

Long-Run Forecasts of Final Energy Demand in Cyprus

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Outline of the study

- Energy balance prepared for years 2012 & 2013
- Estimates of final and useful energy demand in:
 - Households
 - Hotels
- Description of forecast model
- Assumptions for the energy demand forecasts
 - Macroeconomic and fuel price assumptions
 - Scenarios considered
- Results
- Recommendations to national authorities

National Energy Balances for Cyprus

Data	Provider	Source
Total sales and stock changes of petroleum products for 2012 & 2013	Cystat	Online data available on website
Electricity consumption by sector and sub-sector in 2012	Cystat	Publication 'Industrial Statistics 2012'
Fuel consumption by industrial sub-sector (2-digit sectors according to classification NACE rev. 2)	Cystat	Survey on environmental expenditures in industry 2012 - Processed data provided to CUT
Imports and sales of biofuels	MECIT	Provisional energy balance of MECIT provided to CUT
Final energy demand for biomass, solar thermal and geothermal energy in non-industrial sectors	MECIT	Provisional energy balance of MECIT provided to CUT
Fuel consumption of cement plant for production purposes and for power generation	DLI	Data from annual pollutant emission report of cement plant submitted to DLI and provided by DLI to CUT
Electricity consumption by main sector in 2013	EAC	Data provided directly to CUT
Fuel consumption of thermal power plants	EAC	Data provided directly to CUT
Power generation from thermal plants and from renewable sources connected to the electricity grid	CERA/TSO	Data provided directly to CUT
Autonomous power generation from renewable sources	MECIT	Data provided directly to CUT
Other power generation data (auto-consumption of thermal power plants, independent electricity generation and auto-consumption of cement plant, transmission and distribution losses)	CERA/TSO	Data provided directly to CUT

Cystat – Cyprus Statistical Service

MECIT – Ministry of Energy, Commerce, Industry and Tourism

DLI – Department of Labour Inspection of the Ministry of Labour and Social Insurance;

EAC – Electricity Authority of Cyprus

CERA – Cyprus Energy Regulatory Authority

TSO – Cyprus Transmission System Operator

Final and useful energy use in households

- *Final* energy data from a 2009 survey of Cystat transformed to *useful* energy through assumed efficiency figures
- Turnover of equipment + assumptions for future efficiency leads to future *useful* + *final* fuel shares → input to the forecast model

FINAL ENERGY CONSUMPTION IN HOUSEHOLDS, 2009



ANNUAL ENERGY CONSUMPTION BY END USE CATEGORY

Energy product	Unit	Space heating	Water heating	Space cooling	Cooking	Electric appliances & lighting	TOTAL
Electricity	KWh	642	382	1.107	554	3.603	6.288
Heating oil	litres	331	24	-	-	-	355
Kerosene	litres	42	2	-	-	-	44
LPG	kg	50	8	-	67	-	125
Biomass	kg	231	2	-	11	-	244
Coal	kg	-	-	-	48	-	48
Electricity	kgoe	55	33	95	48	310	541
Heating oil	kgoe	284	20	-	-	-	304
Kerosene	kgoe	35	2	-	-	-	37
LPG	kgoe	55	9	-	74	-	138
Biomass	kgoe	83	1	-	4	-	88
Coal	kgoe	-	-	-	34	-	34
ΣΕΡ	kgoe	512	65	95	160	310	1.142

Final and useful energy use in hotels

Final + useful energy consumption by fuel & end use (space & water heating, space cooling, lighting, appliances) based on:

- experience of CUT staff from energy audits and analyses of residential and industrial buildings in Greece and Cyprus
- personal communication with engineers who are in charge of the operation of energy systems in large buildings
- MSc thesis of Mr. Marios Kerimis on hot water use in 4 & 5 star hotels of Cyprus (best graduate thesis award in Cyprus for 2014)

Results probably underestimate actual energy use in hotels, hence:

- Gaps in data were identified
- Recommendations for more surveys regarding electricity use, cooking equipment, and expanding the sample to other accommodation buildings such as hotel apartments and houses

Final Energy Demand Model Outline

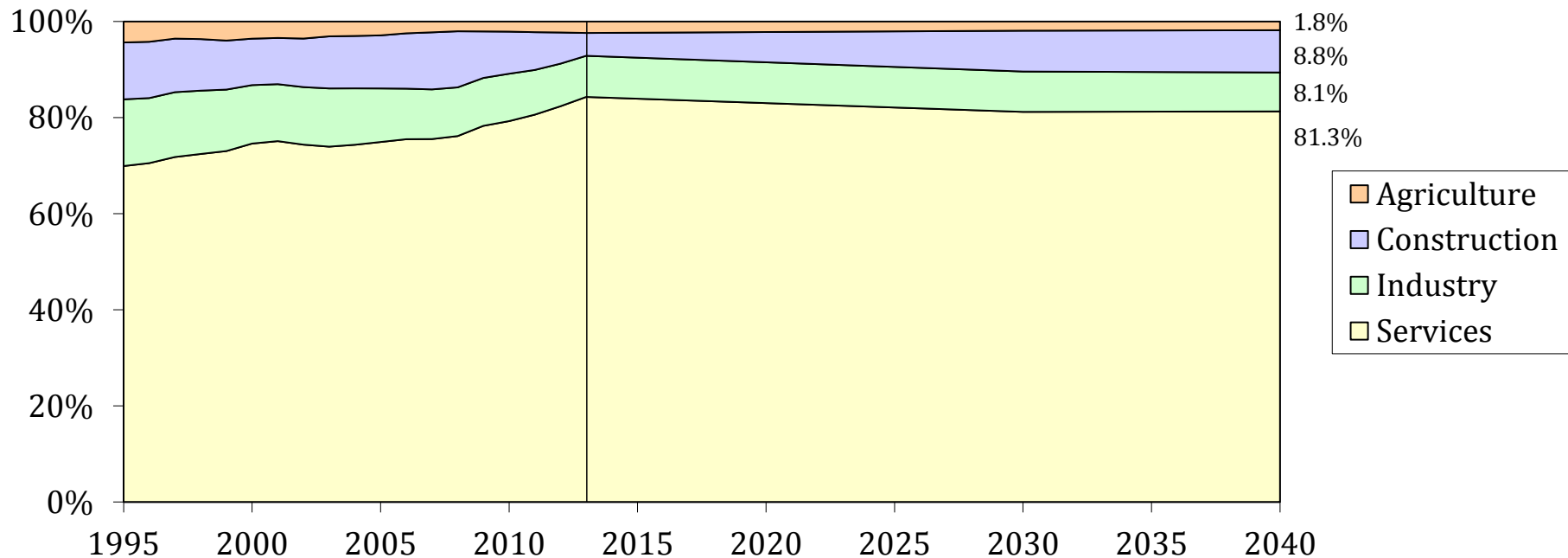
Sectors:

- Industry (split to Cement industry & Other industry)
- Households
- Tertiary sector
- Agriculture
- Road passenger transport
- Road freight transport
- Air transport

Fuels: Gasoline, automotive diesel, LPG, gas/diesel oil, light fuel oil, heavy fuel oil, aviation fuel, electricity, coal, renewables (solar thermal, geothermal, hydrogen, biofuels, biomass)

Assumptions for Energy Demand Model - 1

- Macroeconomic data:
 - Past data from National Statistical Service (Cystat)
 - Future assumptions from European Commission's macro forecasts, IMF outlook and Ministry of Finance (as of May 2014)
 - Sectoral GDP shares:



Assumptions for Energy Demand Model - 2

- Fuel prices:
 - Data up to 2012/2013 from National Statistical Service (Cystat)
 - Future assumptions based on IEA medium forecast ('New Policies Scenario') from World Energy Outlook 2013 (Nov. 2013):
 - Crude oil price expected to reach \$113 per barrel in 2020 (at 2012 prices) and \$128 in 2035 (extrapolated to \$135 in 2040)
 - Future national fuel prices to evolve in line with crude oil price forecast – no 'policy shocks' in fuel taxation assumed
- Exogenous energy efficiency improvements in future assumed so as:
 - To attain energy savings calculated in a bottom-up way from MECIT in the frame of the 3rd NEEAP of April 2014; and
 - To be in line with obligations of Republic of Cyprus stemming from EU legislation (e.g. Directive on energy performance of buildings 2010/31/EC, Energy Efficiency Directive 2012/27/EU)

Assumptions for Energy Demand Model - 3

- Costs of technologies:
 - Estimated with the aid of national data from Cyprus Institute of Energy and consultation with local experts
 - Data refer to representative technologies per sector
 - Future evolution of costs based on 'reasonable' assumptions
- Model is flexible enough to easily accommodate updated energy data for the base year & changes in base year

Energy Demand Scenarios - 1

1. Reference scenario

- No additional measures – at EU and national level – are implemented after 2010
- Used as a benchmark because it was required by EU Directives for preparation of National Renewables Action Plan & National Energy Efficiency Action Plan (NEEAP)
- High-end energy forecast, not realistic anymore

2. Energy efficiency scenario

- Assumes energy savings calculated in a bottom-up way from MECIT in the frame of the 3rd NEEAP of April 2014
- In line with obligations stemming from EU legislation (Directives 2010/31/EC & 2012/27/EU)
- Reproduces the latest official electricity forecast for the period 2014-2023 (TSO forecast approved in June 2014)

Energy savings between scenarios 1 & 2 are identical with those of the Cyprus 3rd NEEAP of April 2014



Energy Demand Scenarios - 2

3. Decoupling scenario

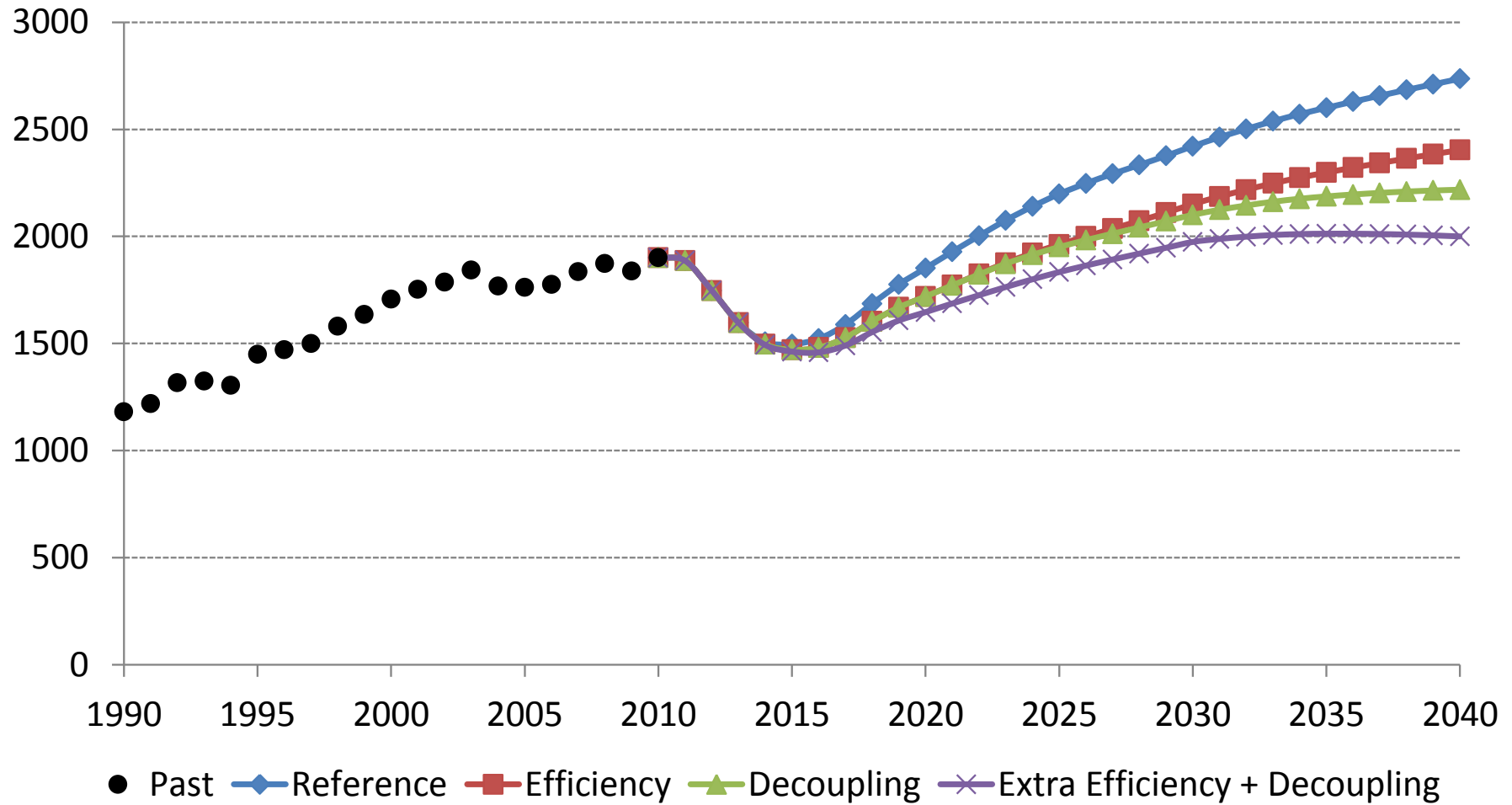
- Same efficiency improvements with 'efficiency scenario'
- Assumes additionally that decoupling of energy use from economic activity takes place post-2020

4. Extra efficiency + decoupling scenario

- Assumes decoupling as the previous scenario, plus more aggressive adoption of energy efficiency improvements e.g.:
 - near-zero energy building regulations
 - strong regional and local energy saving initiatives from municipalities
 - measures to exceed full compliance with the Energy Efficiency Directive 2012/27/EU
- Consistent with EU's 2030 energy & climate targets, serves as a low-end projection of energy needs in Cyprus up to 2040

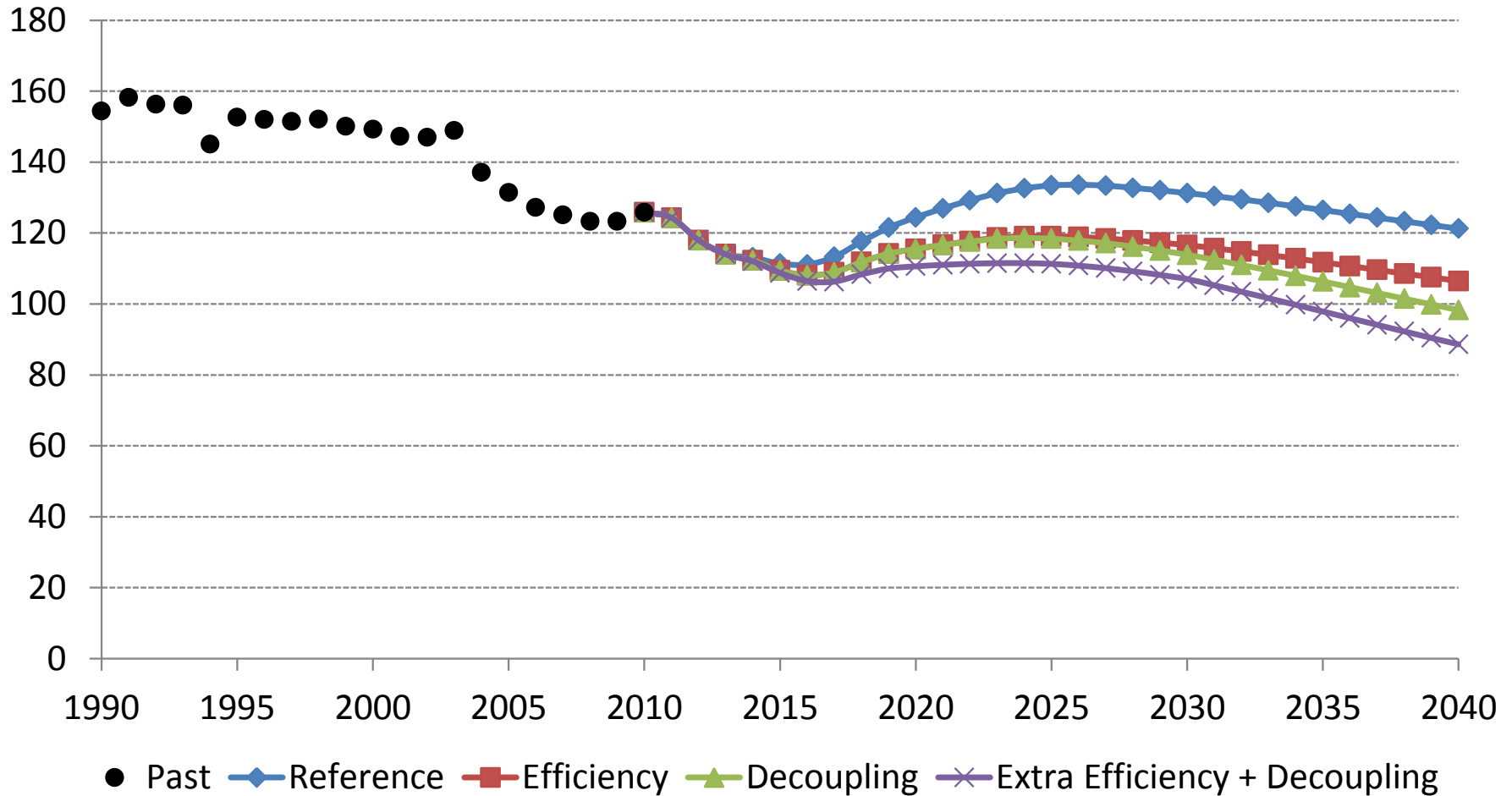
Forecast Results - 1

Final Energy Demand in Cyprus (ktoe)



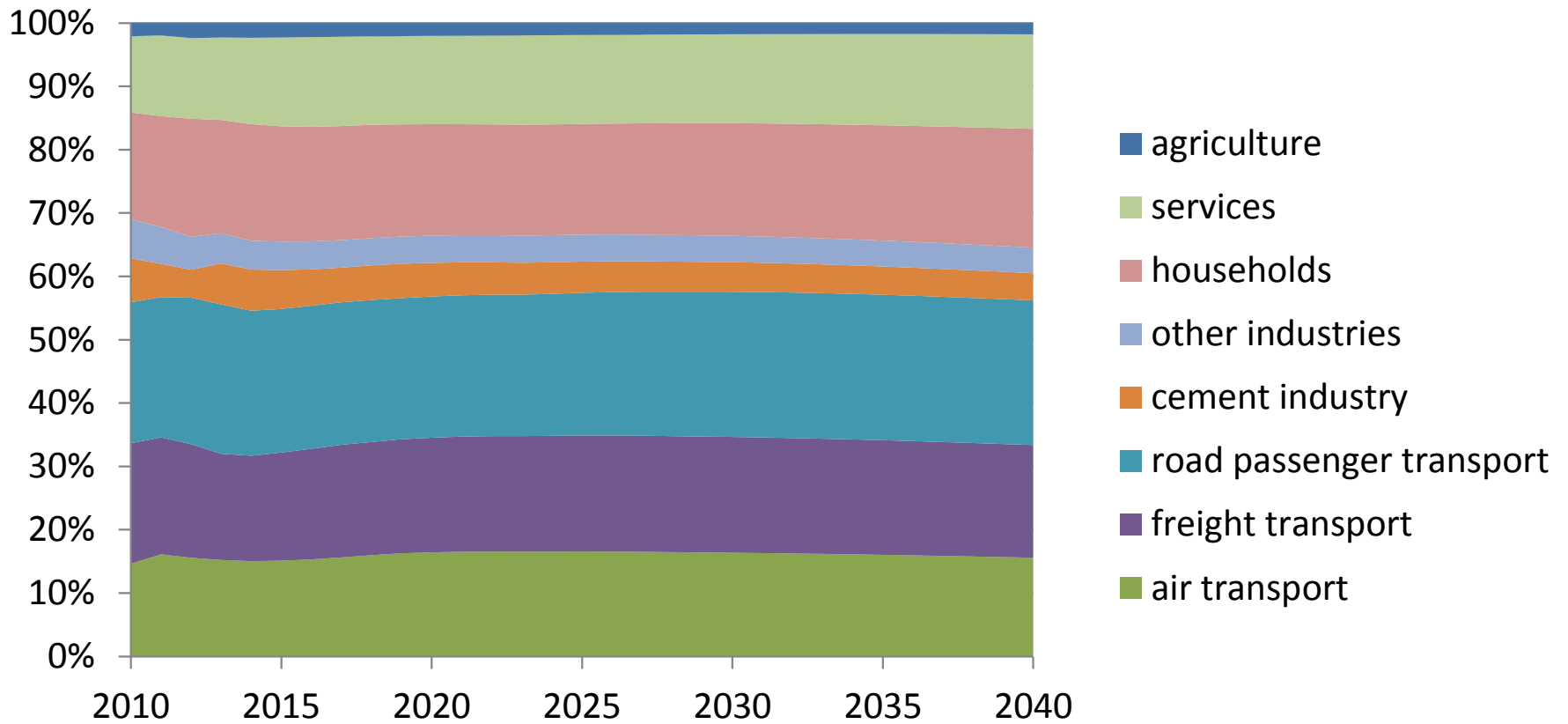
Forecast Results - 2

Final Energy Intensity in Cyprus (toe/MEuro'2005)



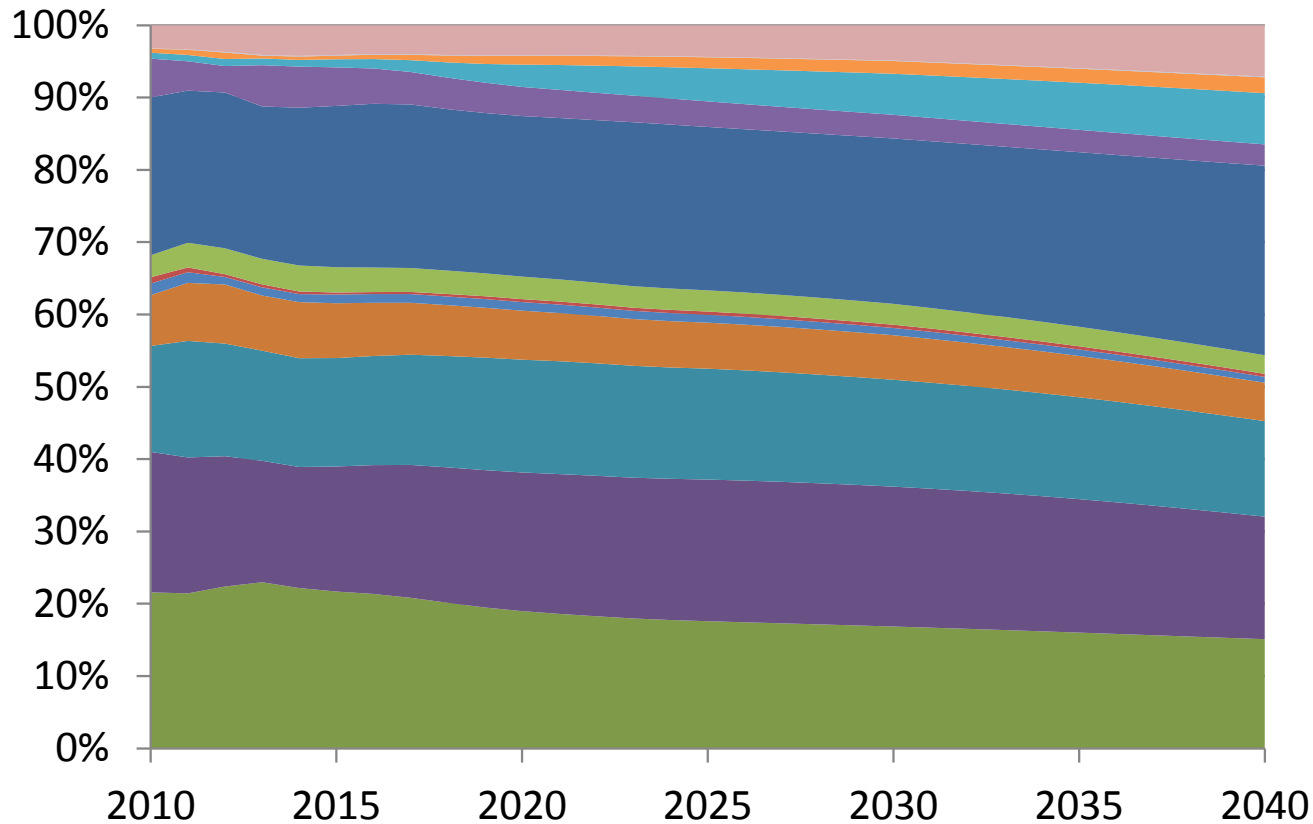
Forecast Results - 3

Energy Efficiency Scenario Final Energy Demand in Cyprus by Economic Sector



Forecast Results - 4

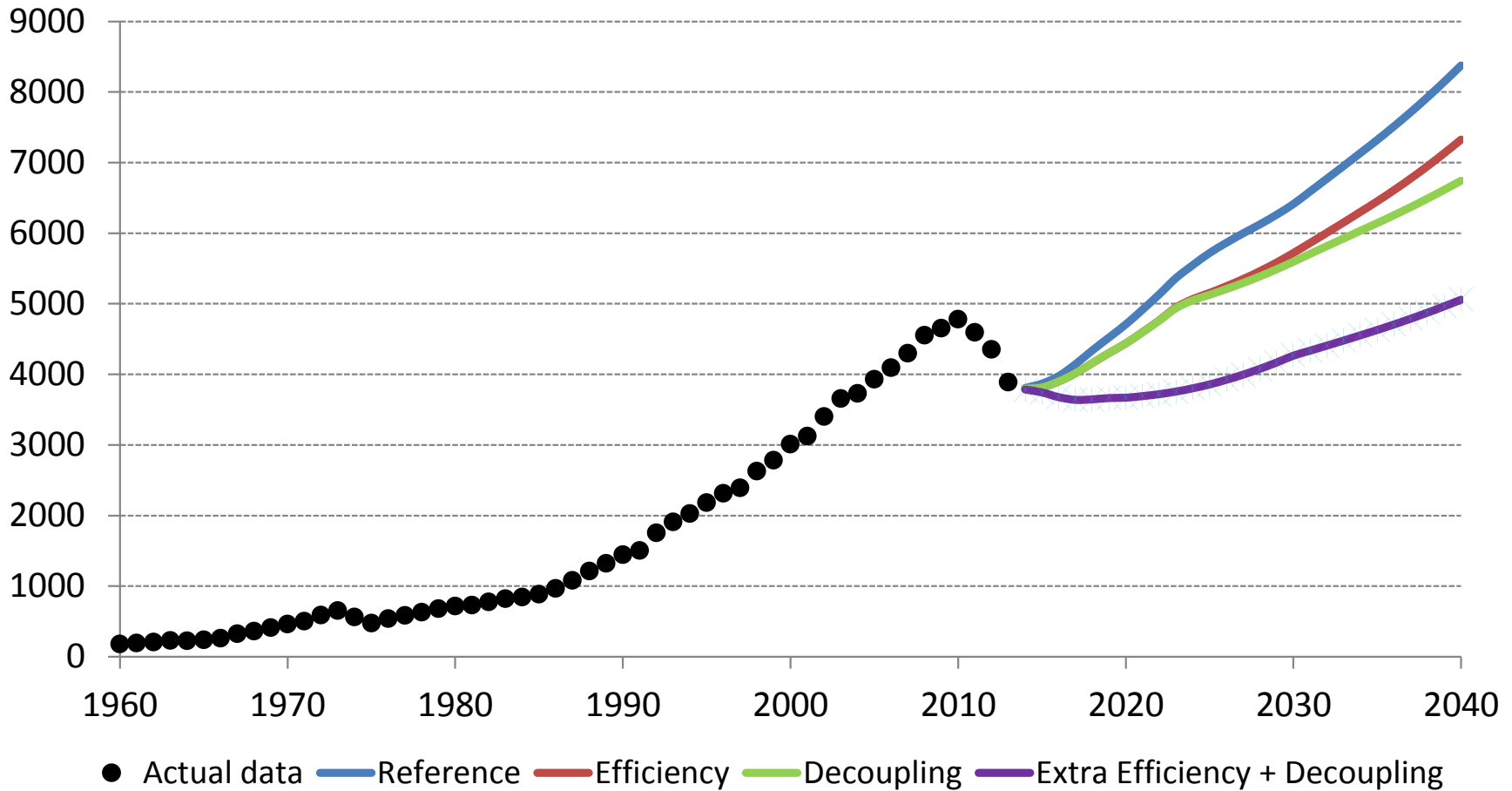
Energy Efficiency Scenario Final Energy Demand in Cyprus by Fuel



- Hydrogen
- Solar Thermal
- Geothermal
- Biomass
- Biofuels
- Other solid fuels
- Electricity
- Liquefied Petroleum Gas
- Heavy Fuel Oil
- Light Fuel Oil
- Gas oil
- Aviation Fuel
- Diesel
- Gasoline

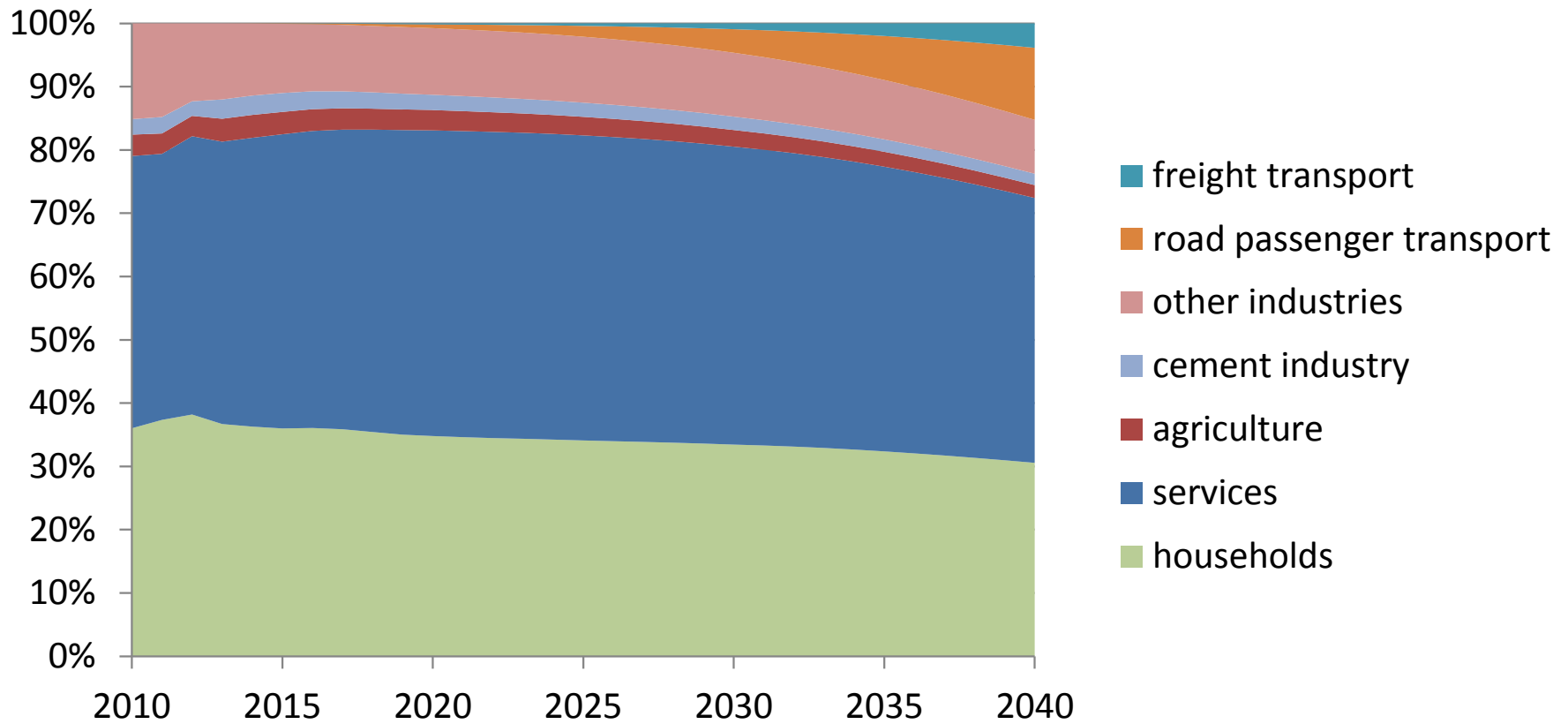
Forecast Results - 5

Final Electricity Demand in Cyprus (million kWh)



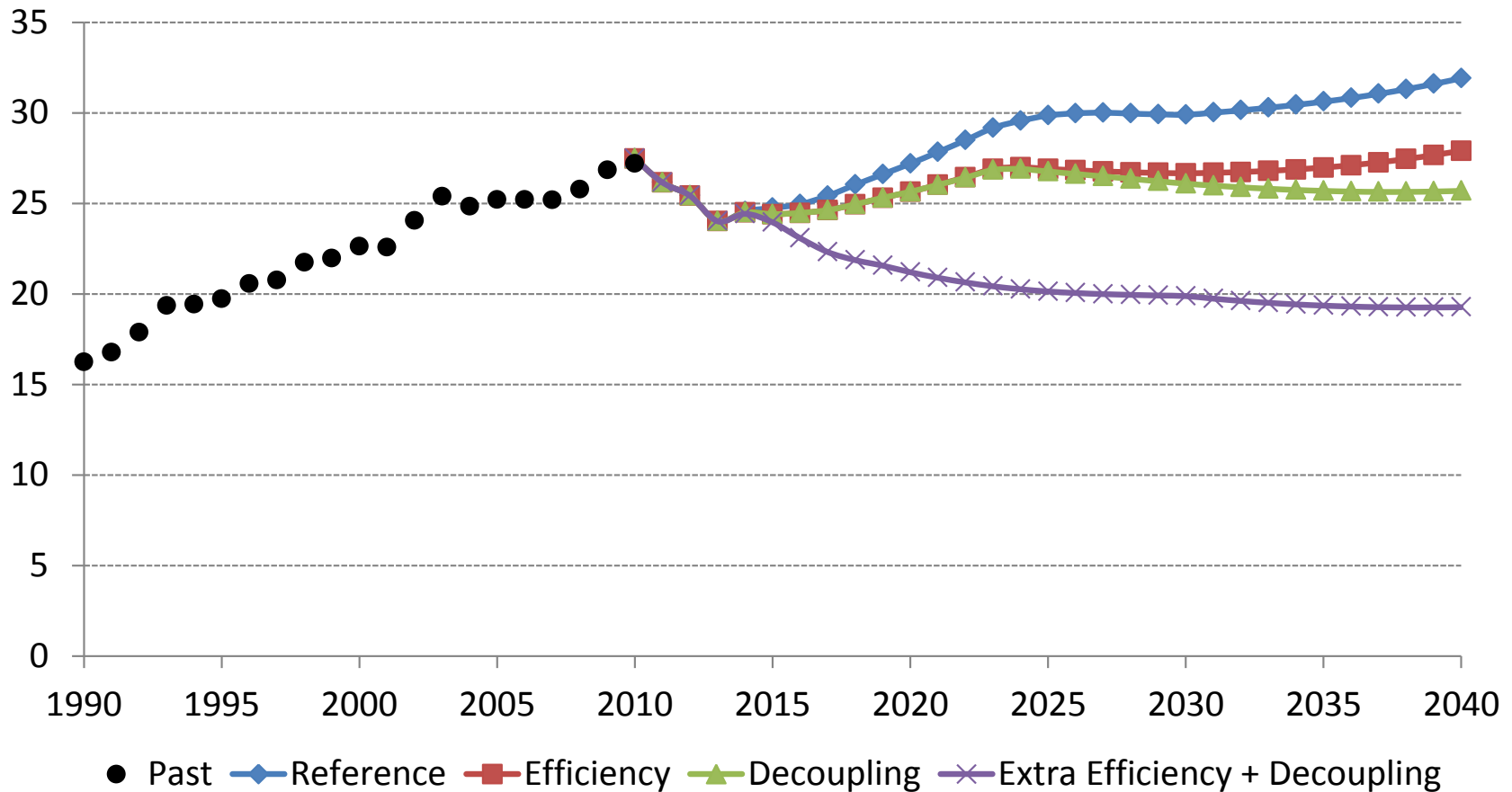
Forecast Results - 6

Energy Efficiency Scenario
Final Electricity Demand in Cyprus by Economic Sector



Forecast Results - 7

Final Electricity Intensity in Cyprus (toe/MEuro'2005)



Forecast Results - 8

Projected savings in final energy consumption between 'energy efficiency' and 'extra efficiency + decoupling' scenarios

	2020		2030		2040	
	(ktoe)	(%)	(ktoe)	(%)	(ktoe)	(%)
Total savings across sectors and fuels	73	4.3%	177	8.2%	404	16.8%
<i>of which in:</i>						
air transport	0	0.0%	8	2.4%	44	11.8%
freight transport	0	0.0%	9	2.4%	50	11.8%
road passenger transport	0	0.0%	16	3.2%	73	13.4%
cement industry	1	1.2%	0	0.3%	2	1.5%
other industries	7	9.3%	13	14.1%	19	19.2%
Households	26	8.7%	58	15.1%	105	23.2%
services	37	15.5%	69	22.9%	106	29.5%
Agriculture	2	5.0%	3	7.4%	5	11.3%
Savings in final electricity	66	17.3%	125	25.4%	195	31.0%

Recommendations

1. Strengthen collaboration between authorities to produce detailed, commonly accepted and publicly available energy balances
2. Conduct energy use surveys at regular intervals especially for heterogeneous sectors such as households and tourism
3. Make a modest commitment of financial and human resources in order to maintain an energy modelling platform that can:
 - Forecast energy production & consumption under different economic, technology & policy scenarios
 - Determine least-cost energy & emission reduction paths
 - Assess economic impact of energy and environmental policies on firms and households