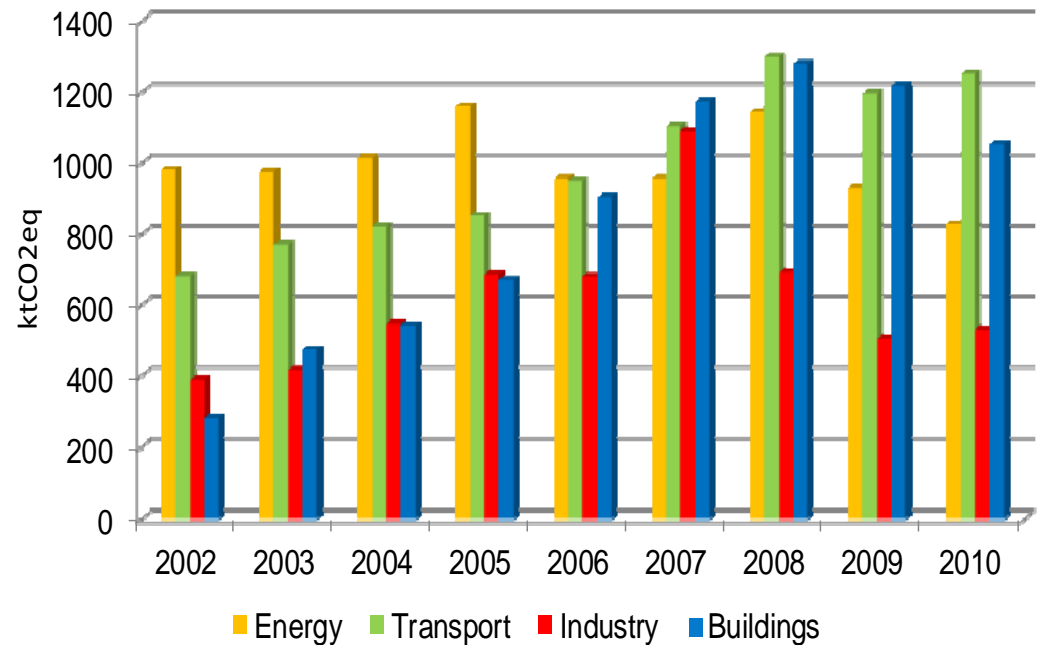


# ENERGY PRODUCTION & CONSUMPTION IN ARMENIA

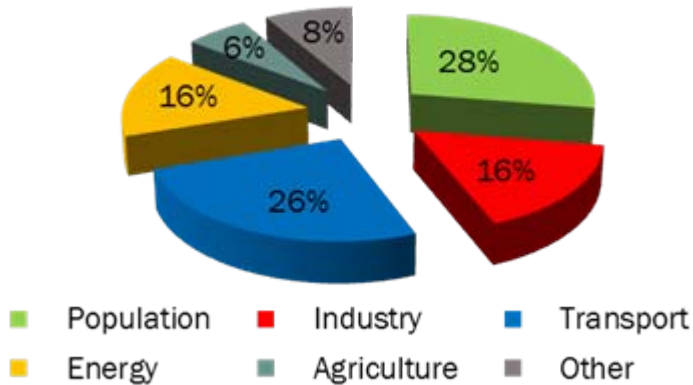
## Production structure



## GHG emissions structure



## Consumption structure



\*Data from year 2010

# HOW UNDP IS ASSISTING ARMENIA IN CLIMATE CHANGE MITIGATION



Empowered lives.  
Resilient nations.

## *Transformational changes towards low carbon development and active involvement in global efforts for climate change mitigation*

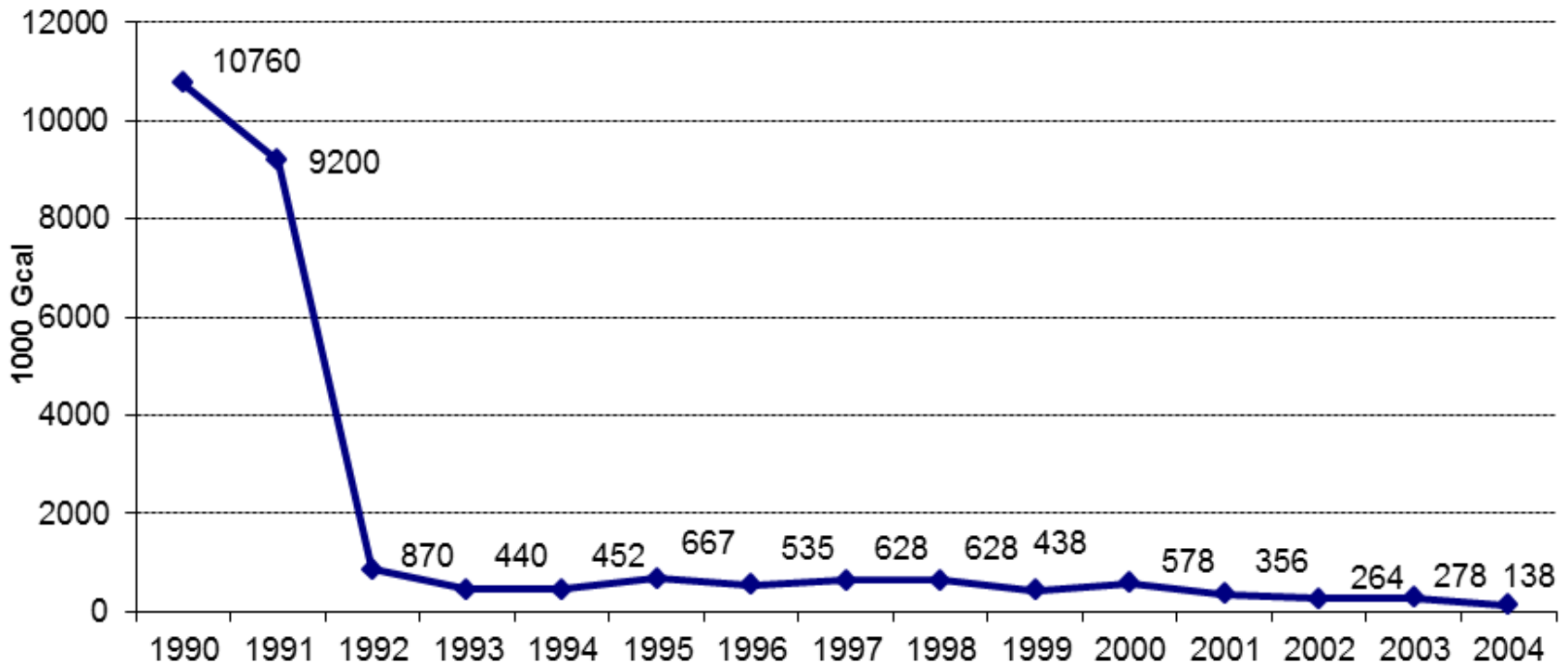
- The GHG mitigation policy development in construction sector, first NAMA in Armenia is on EE in Housing Sector
- Country report on needs for SE4All Initiative
- Energy efficiency related laws and decrees revision and amendment in accordance with EU and Eurasian Economic Community directives and technical regulations
- 15 national and international standards development and adoption for Armenia

## *Supporting behavioral change among population towards energy efficiency*



# **Removing Barriers for Energy Efficiency in District Heating**

# Heat Energy Production in District Heating Systems in Armenia, 1990-2004



- In 2005 the district heating system had actually collapsed - 2.5% of that in 1990.
- Master plan of the City of Yerevan for 2005-2020 envisages district heating restoration in five large residential areas of the city
- Currently the heating of residential building stock is through apartment level heating systems mainly based on natural gas

# Combined heat and power based district heating restoration project in Avan district, Yerevan



39 Multi-storey buildings  
3 public builds  
5,000 residents

Leveraged foreign direct  
investments- USD 12 mln

CHP capacity installed  
- 4MWe and 4.36 MWt

The system was commissioned on  
15 December 2009

- UNDP supported the design and implementation of the restoration of the centralized heat supply system in Avan district of Yerevan
- Establishment of legal framework - Decision of the Government of Armenia No.509-N, from 13 April, 2006 on framework Public Private Partnership and for Pilot, methodology on tariff policy.
- Full reconstruction of main and distribution network,
- Redesign of the internal distribution system in the buildings (from vertical distribution into horizontal one),
- Installation of new internal heating and hot water supply network, with possibility to regulate consumption,
- Installation of apartment level heat and hot water meters for introducing consumption based payment system,
- **A multi-part tariff** system for heat and hot water

# SETTING UP EXAMPLES

## Promotion of RES in Heating Systems



Promotion of solar collectors use for centralized hot water supply in:

- ***Boarding schools***
- ***Kindergartens***
- ***Residential district heating systems***
- ***Community baths***

- Social and environmental benefits
- Improved reliability of heat supply
- Decrease of consumption of natural gas and electricity
- Technical capacity building
- CO<sub>2</sub> emissions reduction
- Awareness rising

**Around 600 sq m of solar water heaters installed**



# **Improving Energy Efficiency in Building Sector**



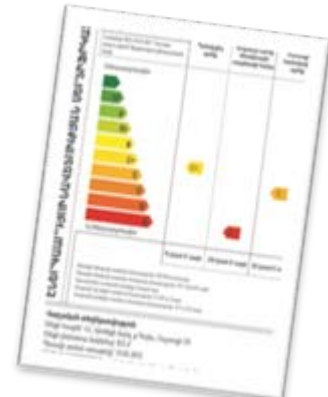
# Assisting in development and adoption of legal and normative documents

- Amendments to the RA Laws “On Urban Development” and “On Energy Saving and Renewable Energy” (submitted to the RA Government);
- “Buildings, structures, construction materials: Safety” Technical Regulation (submitted to the RA Government);
- Harmonization of Energy Performance in Buildings EU Directive – in process;
- Charter of the MUD amended with clause on EE
- Clause on EE included in the Law on Yerevan City Small Center
- 15 EN/ISO standards approximated and adopted
- “Buildings’ Energy Passport” national standard adopted;
- “Construction Climatology” II-7.01-2011 building code renewed.



# Building Institutional and Human Capacity

- Designs of 5 replicable/typical energy efficient individual residential houses along with respective catalog developed for free use (MUD web-site)
- Database developed on locally produced and imported construction insulation materials
- Guidebook on technical solutions for EE
- Seven types of locally produced insulation materials and pre-fabricates were tested and granted certificates.
- More than 50 specialist trained
- Energy efficiency laboratory equipped in State University of Architecture and Construction (2013).
- Testing and certification laboratory established at “Shincertificate” LLC .
- Education curricula and bilingual test book “Green Architecture: Energy Efficiency and Renewable” developed for Universities
- Summer school



# Supporting Behavioral Change Towards Energy Efficiency

- TV programmes for pilot project results dissemination
- Social ads
- Journalists training and contests
- Web-site
- Certification of buildings
  - Media contests to promote topics on EE
  - Articles, thematic calendars

○



# Setting of Examples

## Energy Efficient Building in Goris



- total area: 940 m<sup>2</sup>
- apartments: 22
- storeys: 3

- Design document with increased energy performance requirements
- Thermal insulation of the external walls, first storey's floor and the last floor cover, columns and balcony blocks and elimination of “cold bridges”
- Windows and doors with higher thermal resistance
- Construction of tambours of the entrances
- Installation of regulation and metering equipment for heating system
- Energy efficient lighting system



Incremental cost of EE measures: 8% of total price

Energy performance improvement: about 2 fold

Total additional area: about 23 sq.m

# Demo building in earthquake zone



- total area: 2242 m<sup>2</sup>
- apartments: 36
- storeys: 4



## External insulation of walls with polyurethane

- Incremental cost of EE measures: 6%
- Energy performance improvement: more than 2 fold
- Total additional area: about 91 sq.m

# Setting of Examples

## Refurbishment of existing residential buildings



Empowered lives.  
Resilient nations.

9-storey residential building in Yerevan  
**1<sup>st</sup> project in Armenia**  
(total enveloping with poly styrene,  
establishment of doors and windows in  
staircases)

**Before 178kWh/m<sup>2</sup> year**

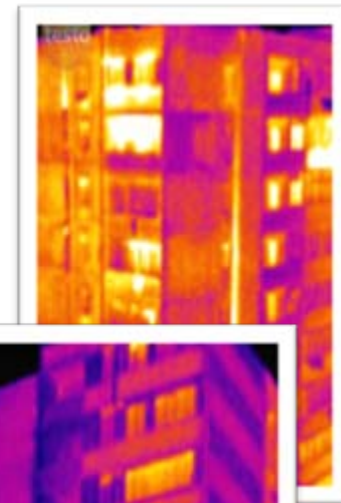
CO<sub>2</sub> emissions: 91 tons annually

620 USD per flat /year for heating season

**After 74kWh/m<sup>2</sup> year**

CO<sub>2</sub> emissions: 31 tons annually

255 USD per flat/year for heating season



**Energy performance improved by about 60%**

# First LEED certified building in the region

## Private donor funded school construction in Yerevan



Empowered lives.  
Resilient nations.

- UNDP assisted in identification of insulation approach and design
- in insulation of all the “cold bridges” of the building (1260 sq. m of beams and columns) with 50mm layer of polyurethane foam

**School for 380 pupils opened its doors on September 2014**



# SETTING UP EXAMPLES

replication of improved building energy efficient design



Empowered lives.  
Resilient nations.

- Professional advise of UNDP expert team promoted revision of initial design of 6 residential buildings constructed by private developer “Al Hamra Real Estate Armenia” LLC
- Benefits gained: increase of internal surface by **916 sq.m** valued at **1800\$/sq.m**
- Direct benefit to the developer - **1,650,000 USD**
- Energy performance improvement - **36%**





# Green Urban Lighting

# Municipal street lighting systems in RA

Indicators	Yerevan	Other cities
<b>Number of illuminated objects</b>	<b>1235</b>	<b>981</b>
<b>Number and type of street lights</b>	<b>54880</b>	<b>7450</b>
<i>High pressure sodium 150W/250W</i>	<i>50785</i>	<i>7450</i>
<i>Mercury (250W)</i>	<i>2000</i>	<i>3734</i>
<i>Mercury (400W)</i>	<i>700</i>	<i>2740</i>
<i>CFL</i>	<i>0</i>	<i>110</i>
<i>LED and halogen</i>	<i>229</i>	<i>0</i>
<b>Total installed capacity of street lighting system, MW</b>	<b>15</b>	<b>4</b>
<b>Annual electricity consumption for 2011, mln kWh/year</b>	<b>31,3</b>	<b>8,7</b>
<b>Annual electricity costs for 2011, mln USD/year</b>	<b>1,99</b>	<b>0,6</b>
<b>Average daily length of operation of street lighting, hours</b>	<b>8</b>	<b>6,44</b>
<b>Annual GHG emissions, street lighting systems, tCO<sub>2</sub>/year</b>	<b>12500</b>	<b>3500</b>

# Main Objective of Project

To save energy and to reduce emissions of greenhouse gases by increasing energy efficiency of municipal lighting in the cities of Armenia via implementation of municipal investment programs and national policies.

## Project Components

The Project activities are organized in four interrelated components:

- 1)Municipal energy audits and technical capacity-building
- 2)Demonstration projects
- 3)Replication via municipal lighting programs and associated financial instruments
- 4)National policies, codes, and standards on lighting

# Demonstration Projects under Implementation

## Pilot project in Yerevan

Pilot site: Avenue connecting city to airport (Isakov Avenue, Tairov and Parakar streets)

Baseline: about 750 luminaries (High Pressure Sodium); capacity: 214 kW

Project: installation of LED based modern EE luminaries; capacity: 80 kW

Expected results: annual power saving: **480 MWh** or GHG reduction of 195 tCO<sub>2</sub>e

## Pilot project in Alaverdi town

Baseline street: 70 luminaries (High Pressure Sodium); capacity: 20 kW

Project: installation of LED based modern EE luminaries; capacity: 3.5 kW

Expected results: annual power saving: **36 MWh** or GHG reduction of 14.5 tCO<sub>2</sub>e

**THANK YOU FOR ATTENTION**

**[www.nature-ic.am](http://www.nature-ic.am)**