



*Empowered lives.
Resilient nations.*

UNDP Supported Energy Efficiency Projects



Vahram Jalalyan
Improving Energy Efficiency in Buildings
UNDP-GEF Project Manager

Interregional Workshop and Study Tour on
Energy Efficiency and Renewable Energy Projects and Policies

8-12 February 2015

Israel



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
- Supporting a behavioral change among population towards the energy efficiency
- Improving legislative and regulatory framework
- Building capacities for professionals
- Showcasing the benefits of renewable energy sources and energy efficiency
- Further integration in regional and global initiatives for achieving the national energy security objectives

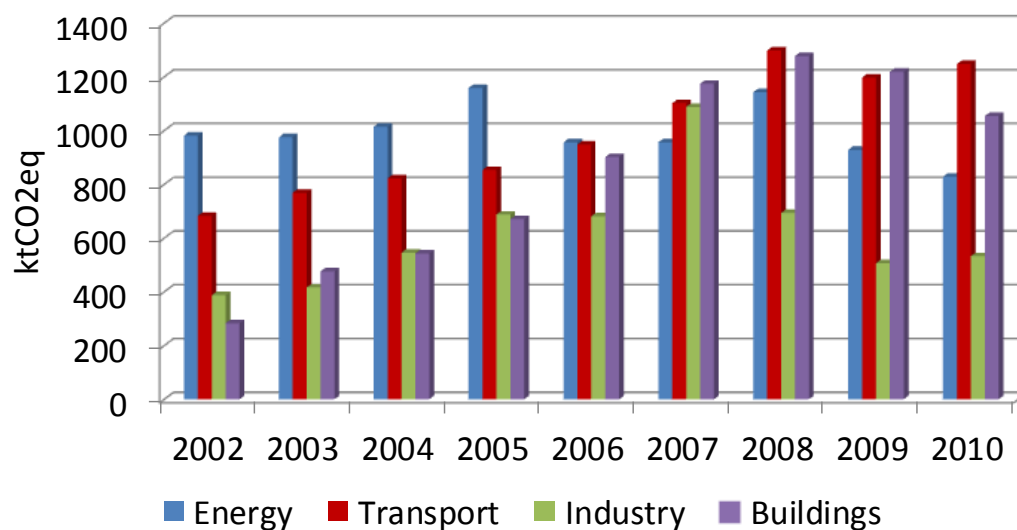
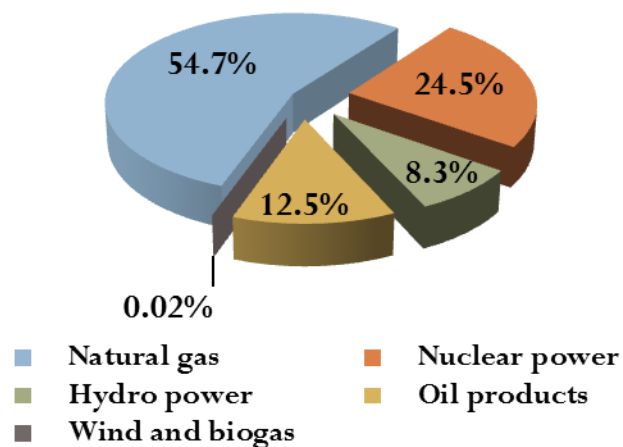


LOADING

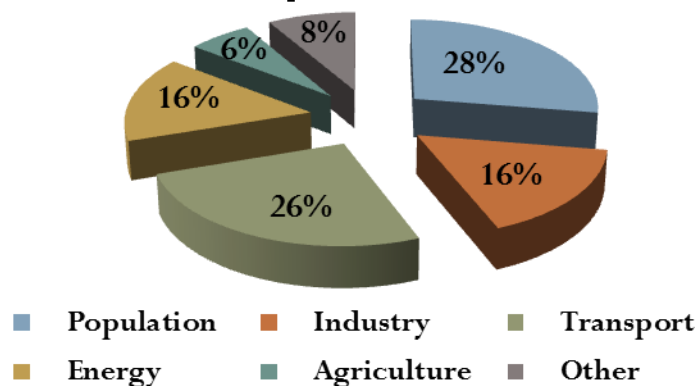
Please wait . . .

Energy Production & Consumption in Armenia

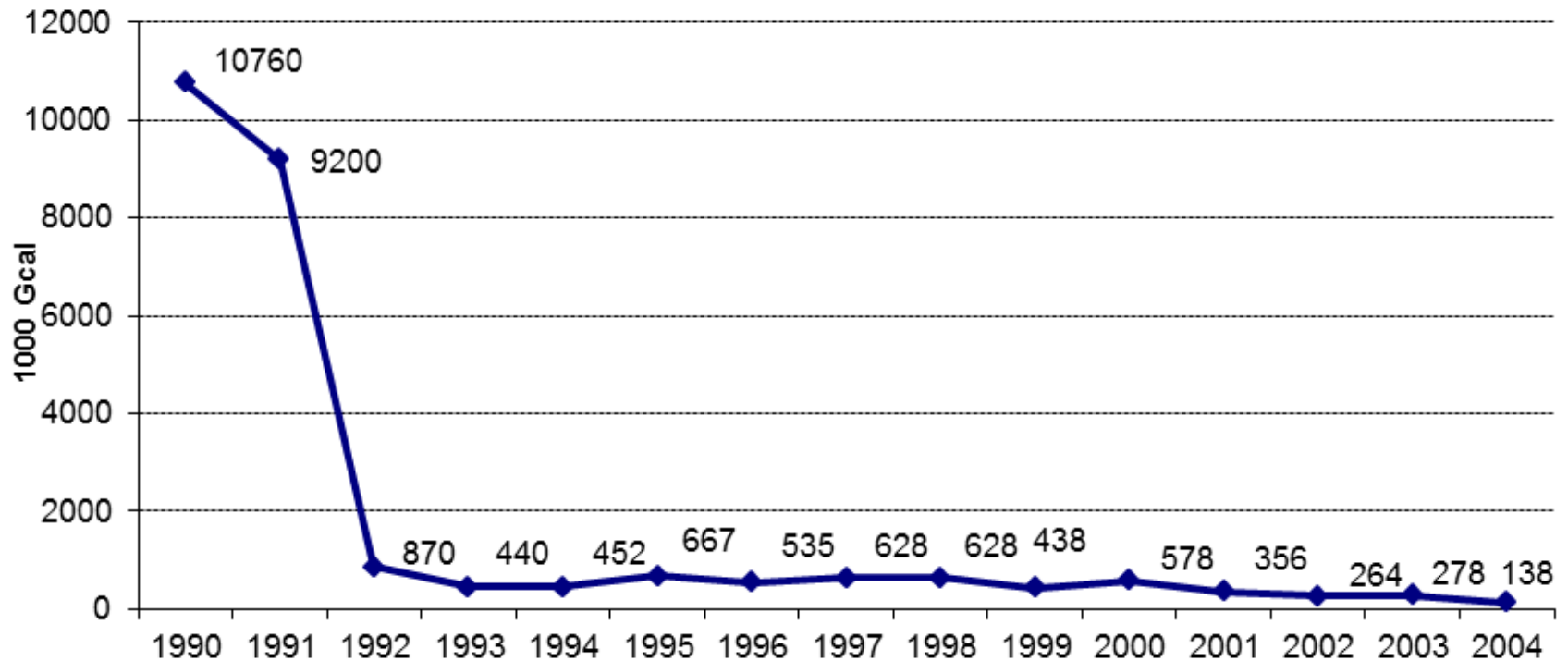
Production structure



Consumption structure



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



The district heating system had actually collapsed: heat generation by district heating systems in 2005 fell to about 2.5% of that in 1990;
Master plan of the City of Yerevan for 2005-2020 provides for district heating restoration in five large residential areas of the city

Energy Efficiency In District Heating

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



39 Multi-storey buildings
445 apartments are joined
2 public buildings

**Leveraged foreign direct
investment- 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
- Decision of the Government of Armenia No.509-N dated 13 April, 2006 on establishing promotional tariff for electricity purchased from CHP plant,
- Full reconstruction of main and distribution networks,
- Redesign of the internal distribution system in the buildings (from vertical distribution into horizontal one),
- Installation of apartment level heat and hot water meters for introducing consumption based payment system,
- The Methodology developed for calculation of heat and electricity tariffs based on useful heat demand (approved by PSRC N206N 7 May, 2007),
- A multi-part tariff system for heat and hot water.

SETTING UP EXAMPLES

Integration of RES and EE in Heating Systems



- **Promotion of solar collectors use in centralized hot water supply based hot water supply system installations - 596 sq m of solar water heaters installed (26 systems)**

Boarding schools

Kindergartens

Hospitals

Residential district heating systems



- **Heat pump based heating and cooling in “AYB” high school**
- **Infrared heating systems**

Legislative and Regulatory Framework

- The GHG mitigation policy development
- 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
- National and international standards development and adaption for Armenia
- Building codes, methodologies and handbooks on energy efficiency



UNDP Climate Change Programme Armenia



Empowered lives.
Resilient nations.

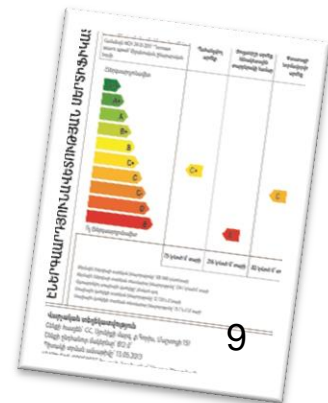
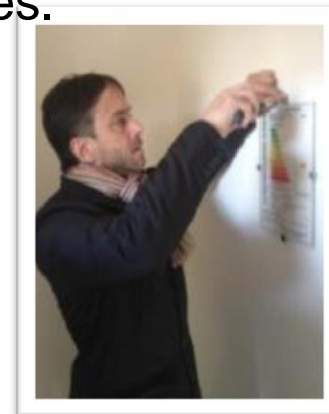
Transformational changes towards low carbon development and active involvement in global efforts for climate change mitigation

- Needs assessment for meeting the objectives of Sustainable Energy For ALL of the UN Secretary General
- Development of the Greenhouse Gas Inventory and Mitigation targets
- Assisting in legislation and normative documents development and adoption
 - **Amendments were drafted to the RA Laws “On Urban Development” and “On Energy Saving and Renewable Energy”** (approved by the RA Government)
 - **Governmental decree on integration of requirements for EE in state-funded procurement procedures** (approved by the RA Government)
 - “Buildings, structures, construction materials: Safety” technical regulations were drafted (submitted to the RA Government)
 - Energy Performance in Buildings EU Directive harmonized (submitted to the RA Government)
 - Charter of the MUD amended with Clause on EE
 - The EE chapter included in the Law on Yerevan City Small Center
 - 15 EN/ISO standards are approximated/adapted and registered
 - “Buildings’ Energy Passport” national standard adopted
 - “Construction Climatology” II-7.01-2011 RA building code renewed.

UNDP Climate Change Programme Armenia

Building capacities of institutions and professionals

- Energy efficiency laboratory established in in State University of Architecture and Construction
- Testing and certification laboratory established at “Shincertificate” LLC
- Designs of five replicable/typical energy efficient individual residential houses along with respective catalog
- Database of locally produced and imported construction insulation materials
- Education curricula and bilingual modules “Green Architecture” - 420 pages
- 11 locally produced and imported insulation materials and pre-fabricates were tested and granted certificates.



Established Laboratories on EE and on Building Physics



Supporting Behavioral Change Towards Energy Efficiency

- TV programs for pilot project results dissemination
- Journalists training and contests (2)
- Web-site (local and regional)
- EE certification of buildings (8)
- Media contests to promote topics on EE (2)
- Articles, thematic calendars (on annual basis)
- School classes, contests (on annual basis)



Energy Efficient Social Building in Goris



940 m² total area
22 apartments
3 storeys

Incremental cost of EE measures: 8%

Energy performance improvement: 2 times

Additional benefit: about 25 m² of living area

- In cooperation with Swiss Development and Cooperation Agency and Government of Armenia
- Total enveloping of the building
- Thermal insulation of reinforced concrete columns and balcony blocks and elimination of “cold bridges”
- Installation of windows and doors with higher thermal resistance
- Construction of tambours of the entrances
- Installation of regulation and metering equipment for heating system



Energy Efficient Residential Building in Earthquake Zone

In cooperation with Government of Armenia, under state housing program.



total area: 2242 m²
apartments: 36
storeys: 4

Incremental costs: 6%

Energy performance improvement: 2 times

Additional benefit: about 90 m² of living area





EE Refurbishment of Existing Residential Building



- 9-storey, 36 apartment building in Yerevan
- In cooperation and with co-financing from Yerevan Municipality

Before 178kWh/m² year

CO₂ emissions: 91 tons/year
620\$ per flat /year – heating

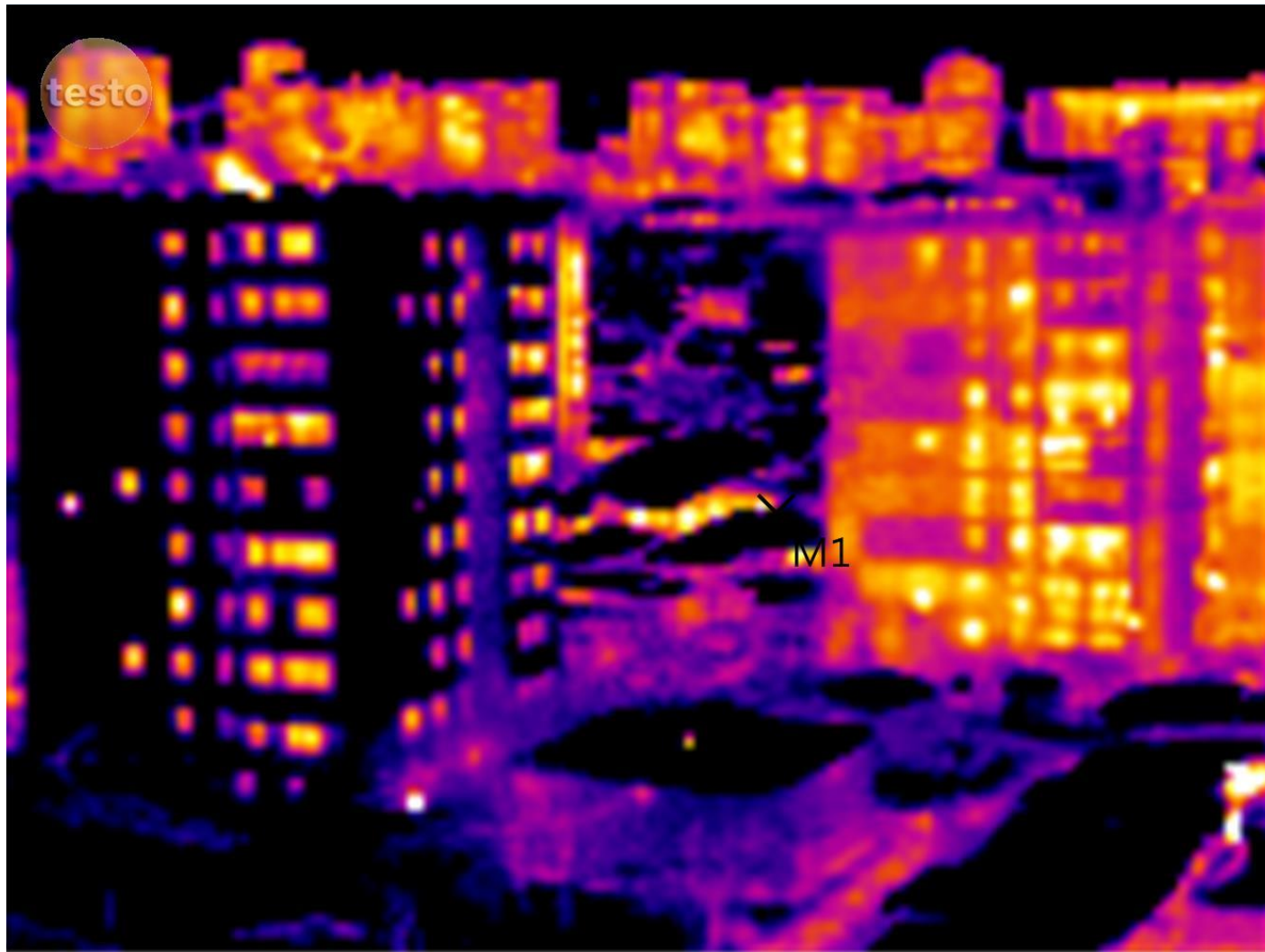
After 74kWh/m² year

CO₂ emissions: 31 tons/year
255\$ per flat/year – heating

Energy performance improved by 60% !



Infrared Imaging of the Energy Efficient Building



First LEED Certified Building in the Region

(Leadership in Energy & Environmental Design)



*Empowered lives.
Resilient nations.*

UNDP assisted private donor funded school construction in Yerevan in:

- identification of insulation approach design and
- insulation of 1260 sq. m of beams and columns with 50mm layer of polyurethane foam, thus eliminating all the “cold bridges” of the building
- Monitoring equipment and software for showcasing the energy saving in online regime
- School opened its doors in September 2014



Insulation of the Building Structure



Replication of Energy Efficient Building Design Involving Private Sector



Empowered lives.
Resilient nations.

- The energy efficient solutions piloted by the UNDP are replicated in the construction by private developer “Al Hamra Real Estate Armenia” LLC
- Additional **>900 sq.m** available as a result of redesign valued at **1800\$/sq.m**
- Direct benefit to the developer - **> 1,500,000 USD**
- Energy performance improvement - **36%**







“Green urban Lighting” UNDP-GEF Project

Overall Goal: 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.

Specific Components:

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

Duration: January 2014 - January 2018

GEF Funding: 1.6 mln USD

Overview of basic parameters of the proposed pilot project

Indicators	Base situation	Results of pilot
Municipality	Yerevan	
Pilot Streets	Isakov Avenue, Tairov and Parakar Str.	
Length, km	9	
Number of poles / luminaries	378 / 756	378 / 482
Average illumination, Lx <i>(Standard - 20 Lx)</i>	16	26
Installed capacity, kW	215.5	79
Annual power consumption, MWh	794.5	291.2
GHG emissions, t CO ₂ /year	352.7	129.3
Total procurement costs, USD	292.750	
Yearly energy saving and emission reduction	63%	
Annual cost savings, USD	49.000	

Overview of basic parameters of the proposed pilot project

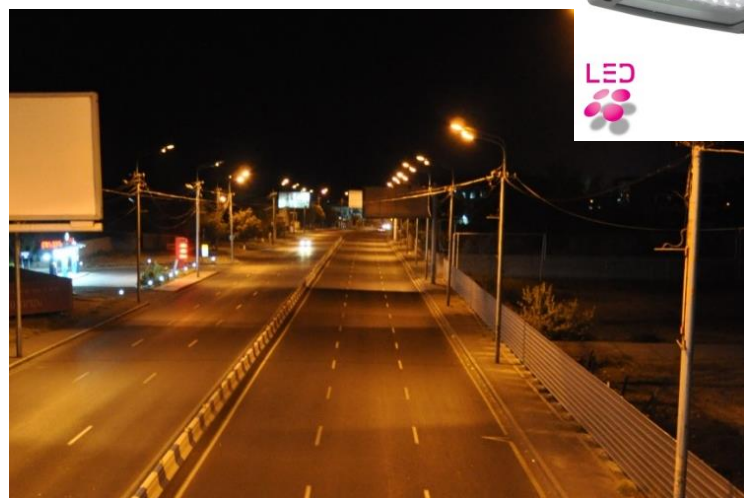
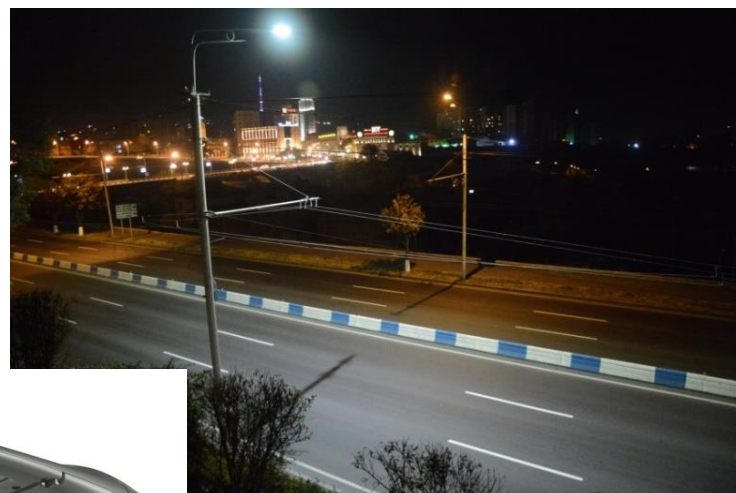
Indicators	Base situation	Results of pilot
Municipality	Alaverdi	
Pilot Streets	Zoravar Andranik, Sayat-Nova and Shahumyan Streets	
Length, km	2	
Number of poles / luminaries	70 / 70	70 / 70
Average illumination, Lx (<i>Standard - 20 Lx</i>)	6.2	11
Installed capacity, kW	19.95	3.5
Annual power consumption, MWh	29.1	5.1
GHG emissions, t CO ₂ /year	12.9	2.3
Total procurement costs, USD	10.300	
Yearly energy saving and emission reduction	82%	
Annual cost savings, USD	10.6	

Testing of the LED street luminary on the pilot street in Yerevan

BEFORE



AFTER



Expected results: **Energy saving and demonstration of technology benefits**

- Improved illumination level (to reach the norm requirement)
- Elimination of unconformity of illumination of the street

THANK YOU



RELOADING

