



REGION OF CRETE
ENERGY AGENCY

“Pact of Islands” Conference

Brussels 21 November 2012



ISLAND SUSTAINABLE ENERGY ACTION PLAN

CRETE

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Dr. N. Zografakis, Director

FRAMEWORK:

- RES / RUE / Climate change: EU targets and national (**regional –local**) obligations(20-20-20, SEAPs, roadmap to 2050, related international initiatives)
- Greek Strategic Support Framework (**SSF**) for Energy-Competitiveness/ Greece-(Cyprus-Israel) electricity connection-NG....
- Regional-**insular** policies: energy, environment, industry, innovation ...
- Innovation – entrepreneurship –technology transfer – networking – Awareness: “**Knowledge economy –Open innovation model**”



CRETE: ENERGY CHARACTERISTICS

- ❖ **Oil dependence: 86%** (61% national Greek average)
- ❖ **High potential of Renewable Energy Sources**
- ❖ **High potential of Rational Energy Use**
- ❖ **Electricity demand: 2.931,47 GWh – 2.981 GWh** (2011)
- ❖ **Peak of power demand: 630 MW** (2011)
- ❖ **RES Elec.Contribution: 19,46%**(2011)/
- ❖ **RES power: 244MW (23%)**



NEED OF AN INTEGRATED REGIONAL ENERGY POLICY

RENEWABLE ENERGY SOURCES INSTALLATIONS IN CRETE (1)

- **26 WIND PARKS:** total installed power of **179,3 MW(2011)** / Electricity > **17%** / **3 more parks** under construction
- **BIOMASS:** 6% of the total final energy consumption (Thermal uses: olive oil mills, bakeries, green houses, hotels, dwellings) **BIOGAS: 2** combined heat/electricity installations
- **SOLAR THERMAL COLLECTORS – CENTRAL SOLAR SYSTEMS FOR HEATING WATER: 450.000 m²** (thermal energy producing **1,8%** of the total energy demand) – **25 Big pilot central** solar heating systems for hotels and SMEs
- **2 SOLAR AIR CONDITIONING SYSTEMS**



RENEWABLE ENERGY SOURCES INSTALLATIONS IN CRETE (2)

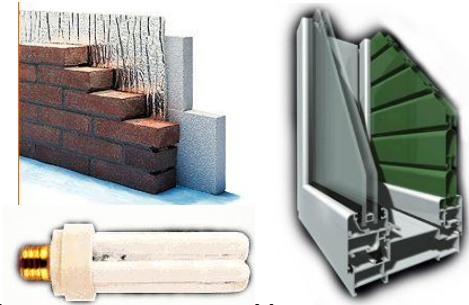
- **PHOTOVOLTAIC SYSTEMS:** (lighthouses, small hotels of ecological tourism, hotels and dwellings): **50** installations of total **1 MW** / **New** installations (80 KW)+**PV roofs= (64MW)(2011)**
- **PASSIVE SOLAR SYSTEMS – BIOCLIMATIC ARCHITECTURE:** (Public buildings, Houses, schools, Research Institutes, etc.) **50 operating installations**
- **SMALL HYDRO:** **2** installations of **0,6 MW** / Total potential: 6 MW
- **PUMP STORAGE SYSTEMS:** Big pilot projects under study and implementation (**100MW**)
- **SHALLOW GEOTHERMY:** 10 installations
- **PILOT PROJECTS:** Electricity production by solar thermal plants(**38MW**)
- **TOTAL RES INVESTMENTS:** Over **750 millions EURO**



RATIONAL USE OF ENERGY AND ENERGY SAVING INSTALLATIONS IN CRETE

- **Penetration of technologies** for Rational Use of Energy and Energy Saving (mainly in new buildings):

- Buildings' insulation
- Use of double glasses
- Use of energy efficient electric light bulbs...



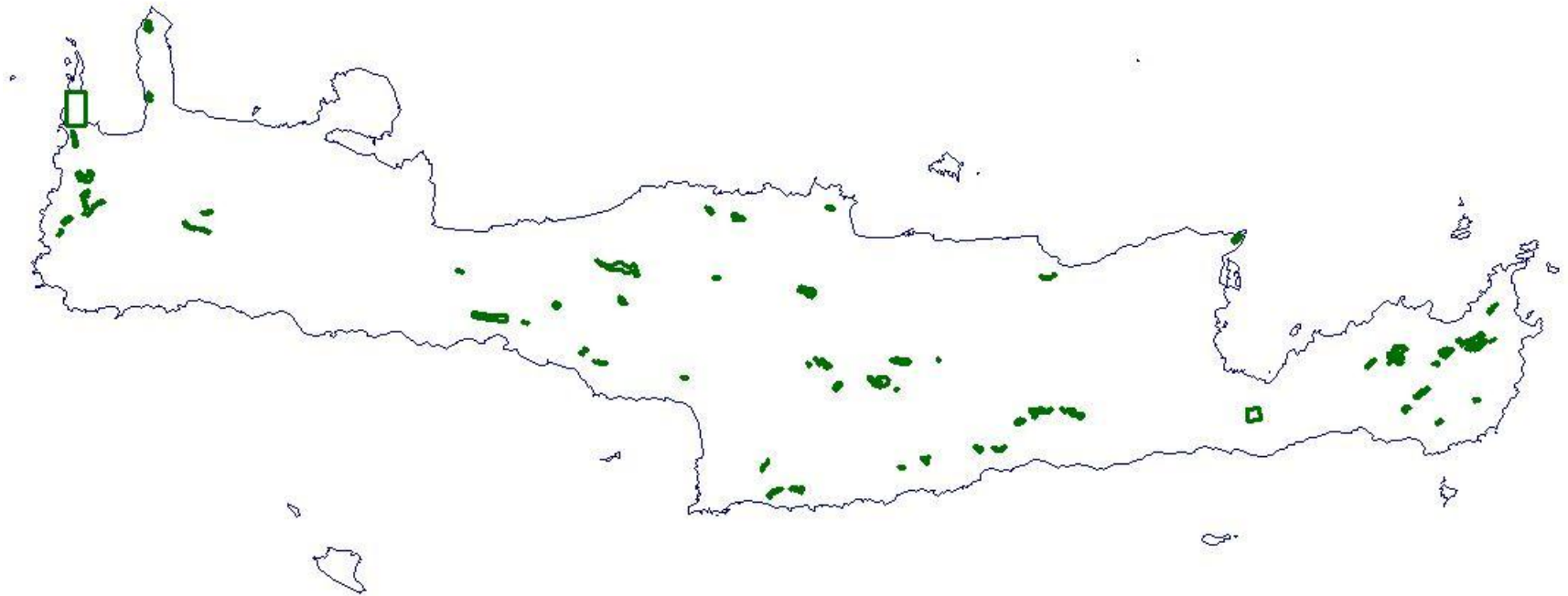
- **Many new installations**, mainly in hotels, Rational Use of Energy and Energy Saving

- Volunteer interventions (coordinated by the Regional Energy Agency of Crete) of big energy consumers in Crete (hotels, Municipalities, pumping water plants, etc.) for **reducing electricity demand** during the summer peaks

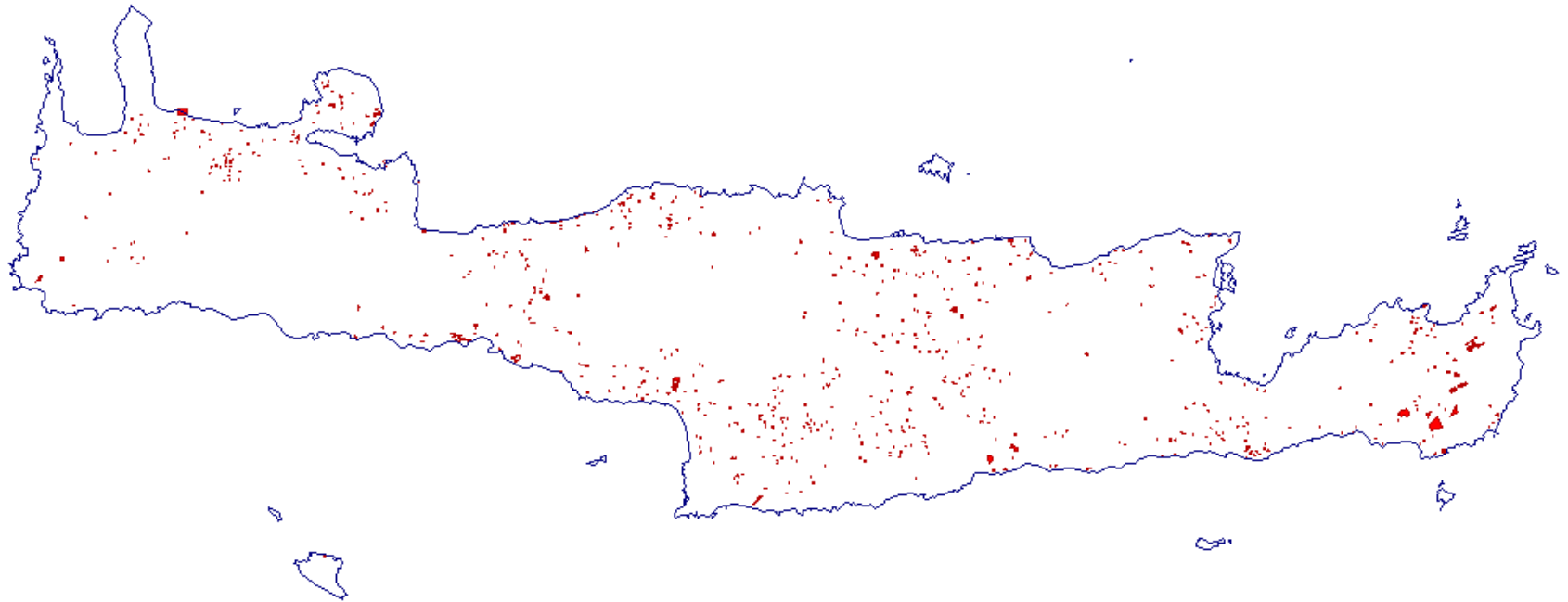
- **Specialised information campaign** professionals, general speeches,



Geographical allocation of **Wind** parks



Geographical dispersal of **PV** plants



Regional Innovation and Added Value on RES in Crete

based mainly
to “Open Innovation Model” →

- Existed Innovations,
- Pilot Implementation,
- “New innovations”

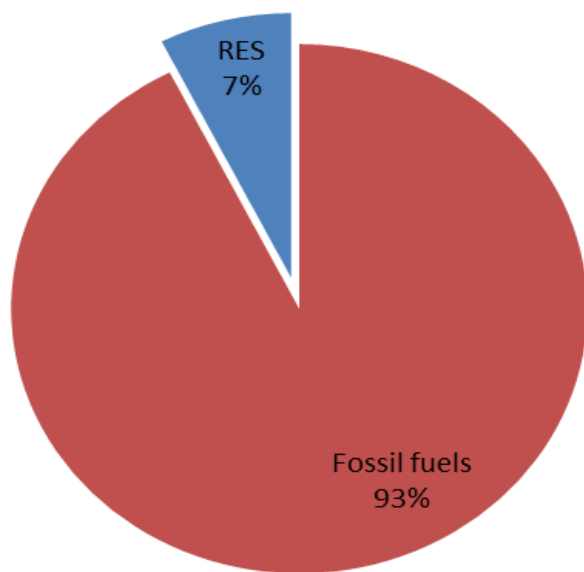
Use - adopt

Adapt

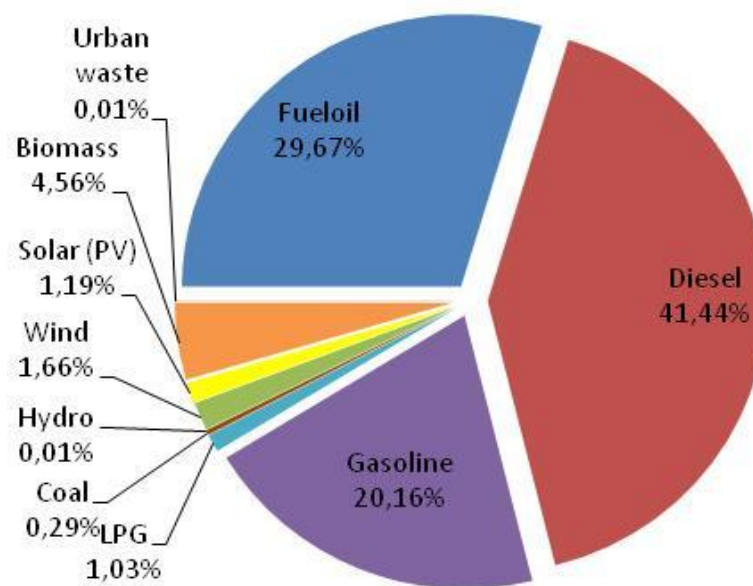
Develop –
combine



Primary energy demand

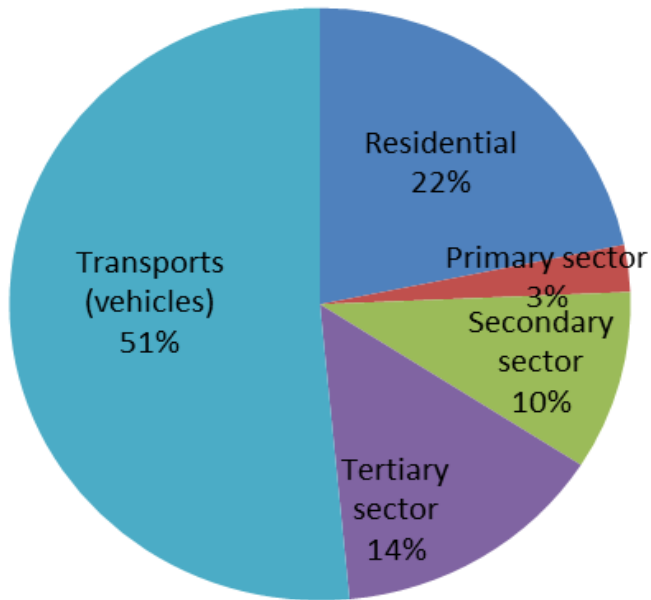


Primary energy demand

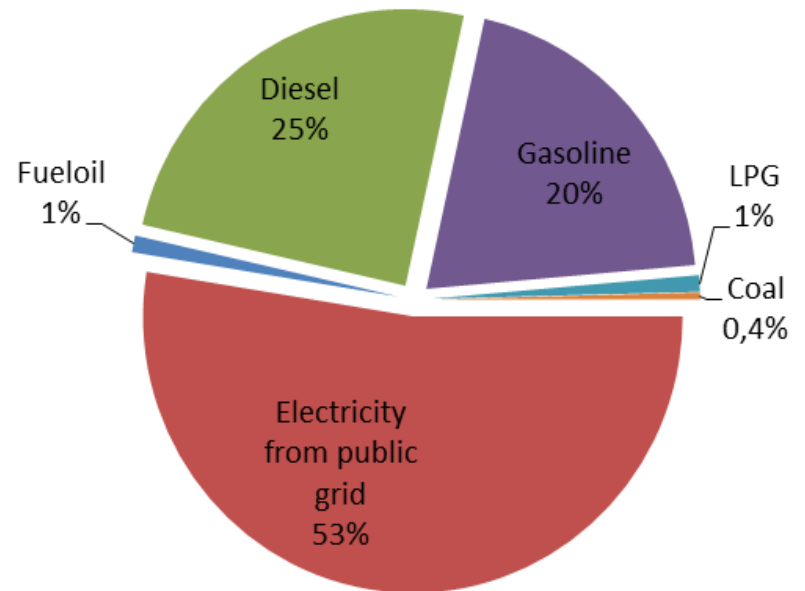


Primary Energy : Base Year 2005

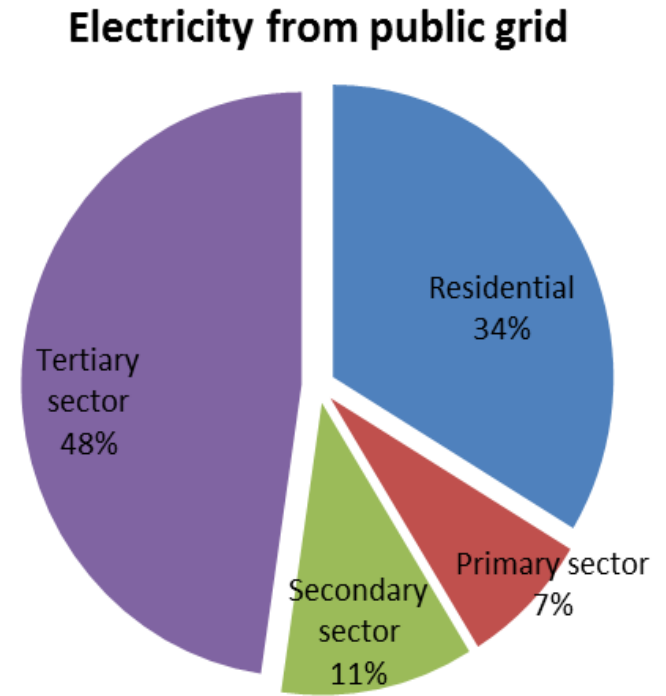
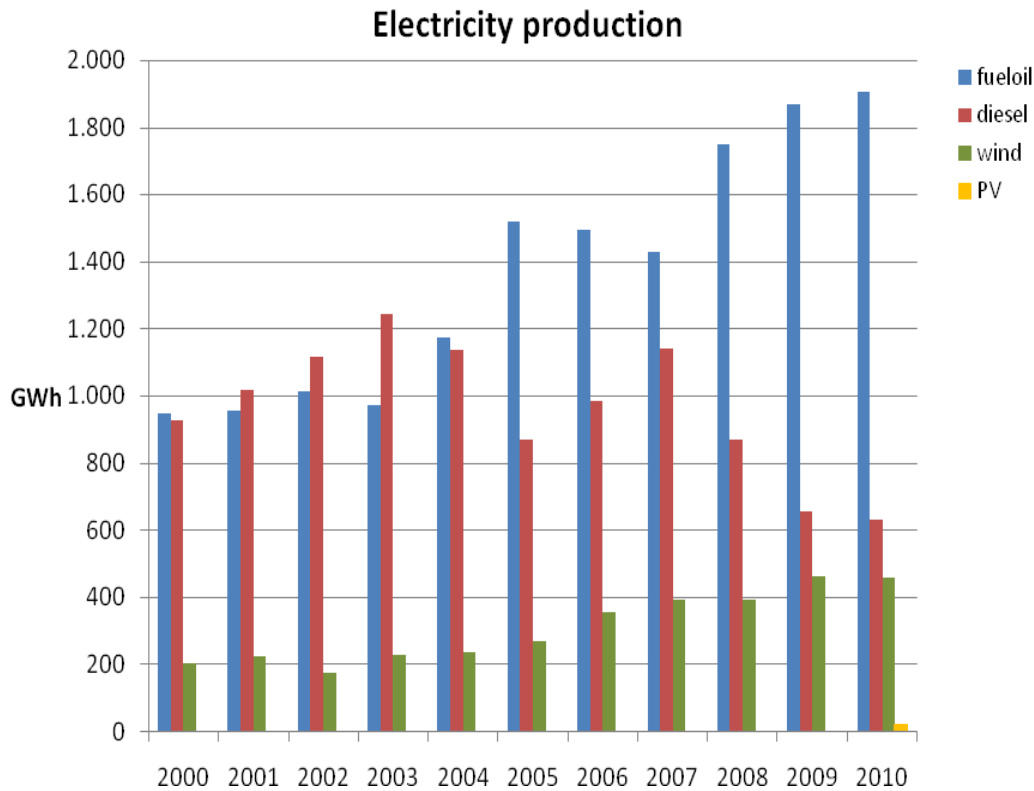
Total energy for final use



CO2 emissions from final energy demand



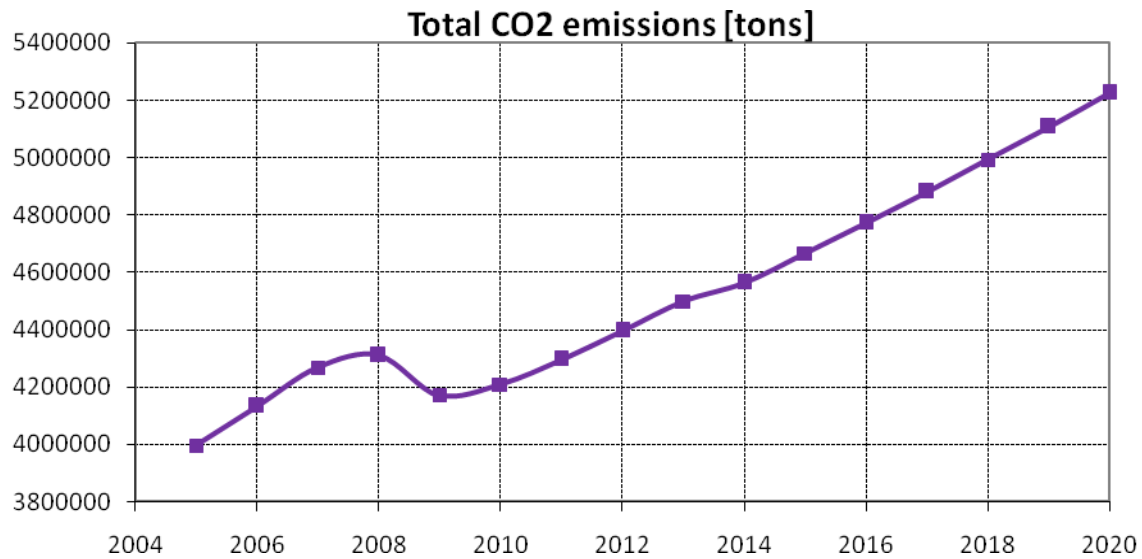
Final Energy :Base Year 2005



Electricity : Base Year 2005

Evolution of Electricity production: 2000-2010

Year	Wind		Wind-hydro		PV		Solar thermal e	
	[MW]	[GWh]	[MW]	[GWh]	[MW]	[GWh]	[MW]	[GWh]
2010	166,7	456	0	0	30,7	21,7	0	0
2015	185	508	7,4	13	40	56	5	13
2020	201,6	554	10,1	18	50	70	10	26

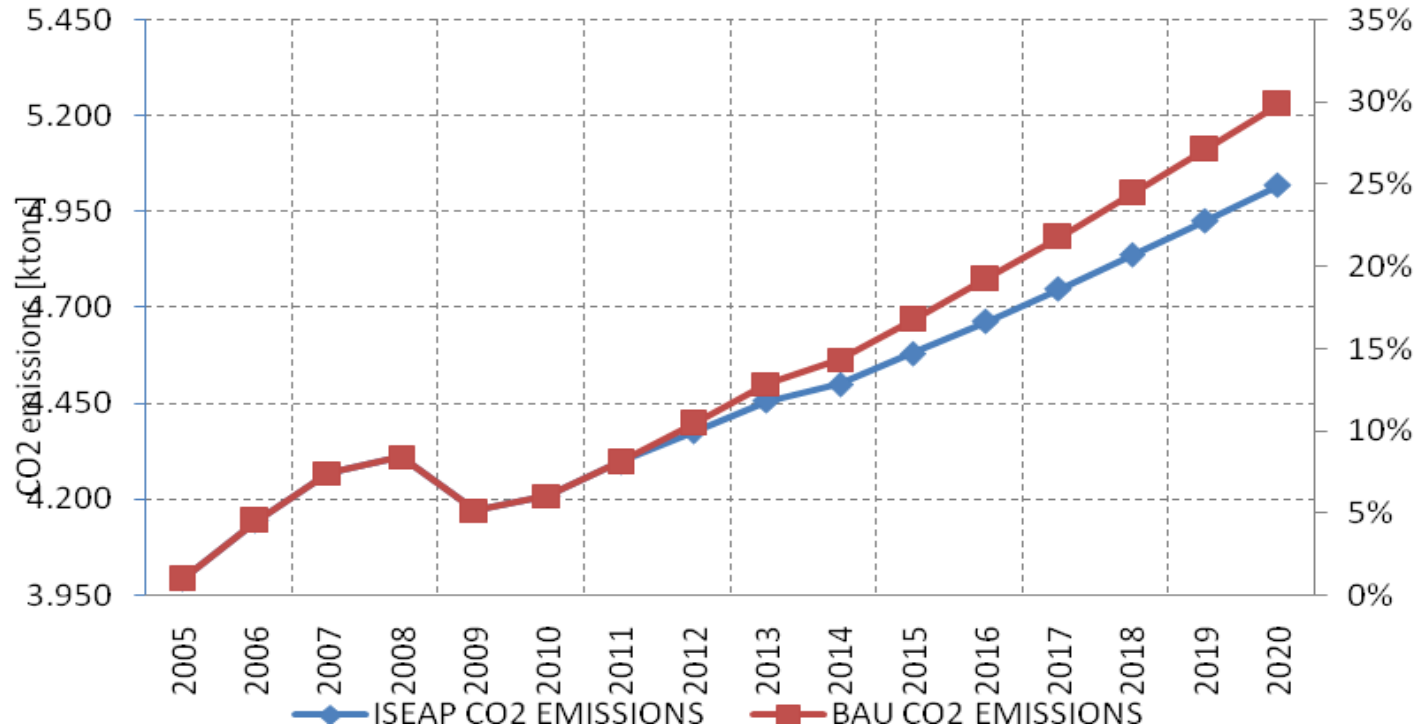


BAU SCENARIO FOR RES: 2010-2020

Activity sector		Primary energy demand reduction		CO ₂ emissions reduction	
		Percentage decrease[%]	Absolute decrease[MWh]	Percentage decrease[%]	Absolute decrease[ktons]
Residential		4.80	1026128	3.56	142189
Primary		0.96	204791	1.33	53158
Secondary		2.28	486964	2.33	92898
Tertiary	Commercial	3.51	751617	5.29	211280
	Tourism	2.97	634433	4.63	184849
	Public	1.01	215353	1.55	61976
Transports		2.50	534321	4.05	161564
Total		16.63	3556022	27.74	1107547

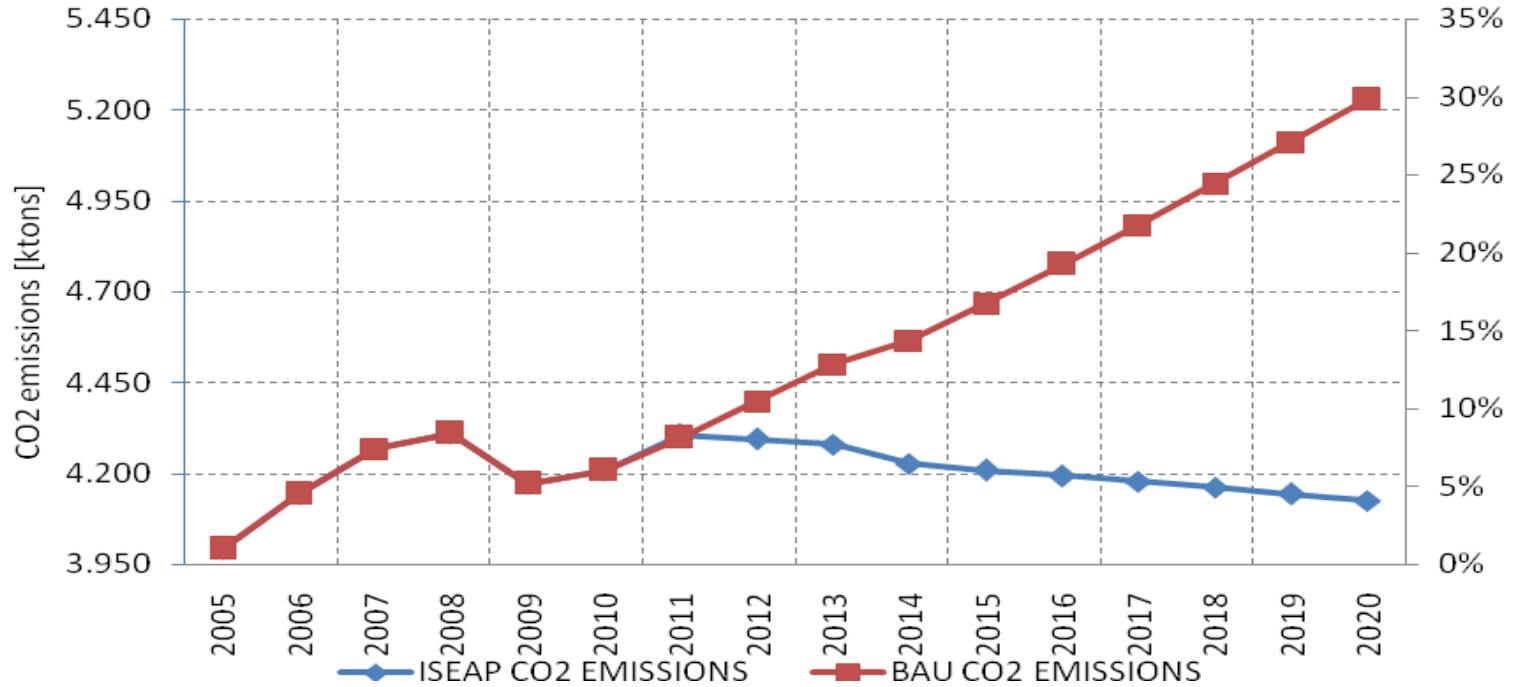
Contribution of each activity sector in the primary energy demand and CO₂ emissions reduction through the implementation of **DSM actions by 2020**

DSM actions - Tourism (Tertiary) sector



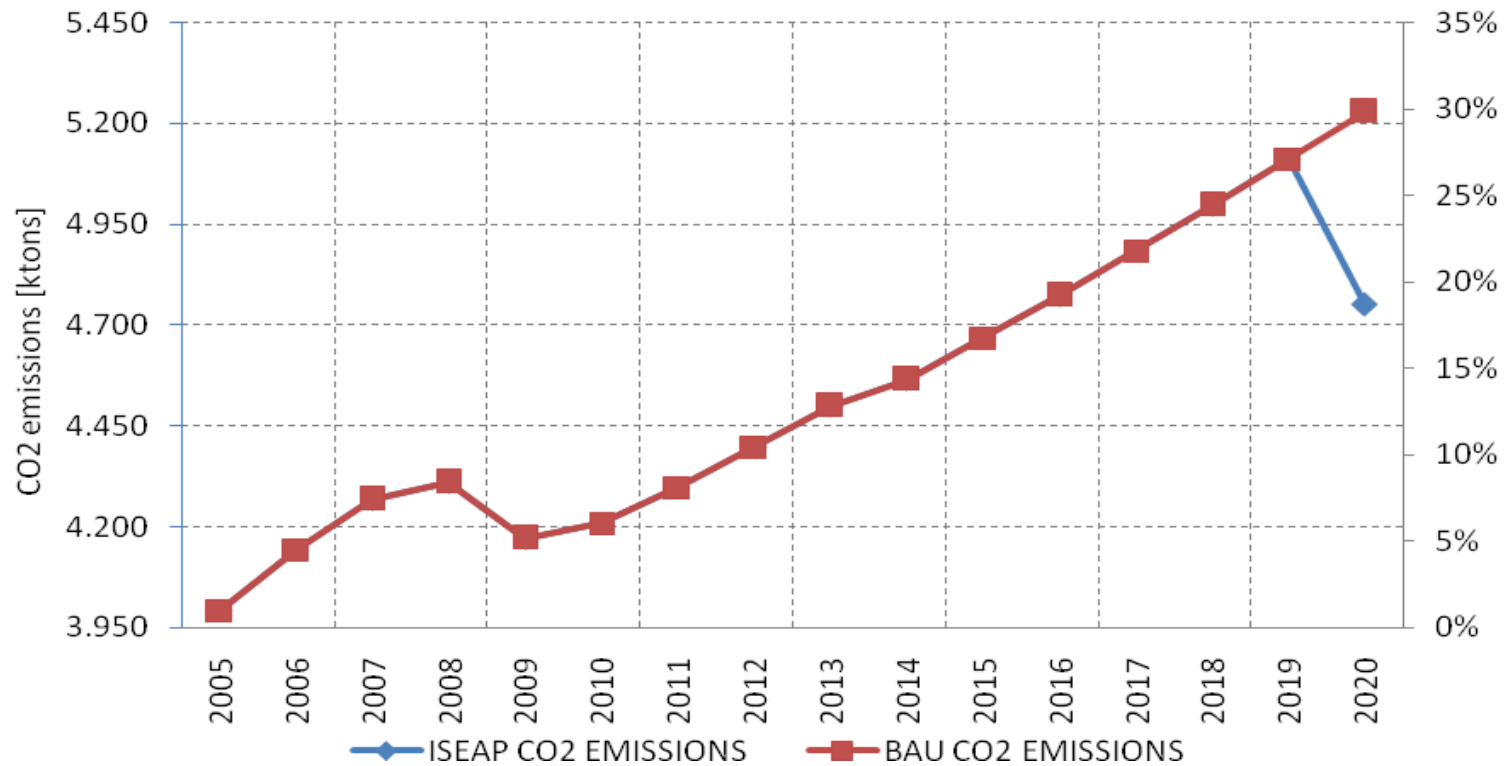
CO₂ emissions before and after DSM actions in the **Tourism** sector

Overall DSM actions



CO2 emissions before and after overall **DSM** actions

Introduction of natural gas



CO2 emissions before and after the installation of the **natural gas** combined cycle generators

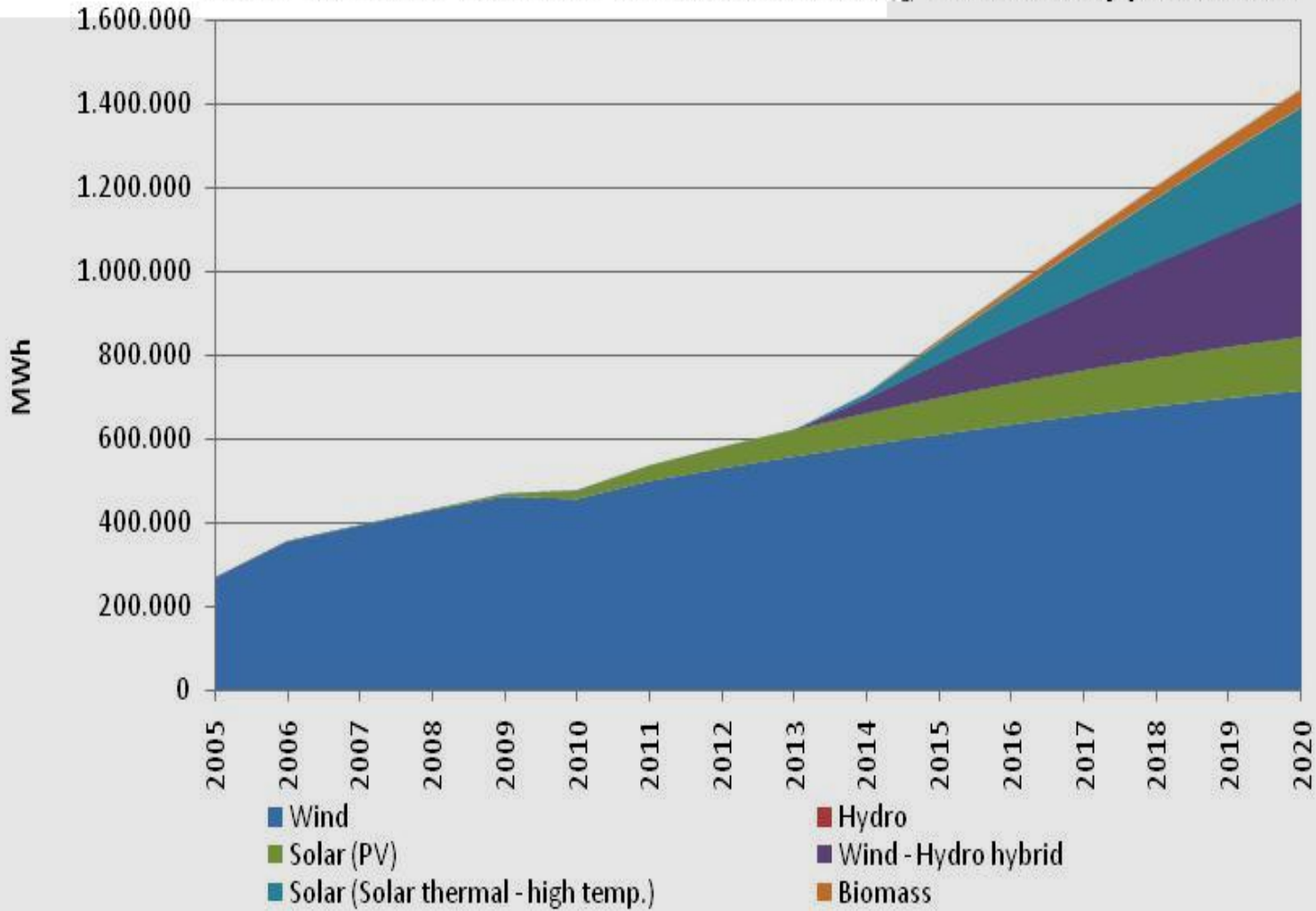
	INSTALLED RES POWER PER SCENARIO IN 2020 [MW]					
SCENARIO	WIND	WIND-HYDRO	PV	SOLAR THERMAL e	BIOMASS	TOTAL
SCENARIO BAU	201,6	10,1	50	10	0	271,7
SCENARIO A	260	183	118	88	7	656
SCENARIO B	840	241	176	115,6	8,45	1381,05
SCENARIO C	1033	286,1	176	115,6	9,58	1620,28

SCENARIO COMPARISON : RES FOR ELECTRICITY PRODUCTION

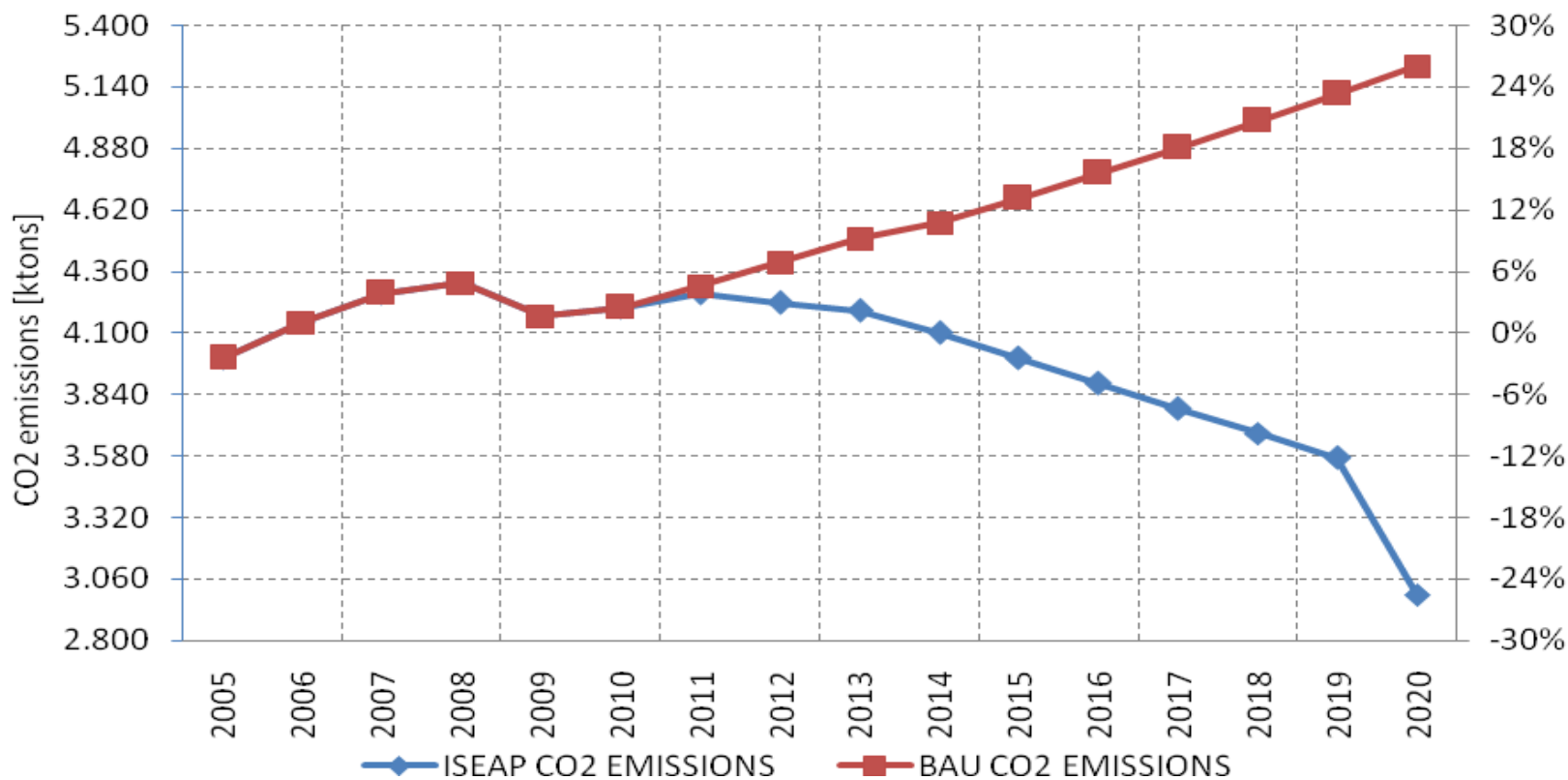
[MW]	WIND		WIND HYDRO		PV		SOLAR THERMAL e		BIOMASS	
YEAR	BAU	SCENARIO A	BAU	SCENARIO A	BAU	SCENARIO A	BAU	SCENARIO A	BAU	SCENARIO A
2010	170	170	0	0	30.7	20	0	0	0	0
2015	185	222	7.4	20	40	81.4	5	5	0	0
2020	201.6	260	10.1	183	50	118	10	88	0	7

ISEAP Scenario : RES installations for electricity production

ISEAP Scenario: Evolution of RES contribution in Electricity production



ISEAP scenario



“ ISEAP - OVERALL Scenario: CO2 emissions development comparison between BAU and ISEAP scenario

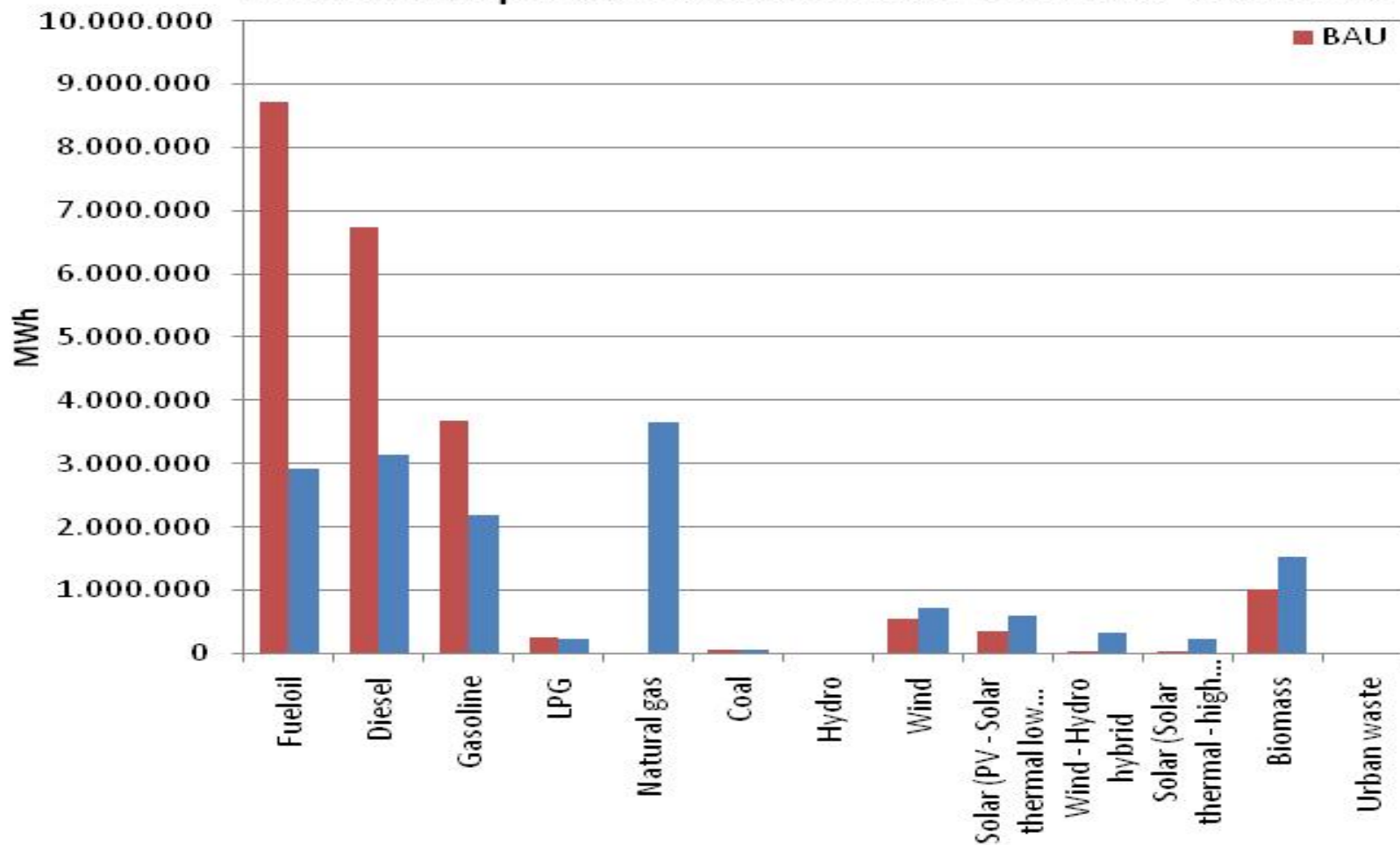
FINAL RESULTS

	Base Year (2005)	BAU (2020)	ISEAP (2020)
RES IN PRIMARY ENERGY DEMAND	7%	9%	22%
RES CONTRIBUTION IN ELECTRICITY PRODUCTION	10%	16%	36%

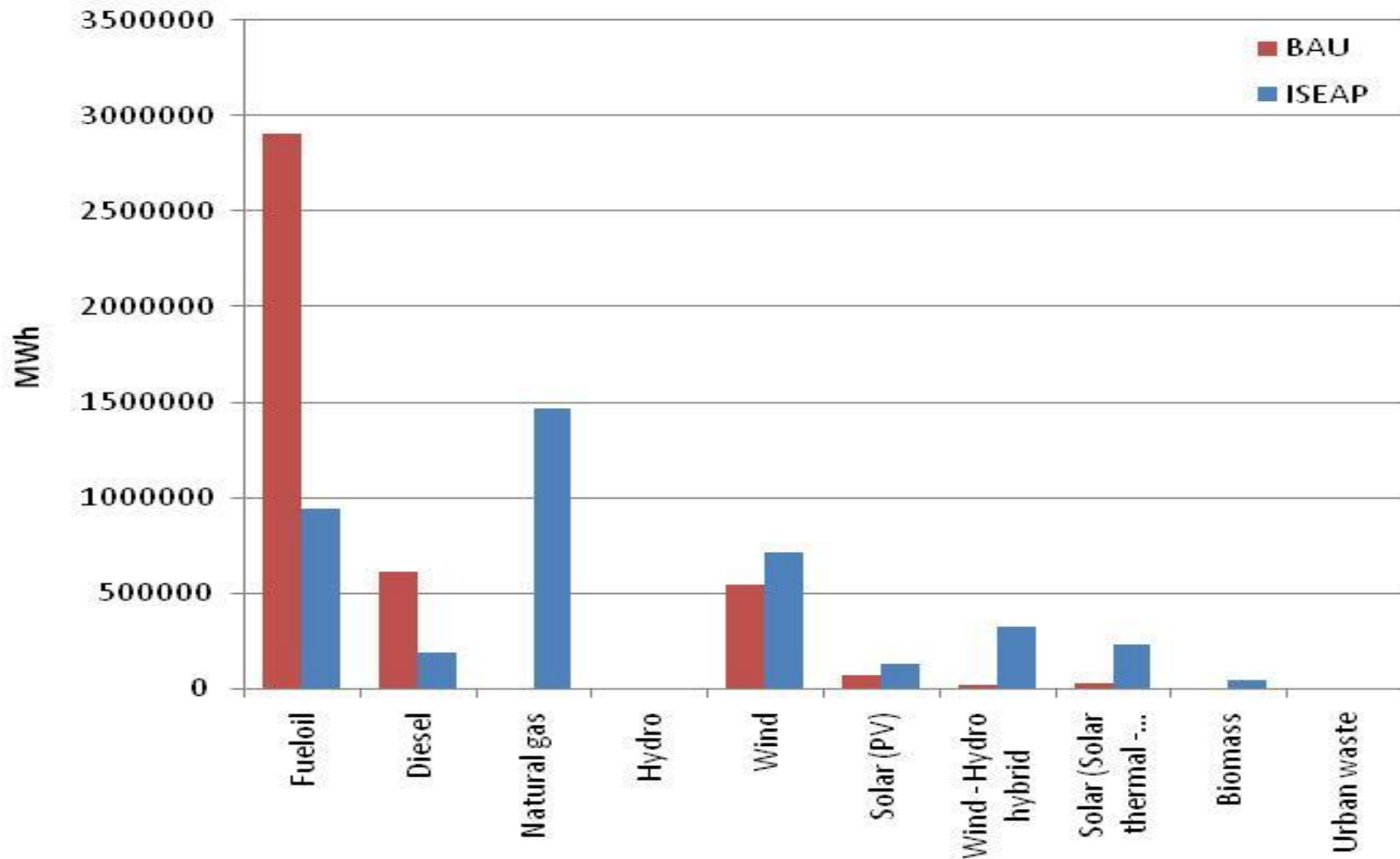
Carbon Dioxide emissions change

ISEAP (AUTONOMOUS DEVELOPMENT-NO CABLE) (2020)	- 25% compared to 2005
	- 56,07% compared to BAU on 2020

Primary energy demand distribution to energy carriers in 2020 Comparison between BAU and ISEAP scenarios



Electricity production distribution to energy carriers in 2020 Comparison between BAU and ISEAP scenarios



6 projects selected for Bankability analysis

- Solar thermal power plant
- Large scale Wind energy development with interconnection to the mainland
- Hybrid wind with pumped storage
- Biomass power plant
- Photovoltaics in roofs
- Photovoltaics in rural land

Input data – Description of projects

Description	Energy production (GWh/y)	Cost of the plant (millions €)
Concentrated solar Thermal power plant 38MW	71.1	141
Large Wind with interconnection - 1077MW	2.830	2460
Wind - hydro pumped storage: 90MW wind - 75MW hydro	275.3	345
Biomass 8 MW	56.1	24
3000x10kW PVs on roofs - 30MW	45.0	57
100x80kW PVs on rural land - 8MW	12.8	11.2

Private & Public Benefits - Bankability

Description	Private Benefits (IRR – PBP)	Public Benefits (IRR – PBP)	Bankability indicator
Concentrated solar Thermal power plant 38MW	10.2% 18Y	9.2% 20Y	6
Large wind with interconnection - 1077MW	11.7% 14Y	22.7% 6Y	2
Wind - hydro pumped storage: 90MW wind - 75MW hydro	9.5% 19Y	14.1% 12Y	3
Biomass 8 MW	13.8% 11Y	22.3% 7Y	4
3000x10kW PVs on roofs - 30MW	15.4% 10Y	14.6% 11Y	8
100x80kW PVs on rural land - 8MW	19.9% 7Y	21.3% 7Y	9

Avoided emissions and Employment created

	CO2 reduction Thtn (annual)	CO2 reduction indicator (tn CO2 per € of investment)	Employment (jobyears) INSTALLATION - O&M
Concentrated solar Thermal power plant 38MW	62.3	0.011	253 – 3
Large Wind with interconnection - 1077MW	3467	0.028	2685 – 287
Wind - hydro pumped storage: 90MW wind - 75MW hydro	241	0.014	480 – 62
Biomass 8 MW	49.1	0.020	63 – 30
3000x10kW PVs on roofs - 30MW	39.4	0.017	32 – 4
100x80kW PVs on rural land - 8MW	11.2	0.025	21 – 4



THANK YOU FOR YOUR ATTENTION !

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Regional Energy Agency