Potentials for energy efficiency improvements and implementation of renewable energy sources in hotel industry in Macedonia

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December 2015

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Part I

General Overview

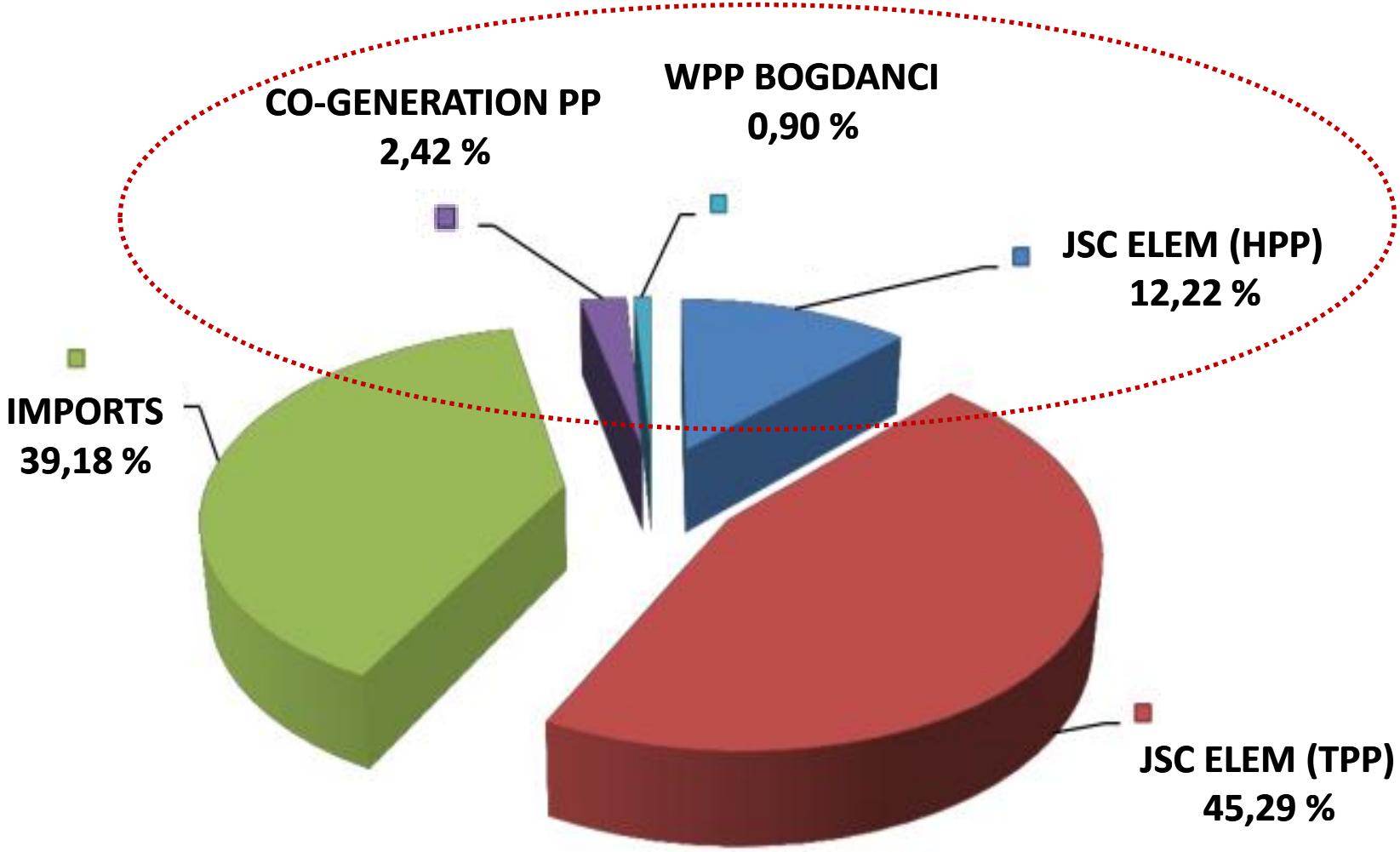
Structure of Macedonian EPS

- **Horizontal integration**
  - **JSC ELEM (Macedonian Power Plants)** – State-own JSC, **Electricity Generation**
  - **JSC MEPSO (Macedonian Electricity Power System Operator)** – Stet-own JSC, **TSO, Transmission Grid and Market Operator**
  - **JSC EVN Macedonia** – Private-own JSC, **DSO, Distribution and Supply of Electricity**
  - **JSC TPP Negotino –** State-own JSC, **Electricity Generation**
  - **JSC TE-TO Skopje** – Private-own JSC, **IPP of Electricity and Heat, Combine-cycle gas-fired power plant**
  - **Large number of smaller electricity producers** (small HPP, solar power generators, small gas-fired PP, bio-mass plants , etc.
- **Gradual opening and liberalization of the Power Market**
- **Preconditions for the establishment of a functional regional Energy ex-Change Market**

Electricity Market Structure

- **Regulated Electricity Market**
  - Regulated prices for Electricity Generators
  - Regulated prices for Transmission & Distribution
  - Regulated margin for Electricity Suppliers
  - Regulated customers ~70% (residential, commercial, S&M industry, etc.)
- **Unregulated (Liberalized) Electricity Market**
  - IPP, Electricity traders, Eligible customers
- **Feed-in (Subsidized) Electricity Market**
  - Privileged generators (generators using renewable power sources: wind, hydro, solar, bio-mass, etc.)

Electricity Market (Sources)



Renewable energy sources

Primary energy sources

- **The Sun,**
- **Gravitational force between the Sun, the Earth and the Moon,**
- **Geothermal energy,**
- **Energy of the controlled nuclear reactions, and**
- **Energy generated as a result of chemical reactions** *(burning coal, oil, natural gas, etc.)*

General classification:

- **Renewable energy sources** – ***(green energy, sustainable energy sources)*** energy sources existing independently of any human activities,
- **Fossil energy sources** – ***(brown energy)*** energy sources with embedded primary energy that could be released by means of burning of the sources.

Why do we need RES?

- **The amount of fossil fuels is limited & more difficult for exploitation mostly due to economical reasons** *(too expensive)*
- **Energy needs in continuation rise 4 – 8 % annually** *(increased living standards especially in Asia and Africa)*
- **Fossil fuels are ecologically unacceptable** – increase pollution of the local environment and the whole Planet in general *(GHG emissions)*
- **Renewable energy resources are practically inexhaustible** *and their utilization provides* ***Sustainable Economic and Energy Development*** *on the long run*

Why do we need RES?

- **The solution of this situation is implementation of either one, or even better, jointly both scenarios:**
  - ✓ **Energy efficiency increase and rational utilization of the energy resources**, and/or
  - ✓ **Increase of the amount of utilization of the renewable energy sources** *(solar, wind, geothermal energy, energy of bio-mass, tidal energy, etc.)*

- **Major drawbacks – RES are**:
  - **Time-Changeable**,
  - **Unpredictable *(Stochastic),*** and
  - **Irreversible**

How to promote more RES?

- **RES could be also characterized with:**
  - **Small installed capacity** *(due to unpredictability of the available recourse and its stochastic character)*
  - **High specific initial investments** *(distribution generation, new and emerging technology, small installed capacity, etc.)*
  - **Unsecured and highly volatile financial benefits and profits**

- **The RES industry needs support and subsidizing from the Governments such as:**
  - **Secured long-term contracts for electricity off-take,**
  - **Guaranteed long-term prices for electricity off-take,**
  - **Priority in the electricity dispatching – first in, last out.**

How we support RES in RM

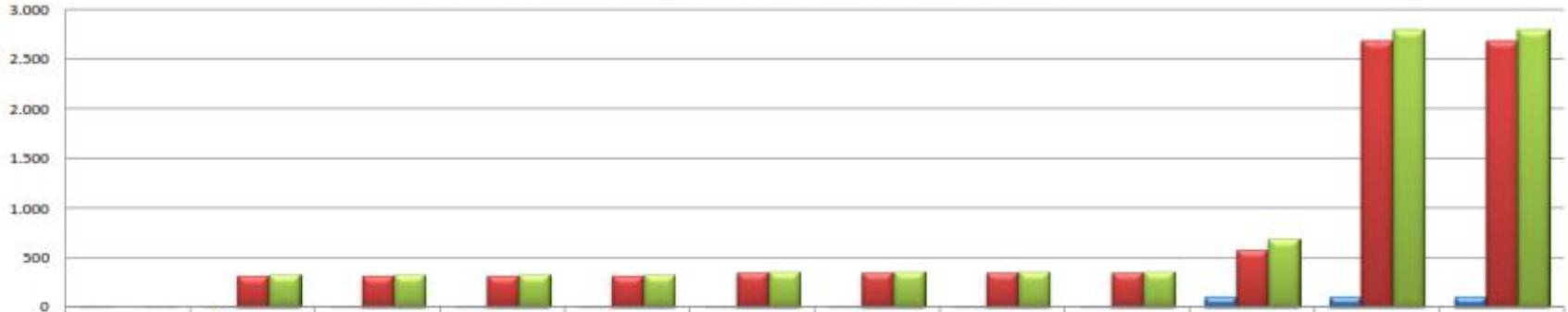
In RM we use the supporting methodology based on

(1) **Licensing** and (2) **Feed-in (Subsidized) Tariffs**

Name	Price	Units	Valid from	Years
Renewable Energy Sources WIND POWER PLANTS ≤ 50 MW	8.9	€cents/kWh	17.04.2013	20
PHOTOVOLTAIC POWER PLANTS ≤ 0.050 MW	16	€cents/kWh	17.04.2013	15
PHOTOVOLTAIC POWER PLANTS > 0,050 MW	12	€cents/kWh	17.04.2013	15
HIDROPOWER ≤ 85.000 kWh	12	€cents/kWh	17.04.2013	20
HIDROPOWER > 85.000 and ≤ 170.000 kWh	8	€cents/kWh	17.04.2013	20
HIDROPOWER > 170.000 and ≤ 350.000 kWh	6	€cents/kWh	17.04.2013	20
HIDROPOWER > 350.000 and ≤ 700.000 kWh	5	€cents/kWh	17.04.2013	20
HIDROPOWER > 700.000 kWh	4.5	€cents/kWh	17.04.2013	20
THERMOELECTRIC CENTRALS ON BIOMASA	15	€cents/kWh	17.04.2013	15
THERMOELECTRIC CENTRALS ON BIOGAS	18	€cents/kWh	17.04.2013	15

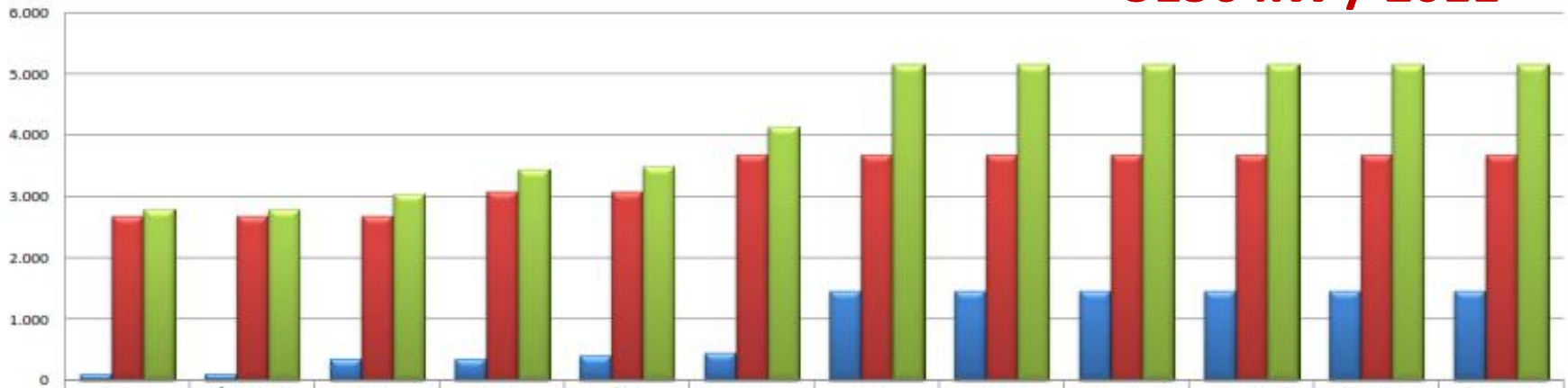
Development of RES in RM

2799 kW / 2010



	Јануари	Февруари	Март	Април	Мај	Јуни	Јули	Август	Септември	Октомври	Ноември	Декември
Фотоволтаични с-ми	10	10	10	10	10	10	10	10	10	110	110	110
Мали ХЕЦ	0	320	320	320	320	352	352	352	352	581	2.689	2.689
Вкупно ППЕЕ	10	330	330	330	330	362	362	362	362	691	2.799	2.799

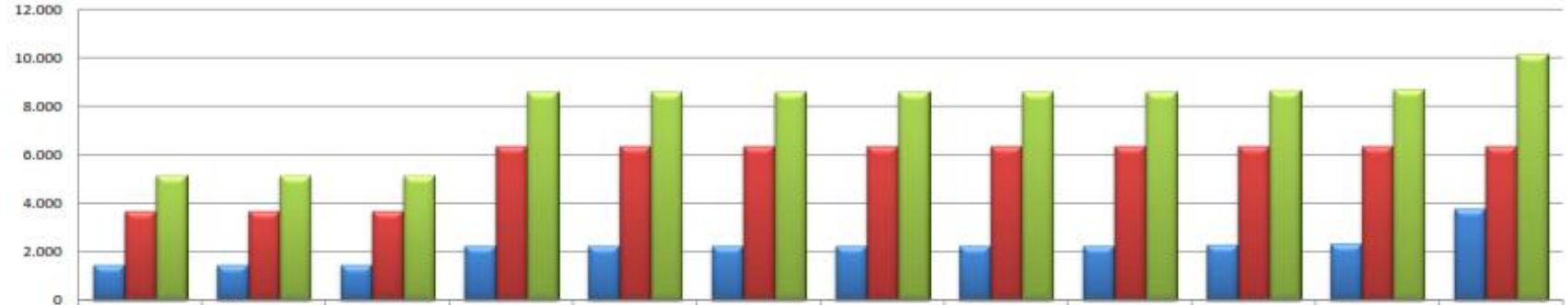
5156 kW / 2011



	Јануари	Февруари	Март	Април	Мај	Јуни	Јули	Август	Септември	Октомври	Ноември	Декември
Фотоволтаични с-ми	110	110	360	360	409	459	1.467	1.467	1.467	1.467	1.467	1.467
Мали ХЕЦ	2.689	2.689	2.689	3.089	3.089	3.689	3.689	3.689	3.689	3.689	3.689	3.689
Вкупно ППЕЕ	2.799	2.799	3.049	3.449	3.498	4.148	5.156	5.156	5.156	5.156	5.156	5.156

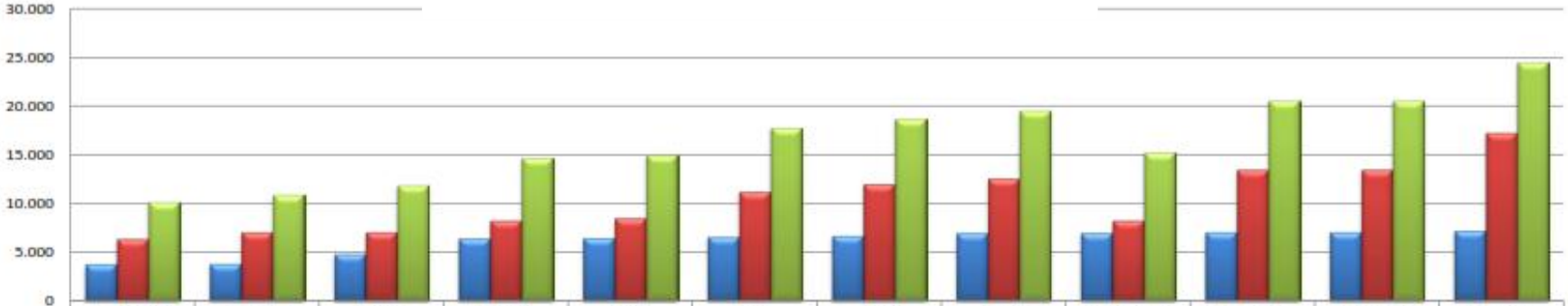
Development of RES in RM

10 164 kW / 2012



	Јануари	Февруари	Март	Април	Мај	Јуни	Јули	Август	Септември	Октомври	Ноември	Декември
Фотоволтаични с-ми	1.467	1.467	1.467	2.244	2.244	2.244	2.244	2.244	2.244	2.294	2.344	3.787
Мали ХЕЦ	3.689	3.689	3.689	6.377	6.377	6.377	6.377	6.377	6.377	6.377	6.377	6.377
Вкупно ППЕЕ	5.156	5.156	5.156	8.621	8.621	8.621	8.621	8.621	8.621	8.671	8.721	10.164

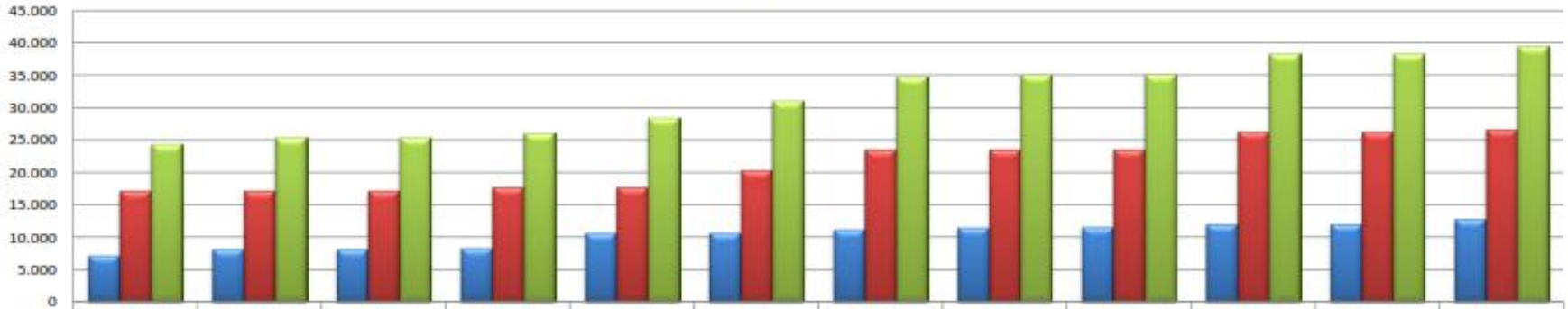
24 528 kW / 2013



	Јануари	Февруари	Март	Април	Мај	Јуни	Јули	Август	Септември	Октомври	Ноември	Декември
Фотоволтаични с-ми	3.787	3.828	4.827	6.421	6.471	6.571	6.680	6.980	6.980	7.080	7.080	7.229
Мали ХЕЦ	6.377	7.081	7.081	8.281	8.515	11.225	12.021	12.581	8.281	13.501	13.501	17.299
Вкупно ППЕЕ	10.164	10.909	11.908	14.702	14.986	17.796	18.701	19.561	15.261	20.581	20.581	24.528

Development of RES in RM

39 601 kW / 2014

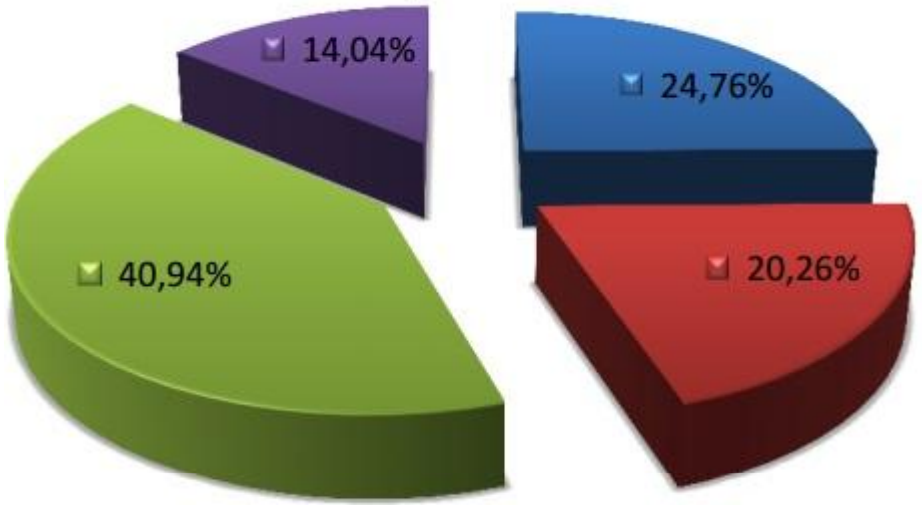


	Јануари	Февруари	Март	Април	Мај	Јуни	Јули	Август	Септември	Октомври	Ноември	Декември
Фотоволтаични с-ми	7.228	8.228	8.228	8.376	10.733	10.733	11.264	11.557	11.601	12.055	12.055	12.851
Мали ХЕЦ	17.229	17.229	17.229	17.779	17.779	20.419	23.619	23.619	23.619	26.374	26.374	26.750
Вкупно ППЕЕ	24.457	25.457	25.457	26.155	28.512	31.152	34.883	35.176	35.220	38.429	38.429	39.601

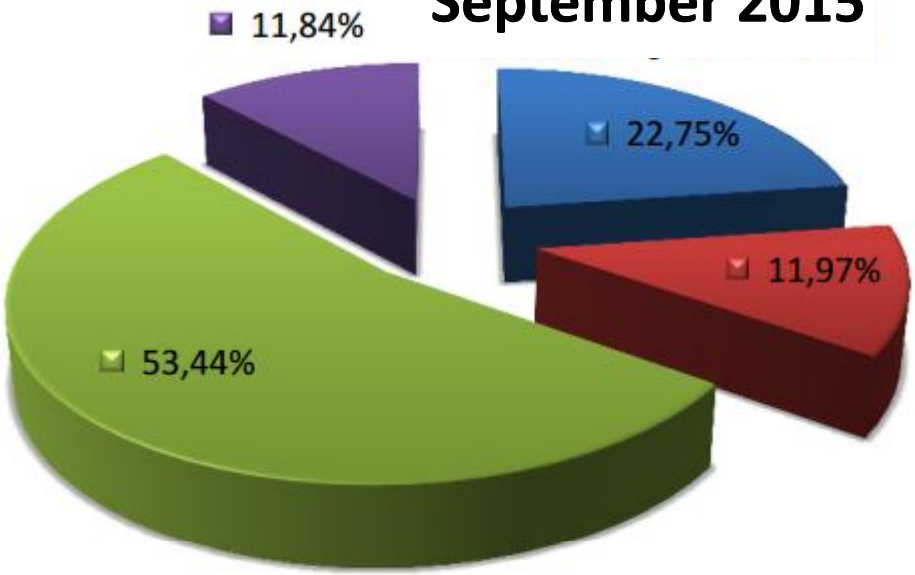
From 2010 till 2014, the installed capacity of newly constructed RES increased 14 times!

RES production in RM (2015)

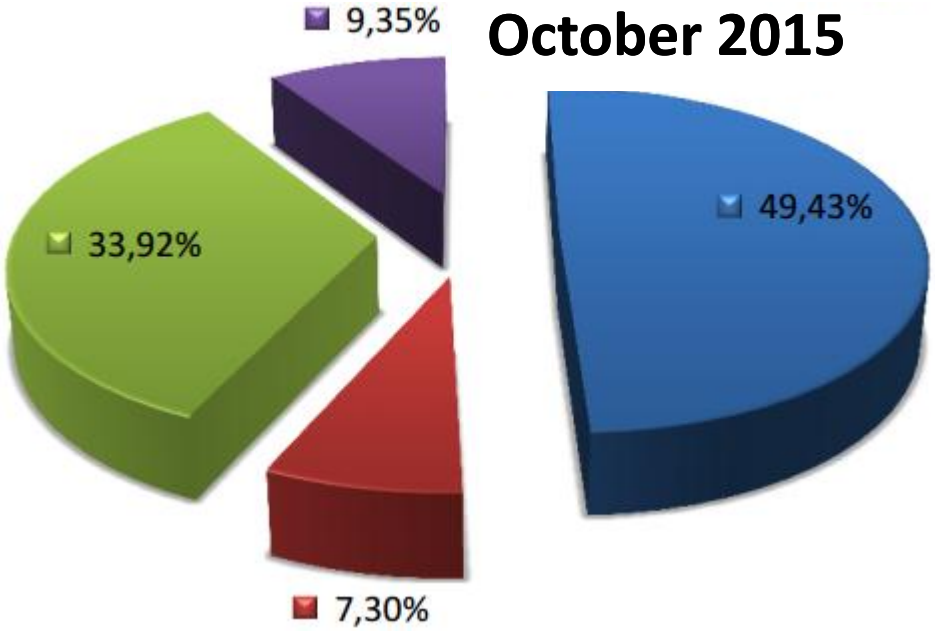
August 2015



September 2015



October 2015



- Small HPP
- Photovoltaic PP
- Wind PP
- Co-generation PP

PART II

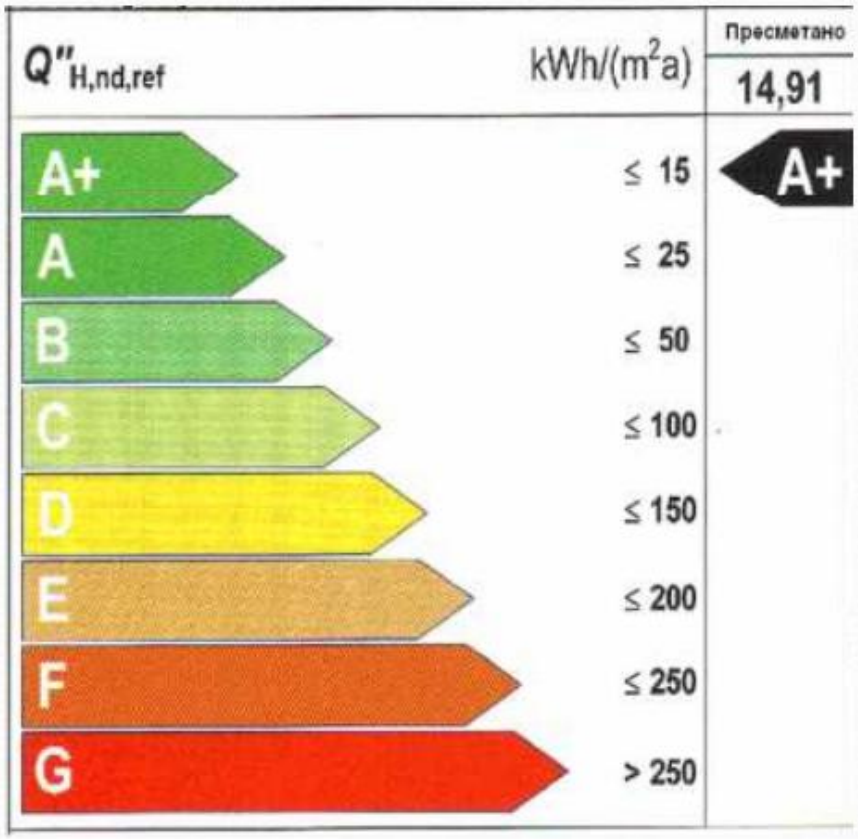
RES & Energy Efficiency in Hotel Industry

Energy Consumption in the Hotels

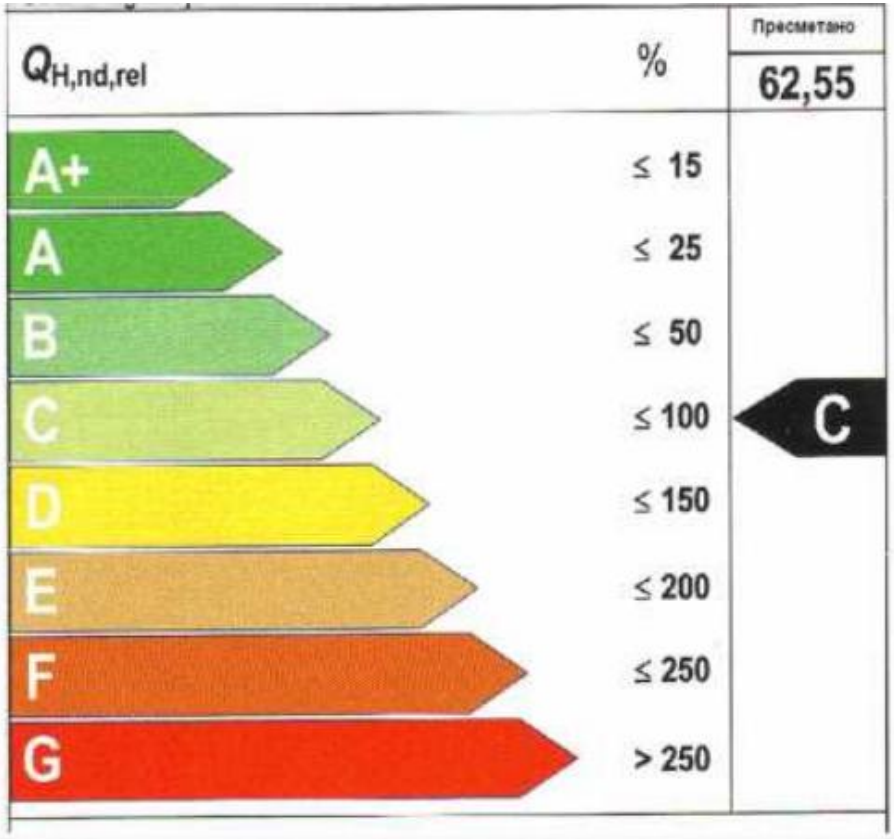
- **Hotels Industry is large energy consumer**
  - **Heating, Ventilation & Air Conditioning (HVAC)**
  - **Lighting *(main, additional, garden, parking, etc.)***
  - **Sport, Recreation, Pools & Spa Facilities**
  - **Hotel operations (hot water, refrigeration, steam)**
- **Improving the quality of services provided to the hotel guests**
- **Decreasing the operational cost & increase the profits**
- **Increase the public awareness for ecological benefits and the environment improvements**

Energy Efficiency Certificates

Energy Efficiency Certificate for Residential (Household) Customers



Energy Efficiency Certificate for Commercial Customers

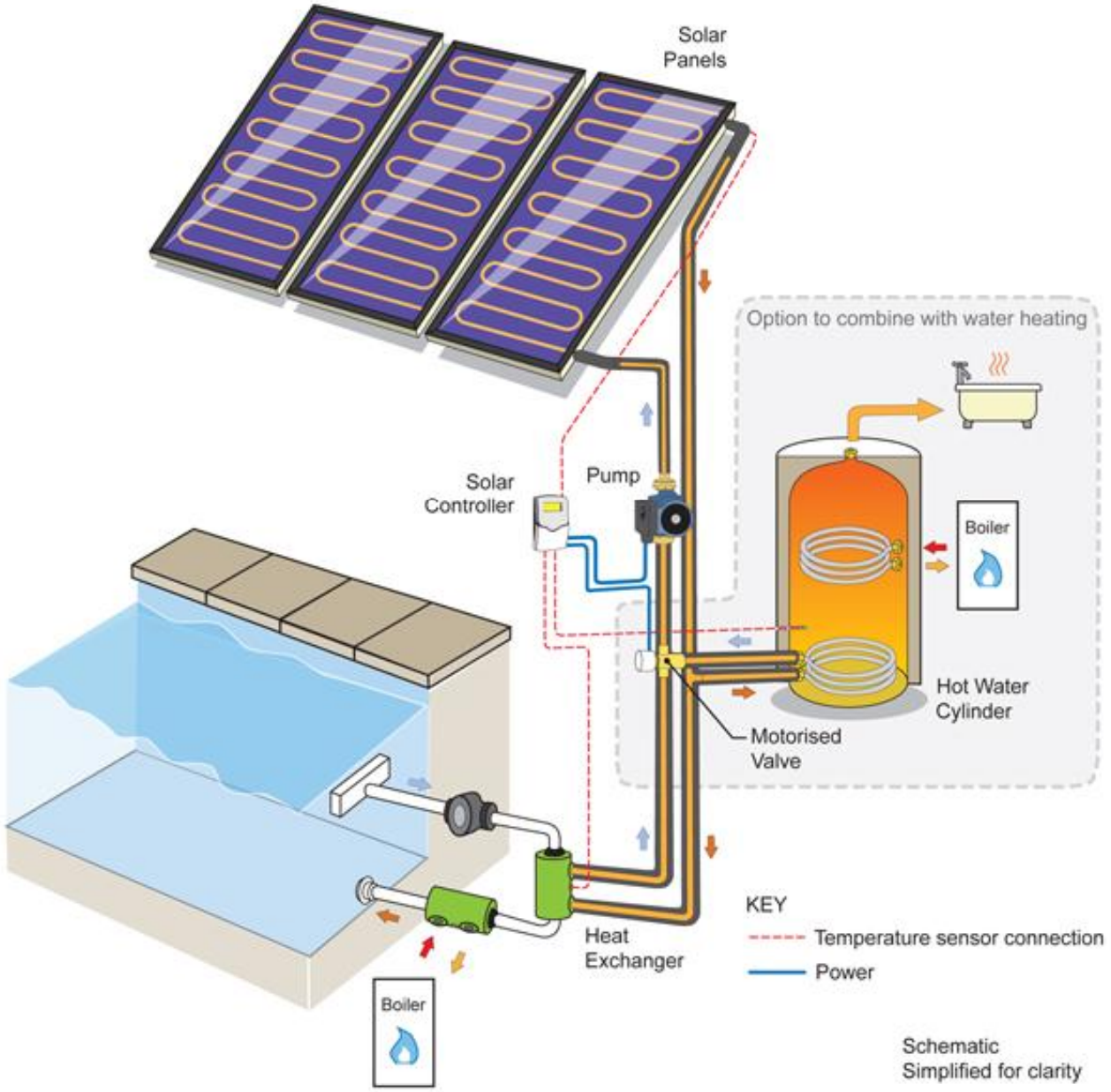


RES in the Hotel Industry

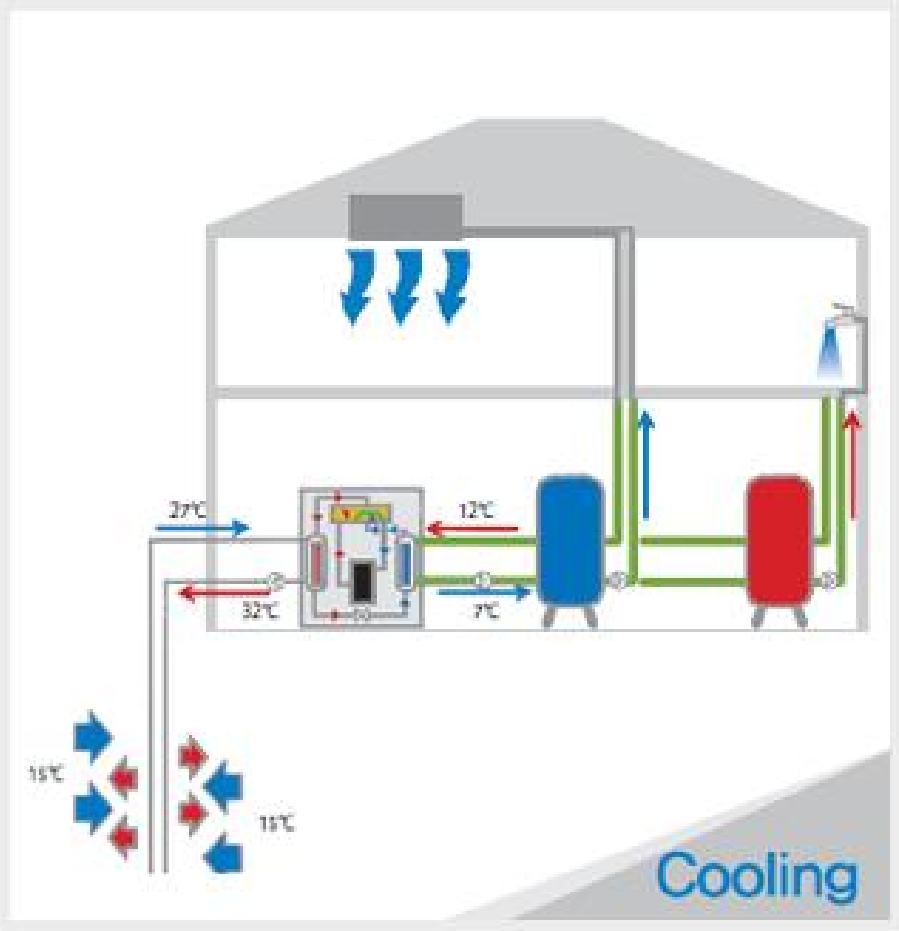
➢ Substitution of energy sources using RES

- **For heating & cooling** – solar thermal panels, direct geothermal heating & cooling systems *(heat pump*), and co-generation systems
- **For generation of hot water & steam** – thermal solar panels, geothermal *(if applicable),* and co-generation systems,
- **For lighting** – photovoltaic systems, utilization of high efficient LED lights, automatic system for switching on-off, light sensors etc.
- **For ventilation** – passive heating & cooling, selection of special construction materials and building design, appropriate location of the hotel, landscape planning, etc.
- **For Hotel operations** *(kitchen, laundry, dry cleaning etc.)* – combine systems for generation of hot water & stream

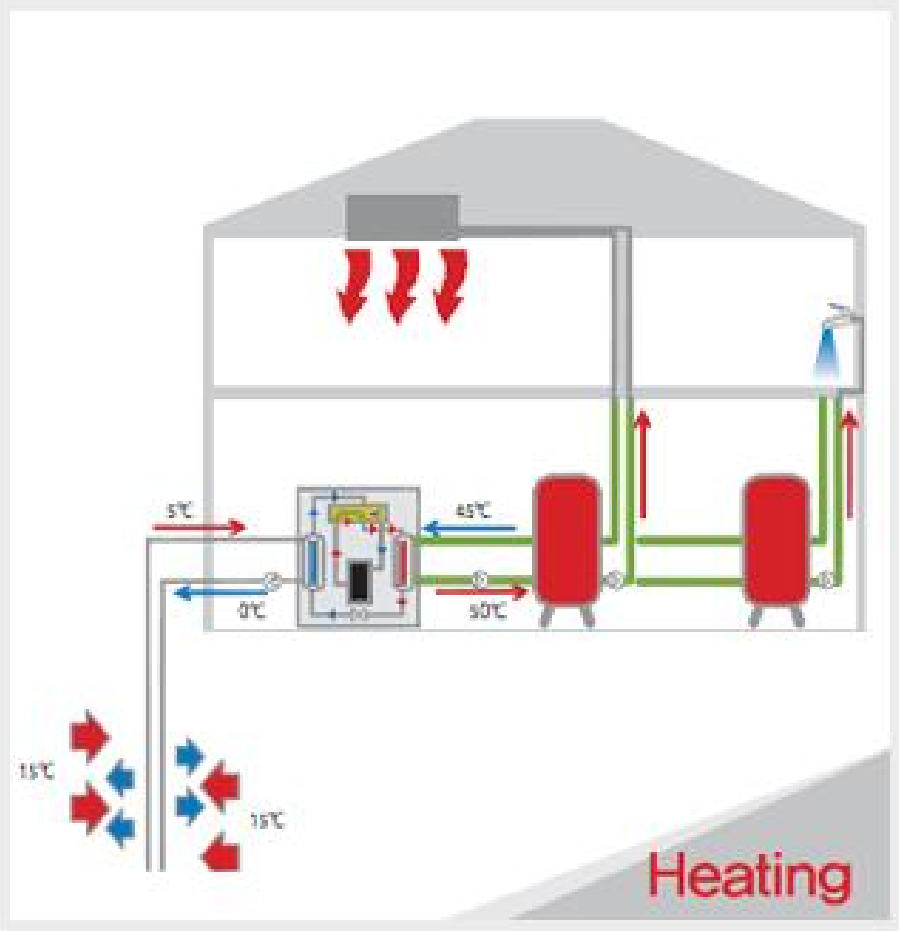
Solar Thermal Panels (Hot Water)



Heat Pump Heating & Cooling mode



It delivers external heat to the underground and cools the indoor environment using heat pump.



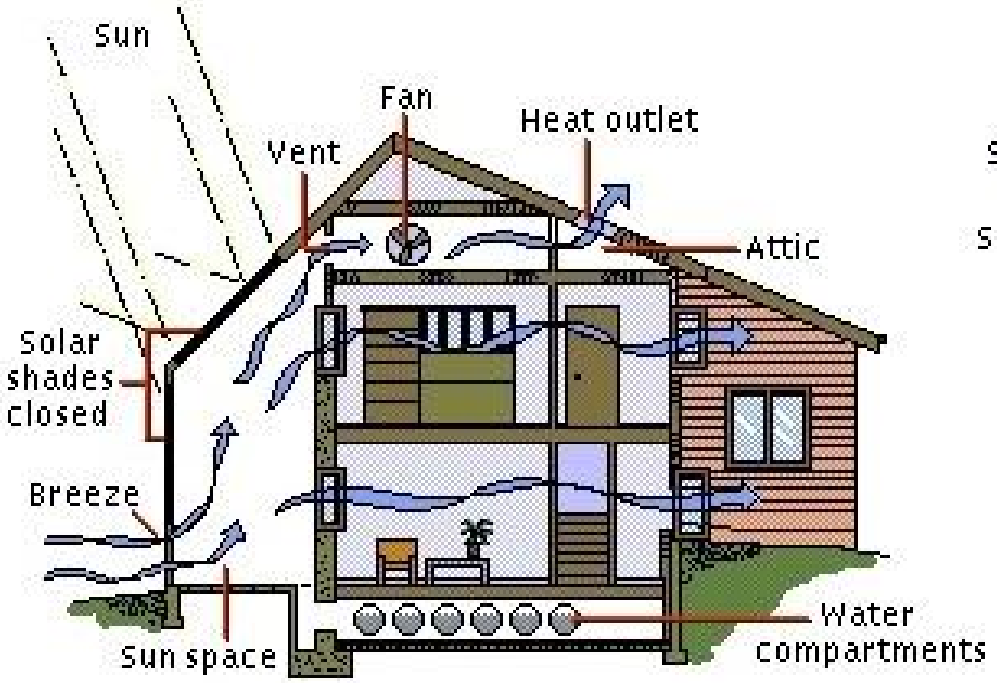
It absorbs heat from the underground and heats up the indoor environment using heat pump.

Combine Solar Thermal & Heat Pump

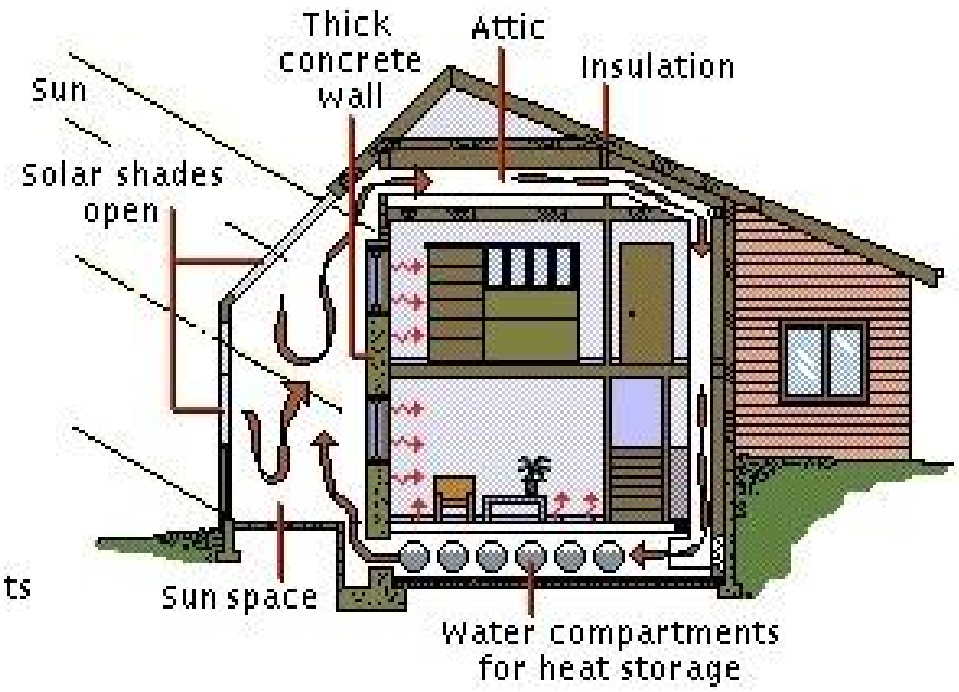
Photovoltaic (PV) systems (buildings)

Photovoltaic (PV) systems (parking)

Passive heating & cooling systems



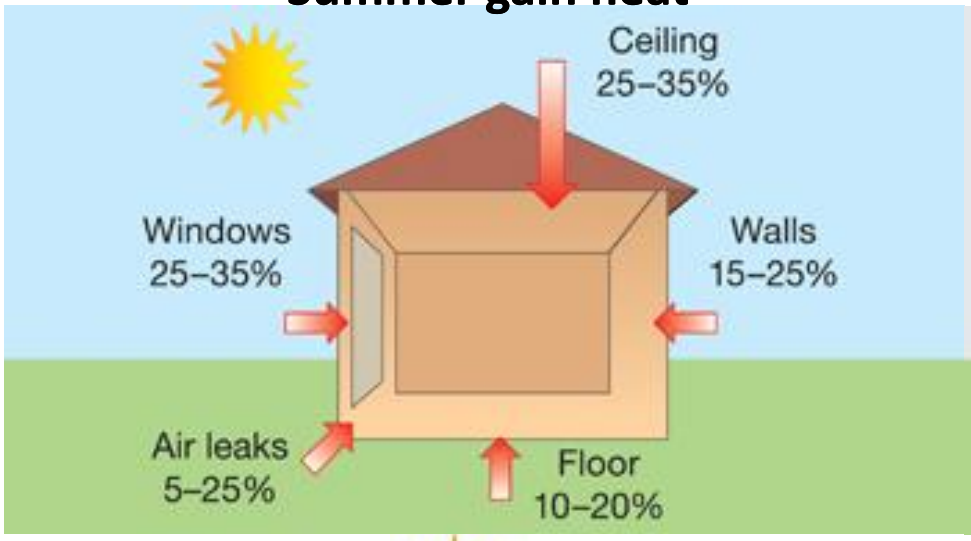
Passive solar cooling (Summer)



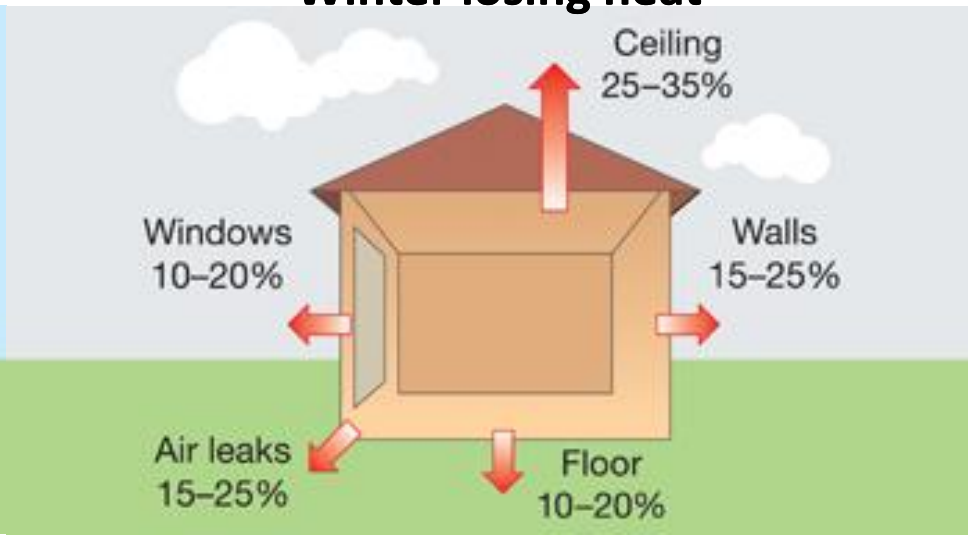
Passive solar heating (Winter)

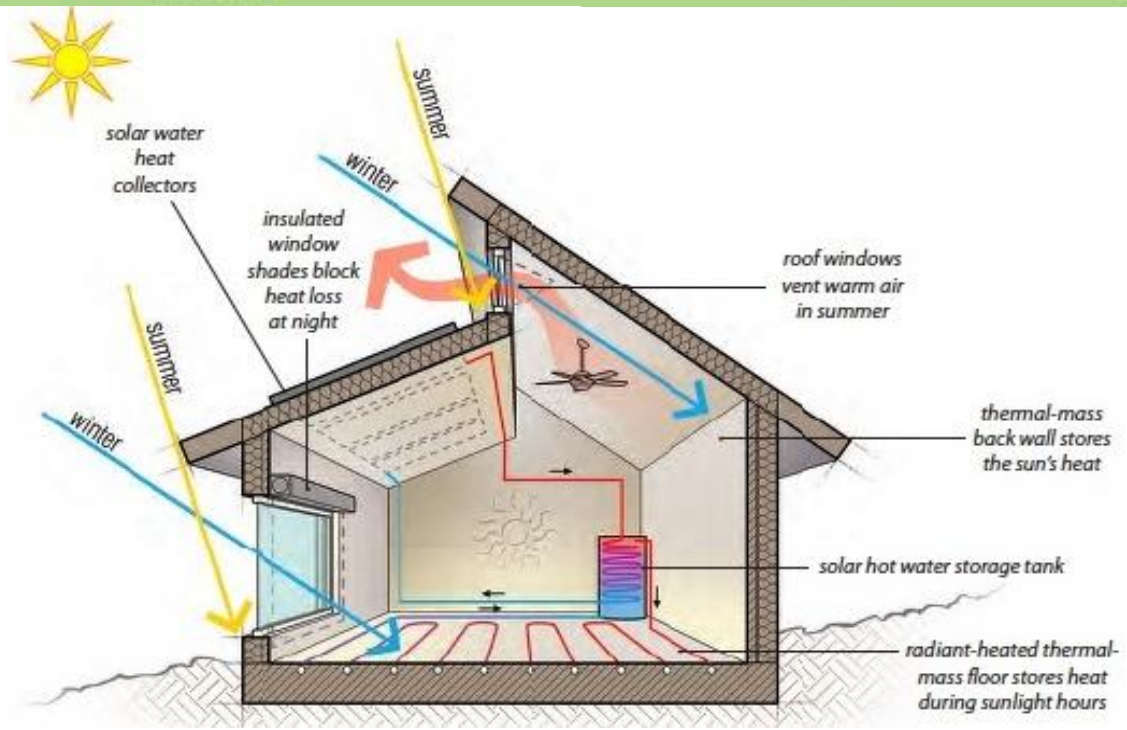
Importance of the adequate isolation

Summer gain heat

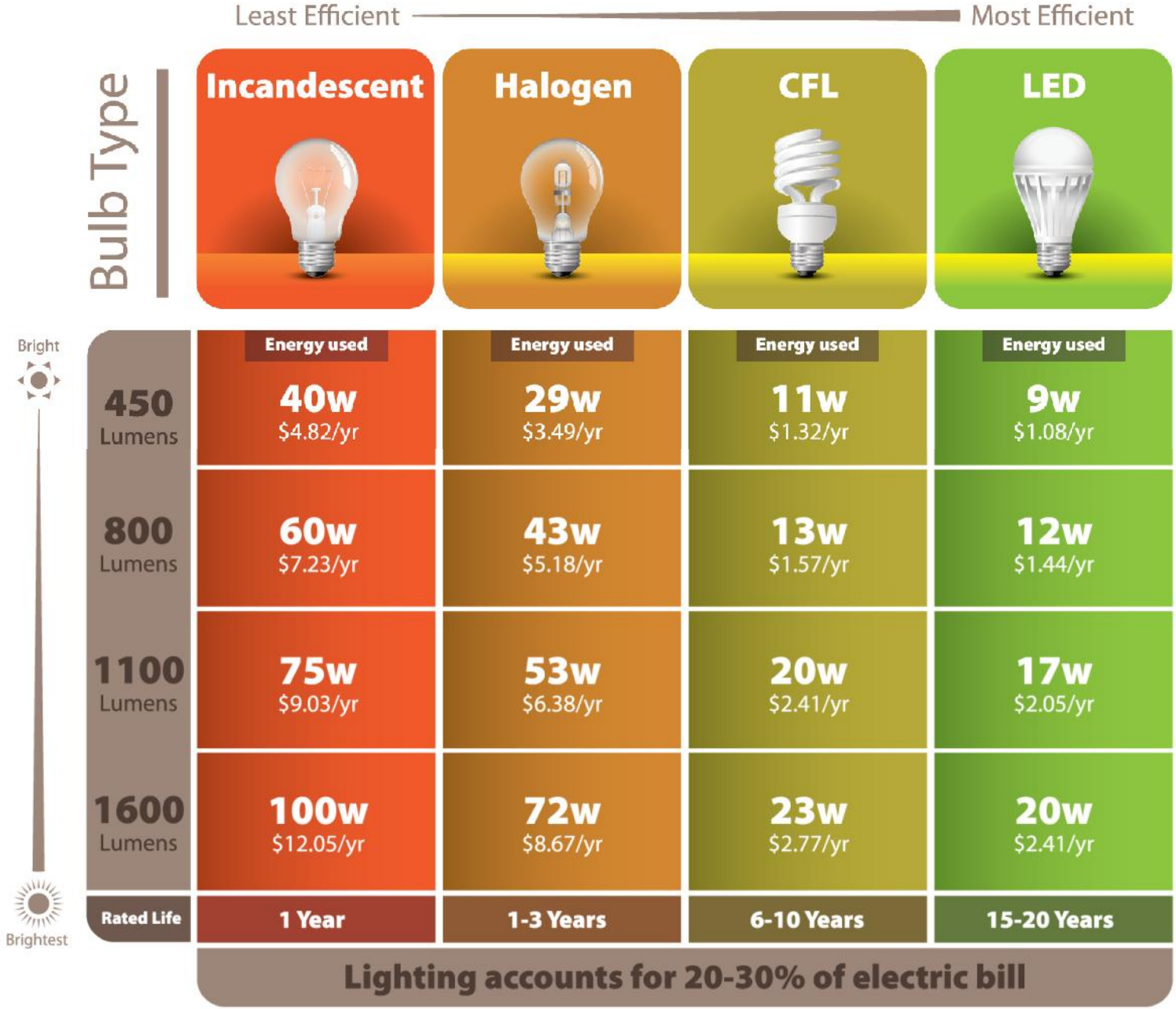


Winter losing heat



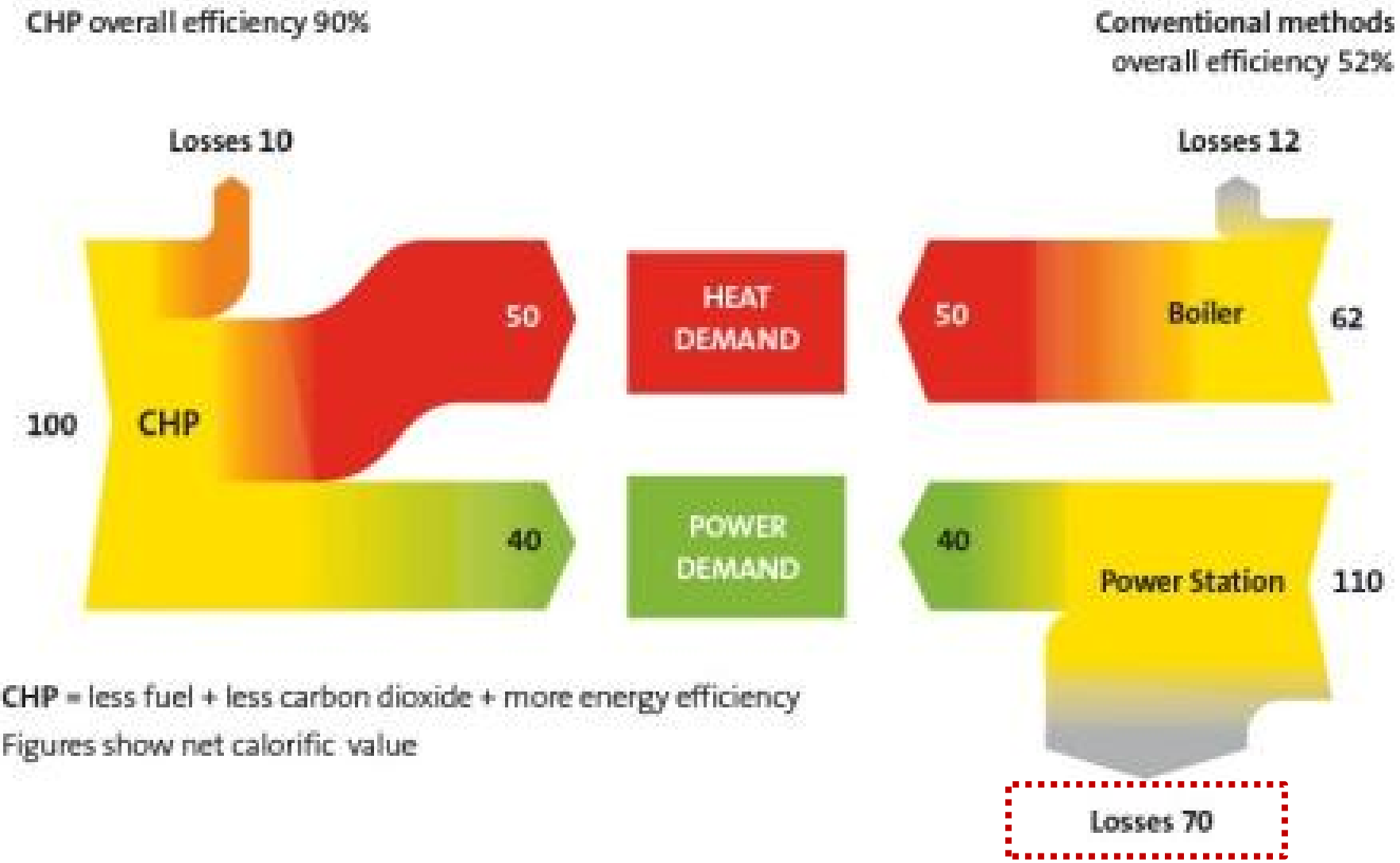


Lighting – hidden menace!



Lighting – what & where!

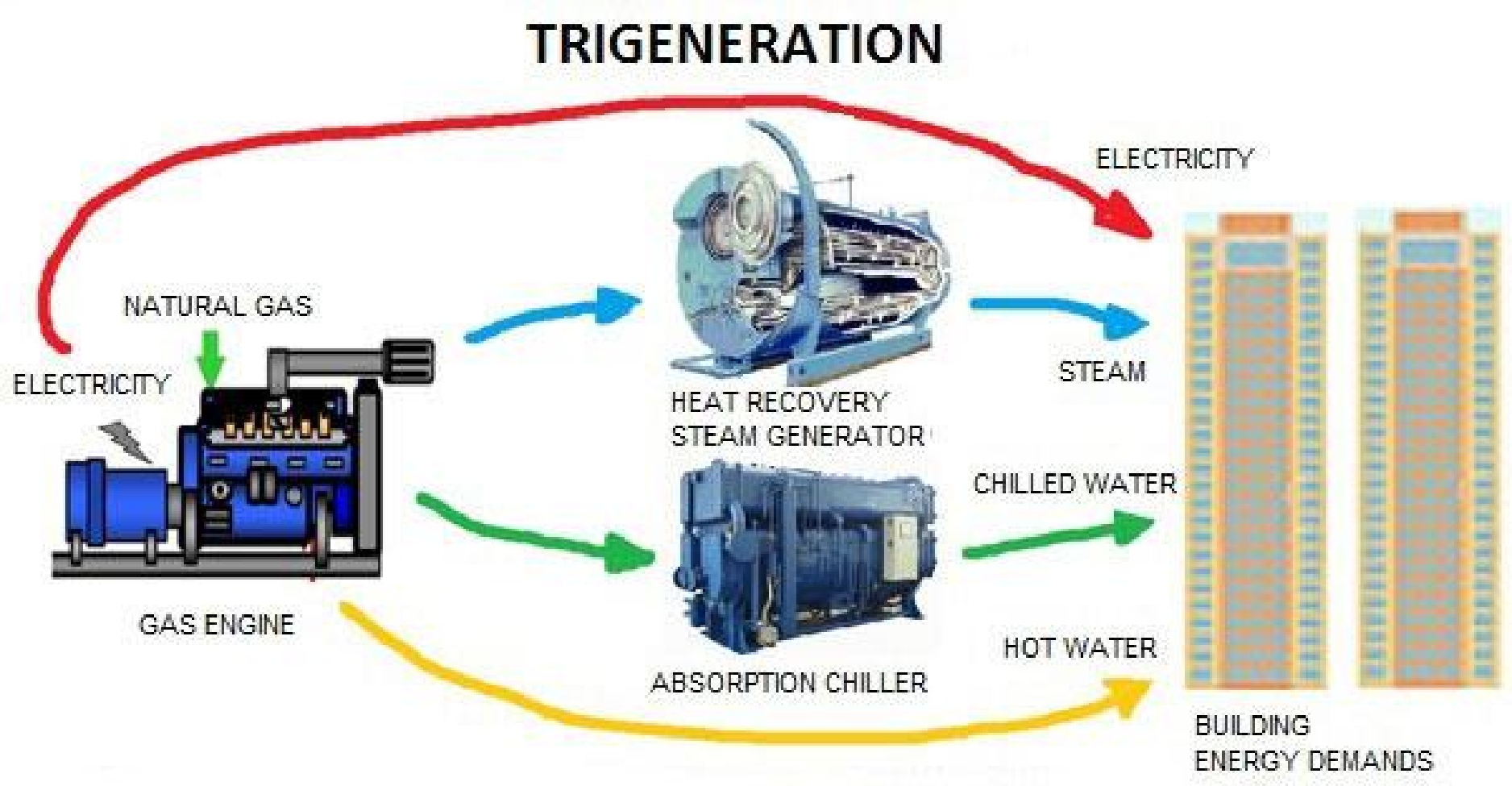
Co-generation & Three-generation



CHP = less fuel + less carbon dioxide + more energy efficiency

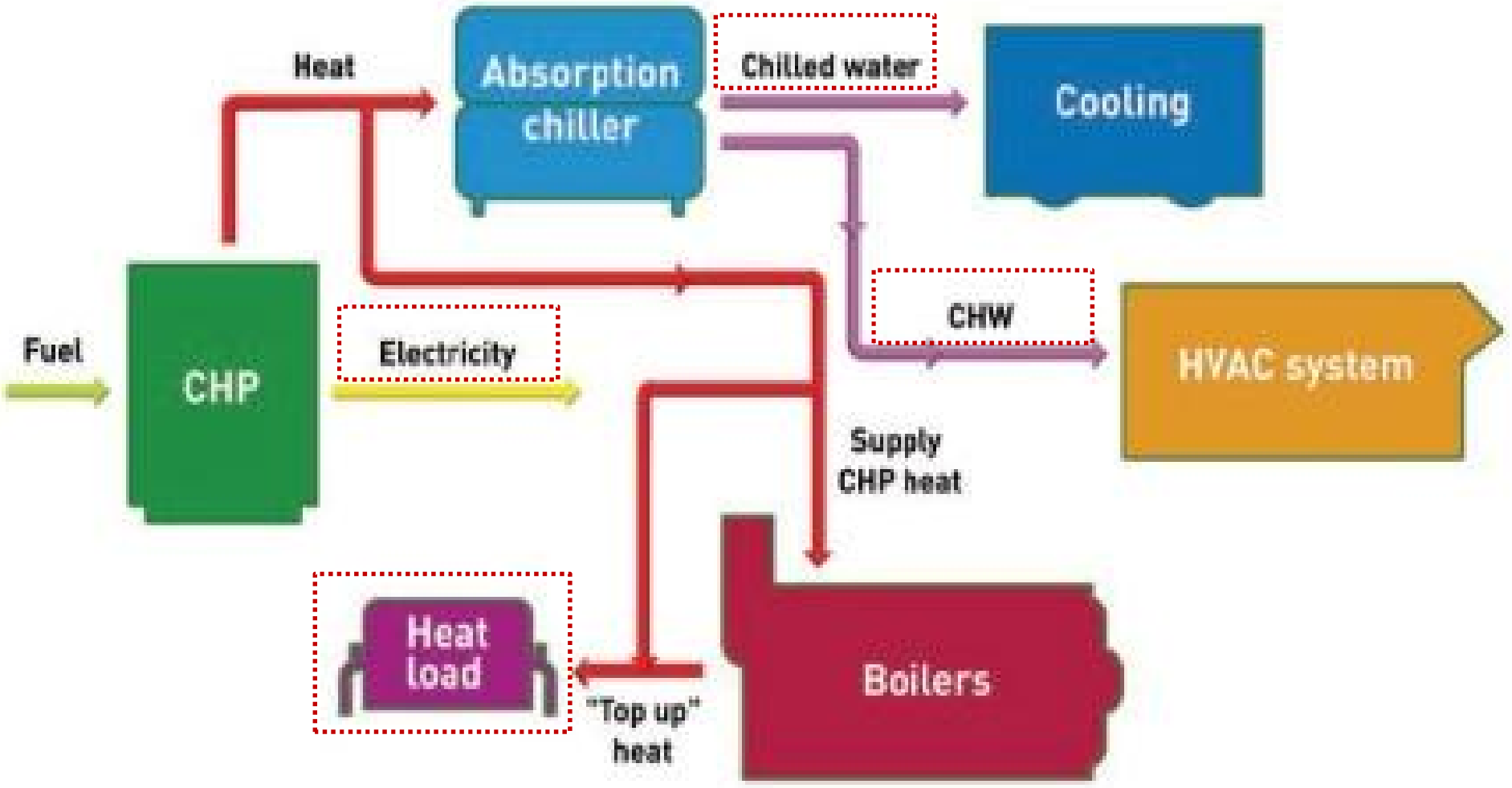
Figures show net calorific value

Co-generation & Three-generation



A GAS ENGINE IS USED TO PRODUCE ELECTRICITY FOR THE BUILDINGS.
ENGINE RESIDUAL ENERGY (JACKET WATER, EXHAUST GASES, OIL RADIATOR AND INTERCCOLERS) IS USED TO MEET BUILDING THERMAL DEMANDS.

Co-generation & Three-generation



Conclusions

- **The potentials for inclusion of *RES*** *(mostly solar and geothermal)* in the hotel industry for direct or indirect substitution of other energy source **are large**
- **Energy efficiency programs should be launched** and could result in **huge decrease in the operational cost** of the industry
- **Hotel's top management should be aware and well informed** about any programs for potential energy efficiency increase and renewable sources utilization in their business
- For best results, **it is imperative that the energy reduction, substitution and efficiency improvements are considered well in advance,** even before the construction of the hotel facilities