WorleyParsons
resources & energy

ESMAP
Energy Sector Management Assistance Program

acclimatise
managing your climate risks

Climate Change Vulnerability and Adaptation Assessment

Workshop 2: Adaptation to meet the demands of the future

Tirana, April 21 2009

WorleyParsons

resources & energy

Agenda for the Day

Time	Item	Who
8.30 – 9.00	Registration, coffee and refreshments	
9.00 – 9.05	Welcome	Jane Ebinger, World Bank
9.05 – 9.20	Introduction, workshop objectives and planning	Stuart Arch, Worley Parsons
9.20 – 9.40	Overview of the EcoNomics Analysis Process	Stuart Arch, Worley Parsons
9.40 – 10.40	Agreeing the "Objective of the EcoNomics Assessment"	All participants
10.40 – 11.00	Break	
11.00 – 11.30	Agreeing the boundaries/ limits and constraints of the assessment	All participants
11.30 – 12.30	Identifying options/ solutions to meet the assessment objective	All participants
12.30– 13.30	Lunch	
13.30 – 14.30	Identifying options/ solutions to meet the assessment objective… continued	All participants
14.30 – 15.30	Identifying risks and opportunities associated with each option	All participants
15.30 – 15.45	Break	
15.45 – 16.45	Identifying data gaps and ways to fill them	All participants
16.45 – 17.00	Summarize actions and timetable	Stuart Arch, Worley Parsons

ESMAP Energy Sector Management Assistance Program

acclimatise managing your climate risks

EcoNomics™

WorleyParsons

resources & energy

How best to manage Albania's future energy security in the face of a changing climate?

ESMAP Energy Sector Management Assistance Program

acclimatise managing your climate risks

EcoNomics™

Workshop Objectives

1. Refresh our minds about:
   - The key issues affecting the Albanian Energy Sector
   - The projections for climate change in the Albania

2. Highlight the conclusions identified at Workshop 1

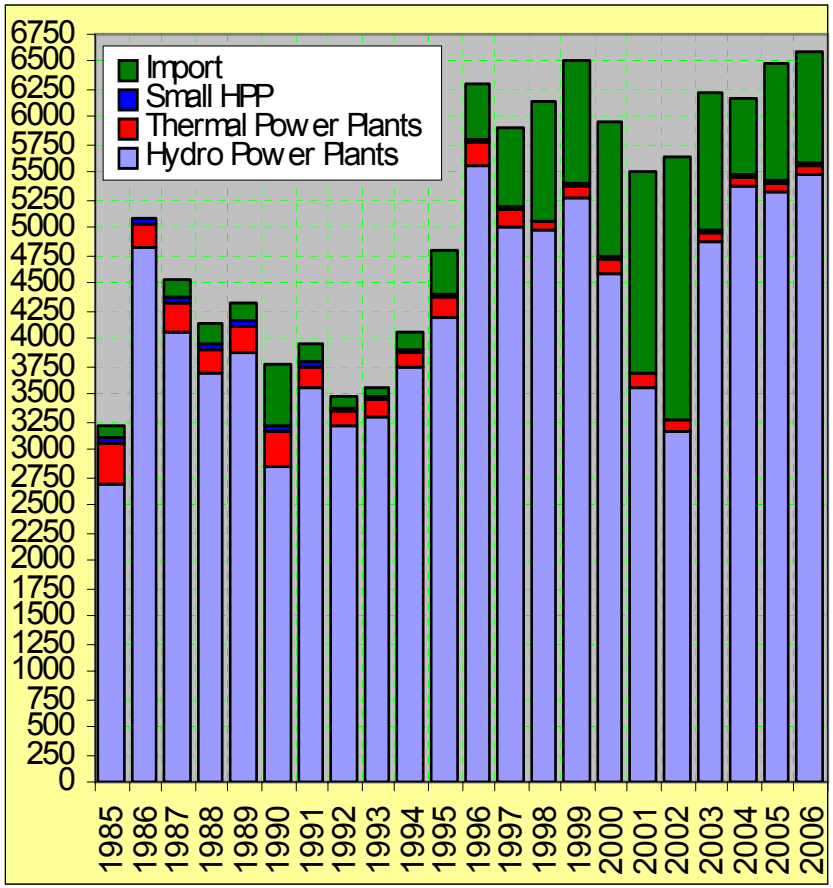
3. Introduce a process for risk and opportunity assessment to support policy makers

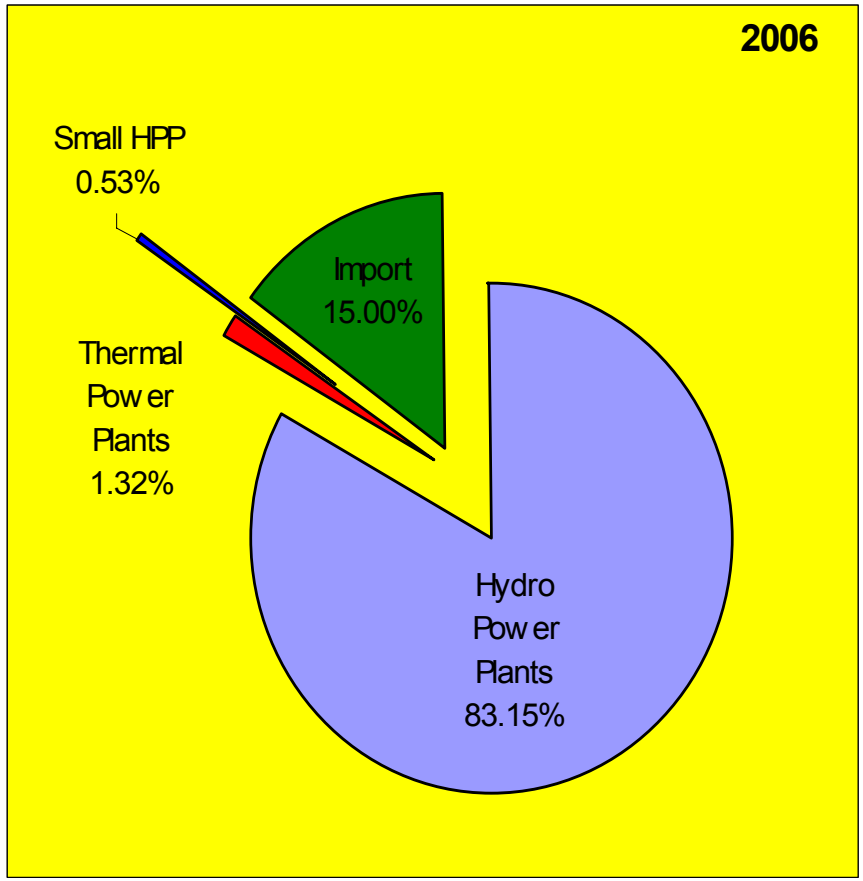
4. Identify adaptation options and confirm key aspects to enable options to be analysed after the workshop

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Background Information

Albanian Power System (GWh)



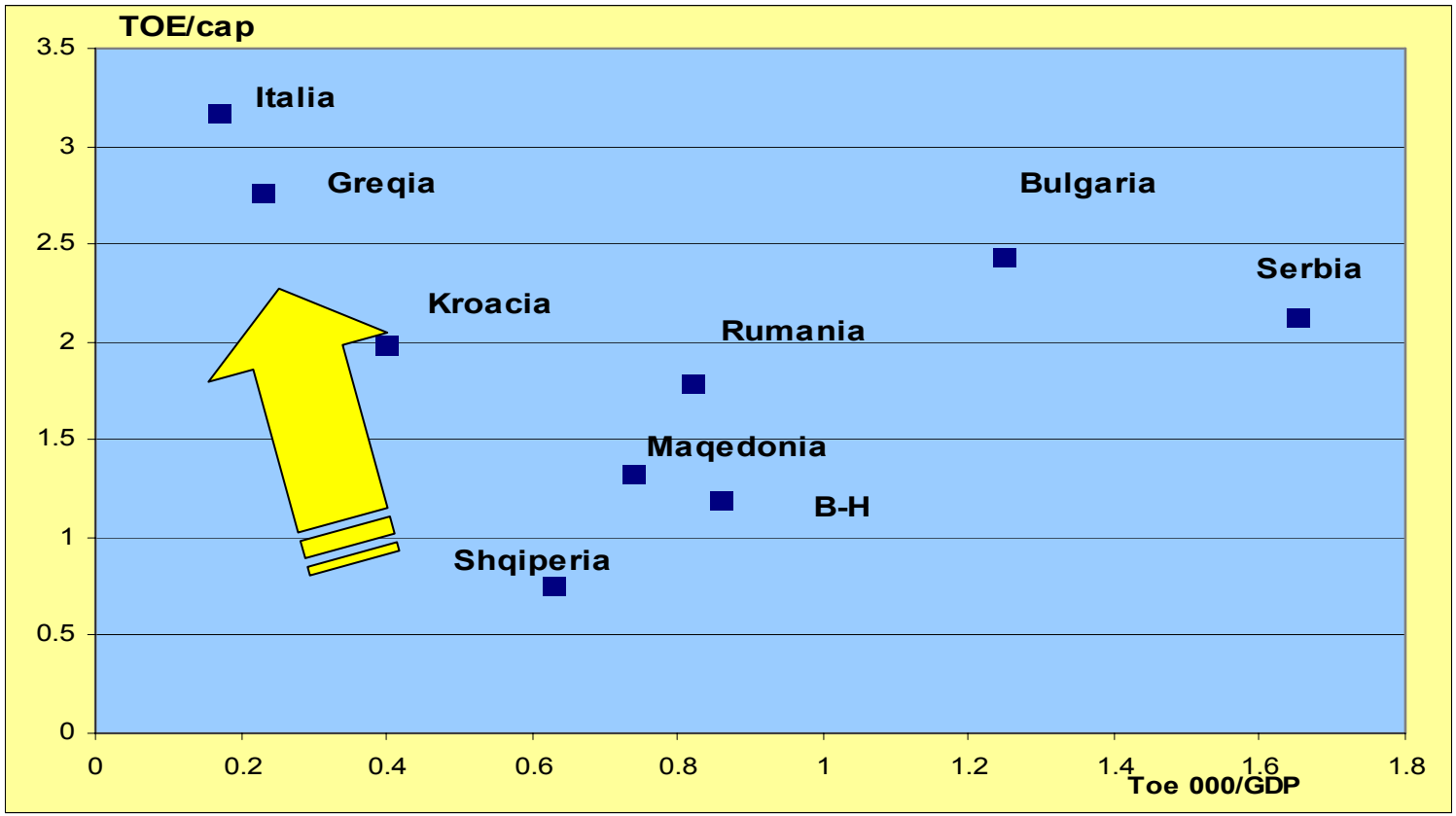


(Source: Besim Islami, presentation at Workshop 1, 2009)

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Draft National Energy Strategy 2007

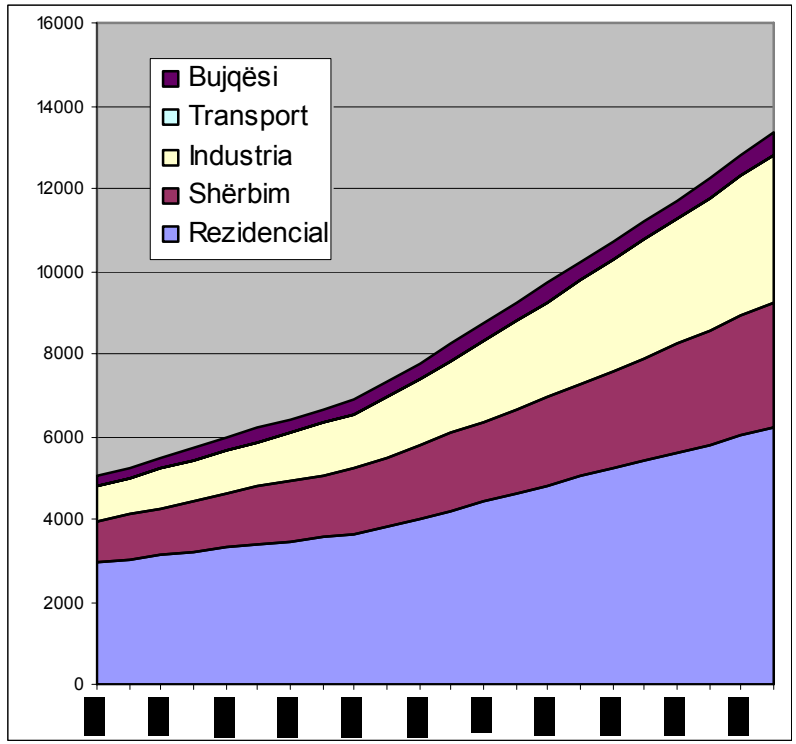
Albanian energy consumption and efficiency



ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Draft National Energy Strategy 2007

- **"As it is indicated in the Graph, the main consumer shall be the sector of population (households)…"**
- **"…although investments have been made…....there are still no visible results in reducing the losses..."**
- **"…high demands determined in this scenario require almost doubling the supplies for a period of 13 years and it has an extremely high cost…"**

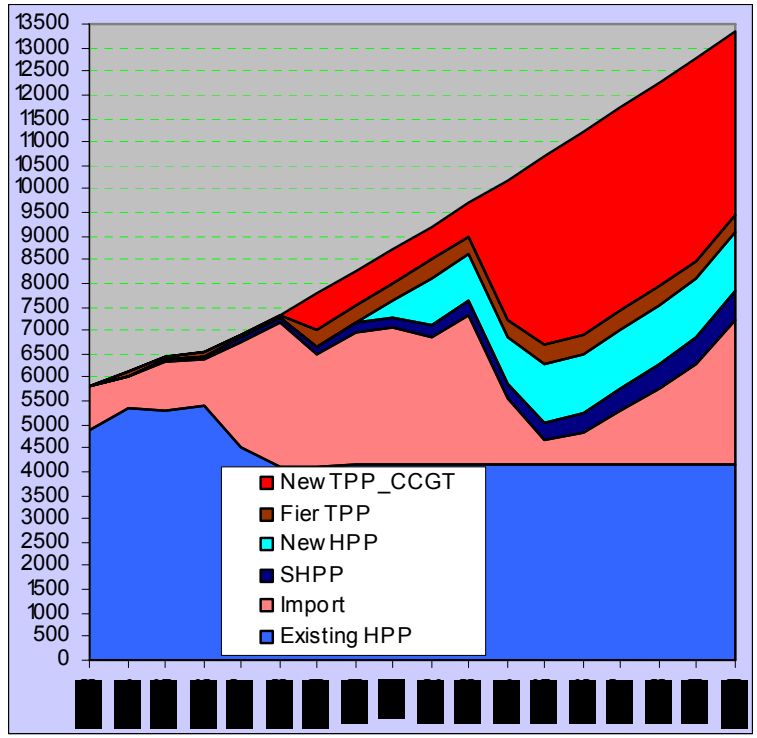


Forecast of electrical power needs for all sectors (GWh)

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Draft National Energy Strategy 2007

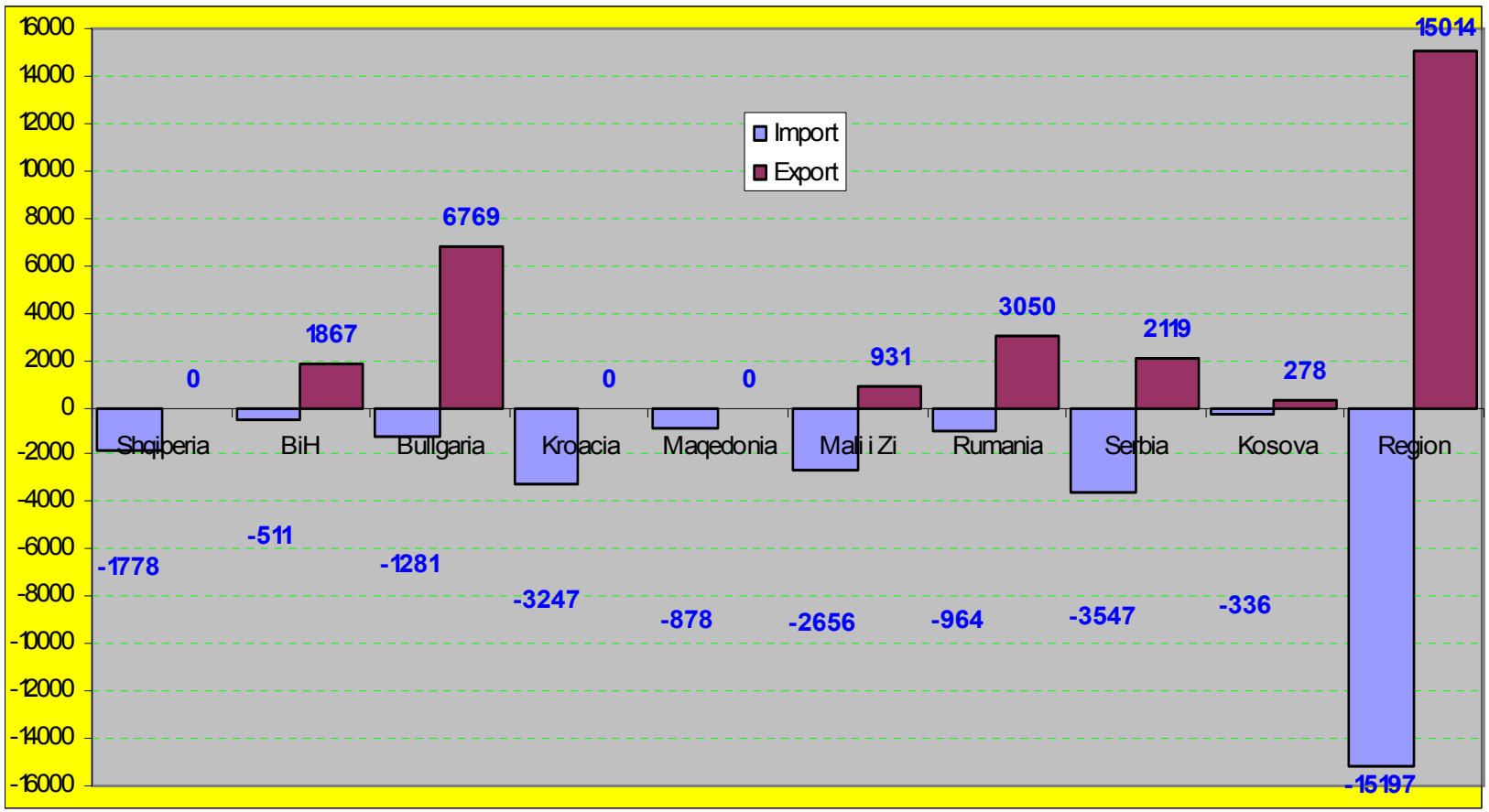
- **"…needs for the future will require the installation of a new installed capacity for 1089 MW."**
  - **642 MW from CCGT TECs,**
  - **437 MW from new HECs**
- **The increased fuel import:**
  - **"shall make that self-sufficiency with oil specifically and energy resources in general, fall considerably"**
  - **"shall have a negative impact in increasing the commercial deficit of the country"**



Forecast of supply with electrical power from TECs and import (*GWh*)

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Import & Export of Electricity in the Region



ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Draft National Energy Strategy 2007

- Recommendations for the implementation of the National Energy Strategy 2007-2020

1. **Primary Aim**: Increase security of electricity supply and efficiency of use of energy resources

2. **Secondary Aim**: Reduce the Import of Oil by-products and increase the security of supply

3. **Tertiary Aim**: Inciting the penetration of renewable energy wherever economical

Workshop 1, March 2009

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

- The objective of the March workshop was to build greater understanding of potential climate risks

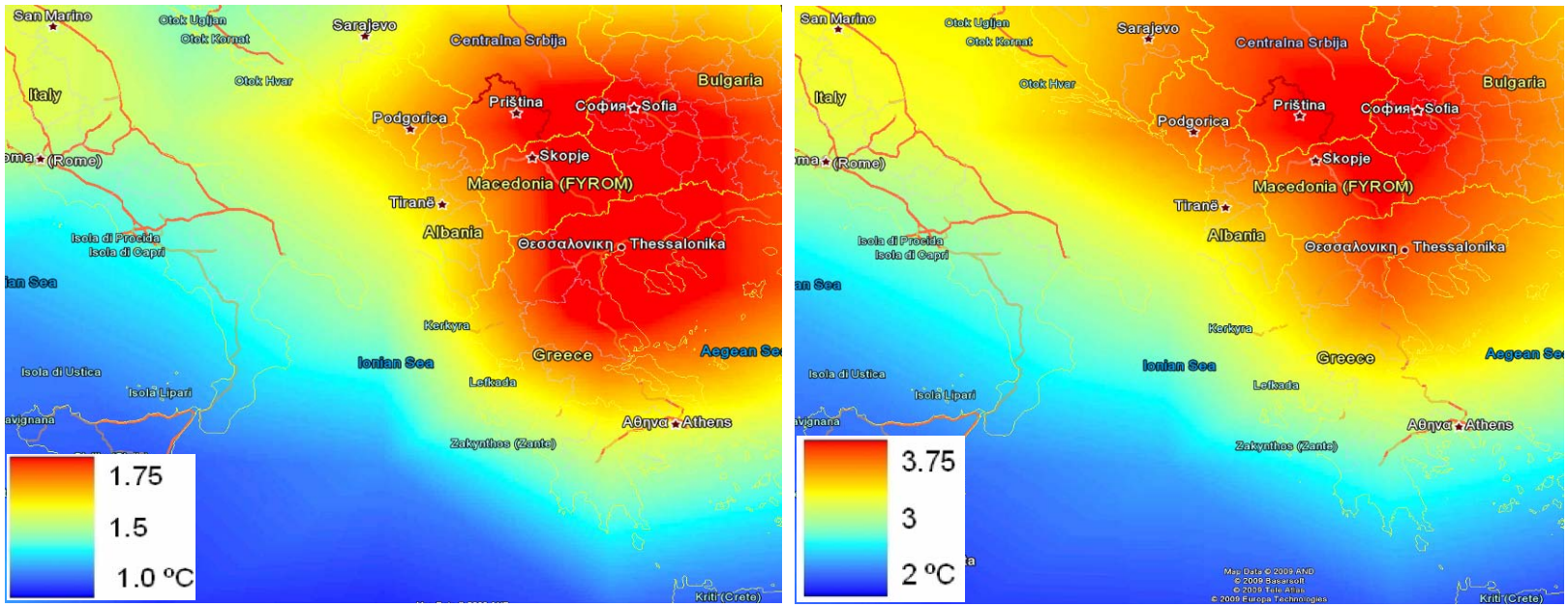
- Plenary sessions and four breakout group discussions looking at vulnerability to climate risks:
  - Hydropower plants and energy demand,
  - Other forms of energy generation: thermal power plants and renewable energy,
  - Electricity transmission and distribution and small hydropower plants,
  - Fossil fuel supply and transmission / transportation.

- Each of these working groups focused their discussions around three key areas:
  - Overall strategies and objectives for Albania's energy sector,
  - Climatic vulnerabilities of existing and planned energy sector assets,
  - Climate change risks.

Increasing temperatures in Albania

WorleyParsons
resources & energy

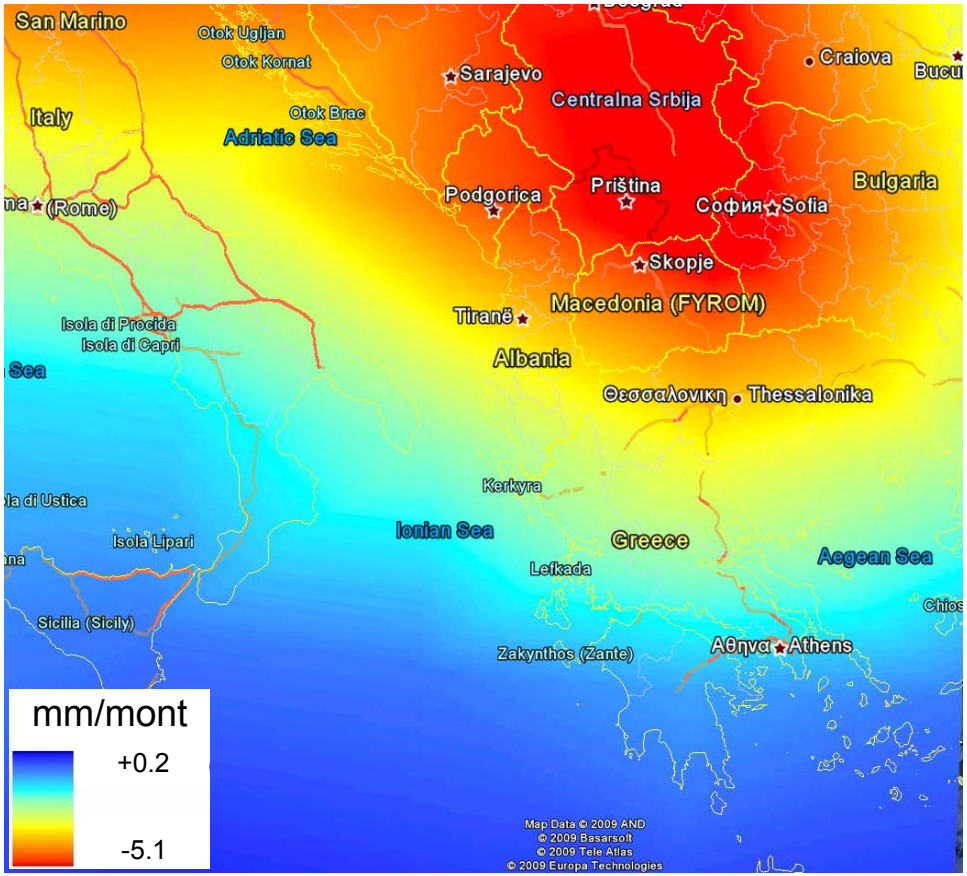
- Increase in annual temperatures: 1°C, 2°C and 4°C by 2025, 2050 and 2100
- Larger increases in summer
- Global temperature difference between last Ice Age and today was only 5°C



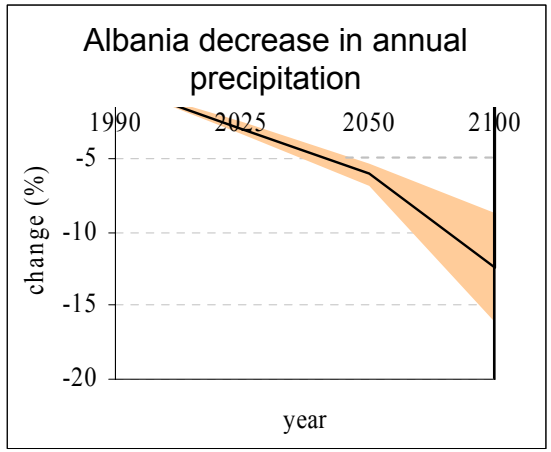
Increase in summer temperature (°C): 2020s (left) 2050s (right)

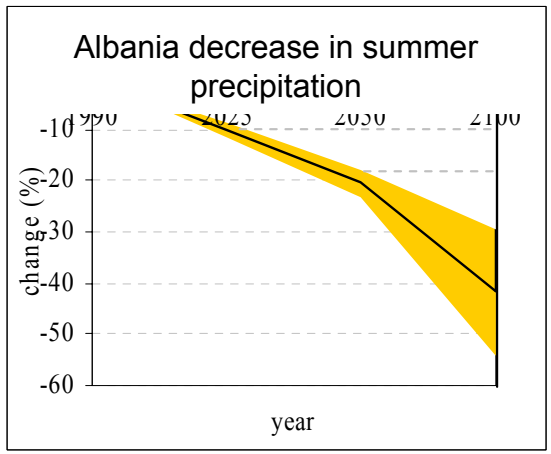
ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Changing precipitation in Albania



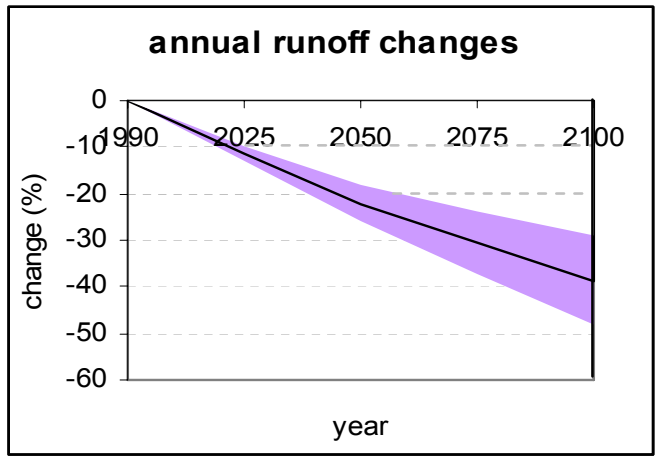
Decrease in 2020s summer precipitation

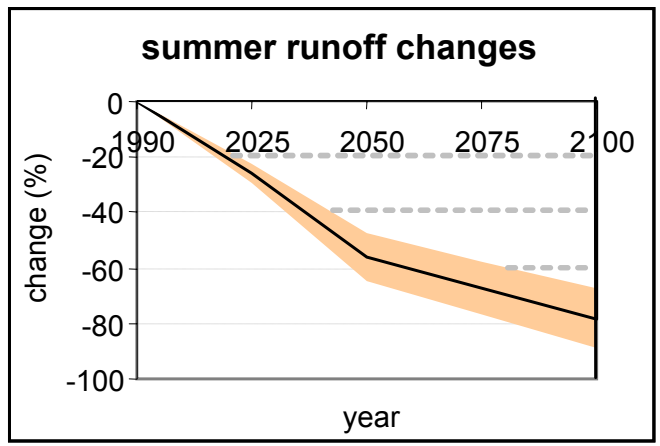




Impacts on water resources

- Lower river flows and groundwater
- Need to manage impacts for drinking water, irrigation of agriculture, operation of hydropower plants





ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Outcomes of the March Workshop

Strengths	Weaknesses
National Energy Strategy recognises the issues	Existing energy supply-demand imbalance
Albania has plentiful water resources	High dependence on climatically-sensitive hydropower production
Feed-in tariffs help to diversify the energy portfolio	Existing older energy assets
Some assessments of climate change risks to hydropower production have been undertaken	Existing climate risks and extreme events are not generally well understood, managed or planned for
Electricity transmission grid has been improved	Mis-management / loss of water resources
Future investment in Distribution Grid	Distribution grid serving rural and mountain communities; grid losses are high
Generally the oil production facilities are not very vulnerable to climatic risks	Lack of national wind resource mapping at turbine height (about 80m)
	Quality and availability of hydro-met data
	Coastal erosion in vicinity of assets
	Significant legacy of contaminated land around oil and coal mine facilities

Outcomes of the March Workshop

Opportunities	Threats
Climate change models are generally in agreement over Albania that future summers will be drier and temperatures will increase throughout the year	Higher financial losses, increased OPEX and CAPEX if climate risks are unmanaged – could lead to reduced shareholder value
Climate change resilience can be built in at lower cost when rehabilitating existing assets and developing new assets	Concerns about unmanaged climate risks could mean that Albania is less attractive to foreign investors
Tariffs and incentives can be developed to promote climate resilience of energy sector	Higher peak demand in summer
Consideration of climate change can be built into long-term energy sector contracts	Less electricity generation from hydropower facilities due to reduced precipitation and increased siltation
There is considerable scope for additional hydropower generation	Higher costs for maintaining dam security
There is large potential to improve energy efficiency (supply and demand side)	Climate change could increase risk of conflicts between water users in the region
Reduction of energy demand in winter	Environmental performance of water-cooled thermal power plants reduced
Thermal power plants are less vulnerable to climate variation	Sea level rise could lead to increased coastal erosion
Higher solar radiation increases opportunities for solar water heating	Slight efficiency losses for thermal power plants
Opportunity to develop and diversify energy sources	Hydrological basins are changing due to the effects of erosion
	Potential mal-adapted infrastructure design if climate resilience is not built in

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Outcomes of the March Workshop

- Large Hydro Power Plants
- Threats
  - Paucity of hydro-met data makes it difficult to manage water
  - Reduced (15% by 2050) / more extreme precipitation will reduce power production
  - Increased sedimentation and erosion pose risks to HPP
  - Competing demands for irrigation and municipal water
  - Increased OPEX and reduced investor confidence
- Opportunities
  - Import-export offers opportunities to reduce spilling water and make profit
  - Some evidence that climate change has not yet been seen in some catchments

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Outcomes of the March Workshop

- Small Hydro Power Plants
  - Already experiencing shorter operating periods and lower electricity production due to lower river flows
  - Reduction in snow would be a significant impact
  - Not necessarily in best locations or sized for optimal power
- Thermal Power Plants
  - are not believed to be very sensitive to the predicted changes
  - Impacts of discharges to the environment may be more significant
  - will be impacted by CO2 taxes in EU and fluctuating oil market
- Other sources
  - Lack of data for wind energy
  - Opportunity for increased solar energy

Outcomes of the March Workshop

- Energy Demand
  - Reduced winter heating requirement in the future
  - Peak summer demand is now similar to peak winter demand
  - Increases in extreme events may change peak demand
  - Opportunities to reduce ‘technical’ and ‘non-technical’ losses
  - Climatic changes will impact the regional demand

Threats to Energy Security

Risk Summary

Threats

Sort

17	Higher peak demand in summer due to higher temperatures could lead to lack of capacity	Extreme
18	Losses continue to increase effective demand and reduce energy security	Extreme
19	Less electricity generation from hydropower facilities due to reduced precipitation could reduce energy security	Extreme
20	Lack of data creates uncertainty about optimal sites for generation using wind	Extreme
21	EU Carbon trading schemes add significant cost to thermal power generation	Extreme
22	Changes in seasonality of river flows creates problems for hydropower	Extreme
23	Concerns about unmanaged climate risks causes Albania to be less attractive to foreign investors	Extreme
24	Climate change increases risk of conflicts between water users.	Extreme
25	Increased CAPEX / OPEX due to climate change could lead to reduced shareholder value	Extreme
26	Higher peak demand across the region could increase import prices and reduce supply	Extreme
27	Paucity of hydro-met data makes it difficult to manage water resource and optimise operation of hydro plants	Extreme
28	Increased Sedimentation of hydropower leads to reduced output	High
29	Mal-adapted infrastructure design if climate change not built in could lead to failure of some assets	High
30	Changes in precipitation lead to higher costs for maintaining dam security and transmission losses	Moderate
31	Increased environmental impact of water-cooled thermal plants due to water abstractions and discharges	Moderate
32	Sea level rise could lead to increased coastal erosion potentially affecting port facilities	Moderate
33	Efficiency losses for thermal plants due to higher air and water temperatures and possible scarcity of cooling w	Moderate
34	Changing ground conditions could effect contamination conditions in oil production areas	Low

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Threats to Energy Security

Risk Map
Before Treatment

Likelihood				Consequence: Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
	A	Almost Certain	95%			26 27	21	17 18
	B	Likely	80%			28	22 23	19
	C	Moderate	50%		30 31 32 33	29	24 25	20
	D	Unlikely	20%		34			
	E	Rare	5%					

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Opportunities

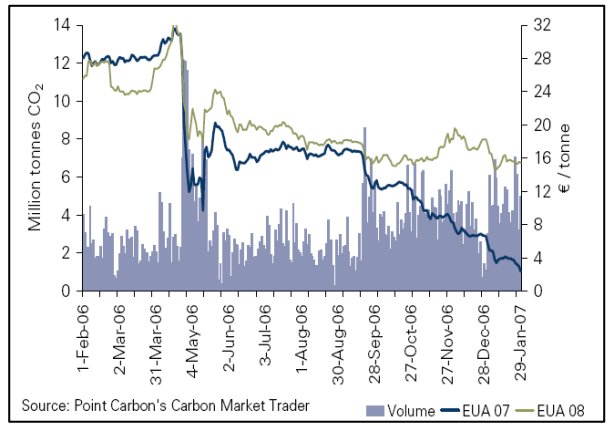
1	Thermal plants are not as climatically vulnerable as many other forms of generation, so developing these may
2	Geothermal energy is not climatically vulnerable and therefore could provide more future resilience
3	There is an opportunity to diversify the energy sources and therefore be more resilient to climate risks
4	Improved energy efficiency could reduce demand
5	Higher temperatures could reduce demand for space heating
6	Warmer winters could reduce peak demand
7	Less cloud cover increases the viability of solar water heating
8	New assests could be created which can be climate resiliant
9	Rehabilitation provides and opportunity to build in climate-resiliance
10	Diversification through renewables and thermal power plants could provide greater energy security
11	Scope to increase hydroelectric installed capacity and mitigate risks of reducing production in the face of climat
12	Climate change models are in general agreement and thus provide opportunity to plan effectively
13	Climate change risks assessments could be built into the enery sector planning and design
14	Tariffs and incentives could be developed to promote Climate resilience of energy sector
15	Consideration of climate change could be built into long-term energy sector contracts
16	Import - Export opportunities may make it possible to balance power generation and optimise efficiency / costs

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Today's Workshop

The Purpose

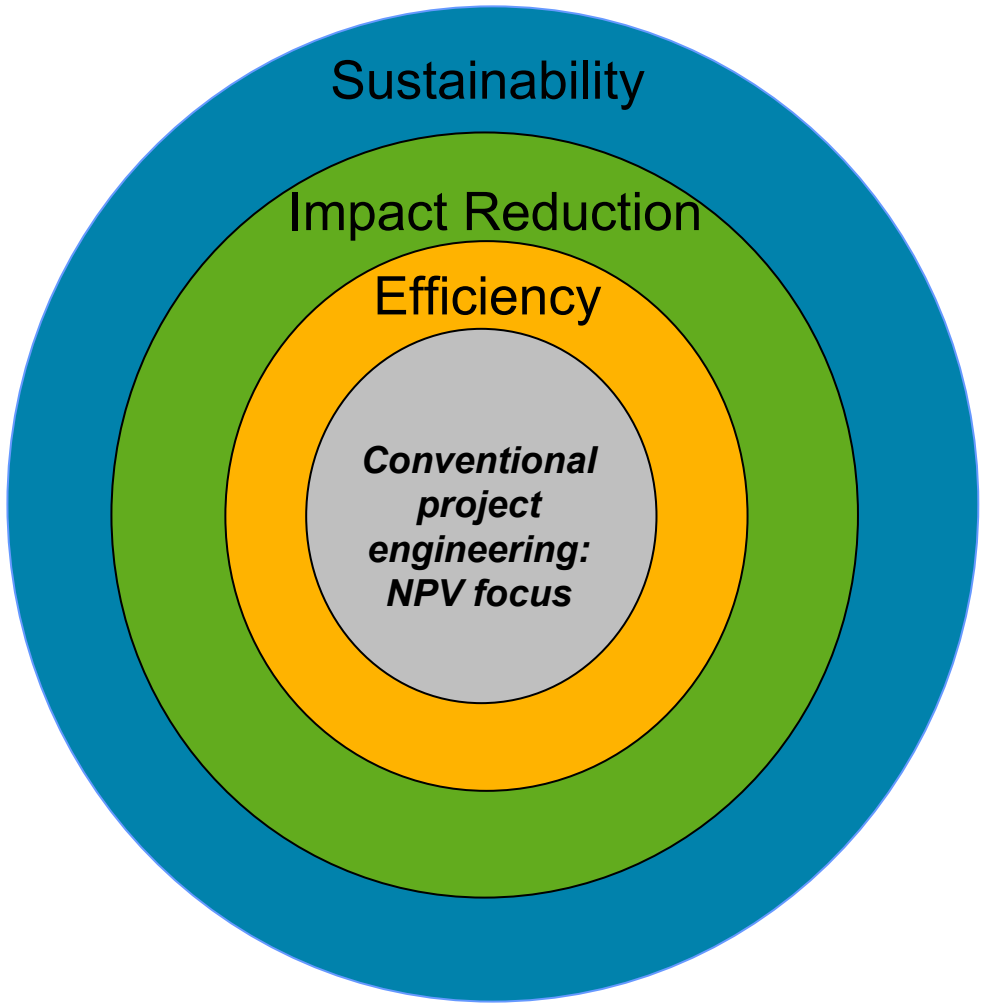
- Climate Change is a business reality
- Sustainability is an emerging business driver
- Resource costs and taxes are increasing
- Stakeholder expectations are rising
- The purpose of today is to think about business, environmental and social risk management



ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Widening the Perspective

Strategic economic analysis



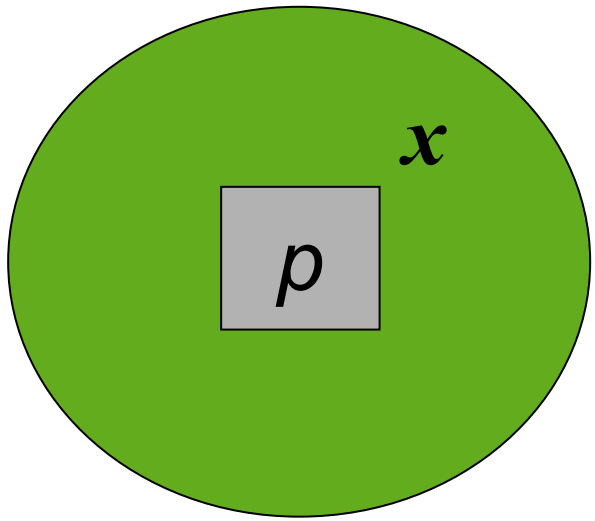
ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Using the Language of Money

$$NPV = \sum_{0}^{t} \left[\frac{(B_p + B_x) - (C_p + C_x)}{(1+i)^t} \right]$$

P = project (internal)

x = society and environment (External)



ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™

Aspects to monetize in this study

- OPEX and CAPEX
  - Industry standard information
  - Factored for Albanian market
  - Requires the workshop to identify and agree options
- Social Aspects - Value of Energy security
  - Impact of GDP
  - Public sense of wellbeing and political reputation
  - Investor Confidence
- Environmental Impact
  - Green house gas emissions
  - Water use
  - Pollution
- Impacts of Climate Change

Key elements of the Process

- Today's workshop
  - We have a wide range of stakeholders
  - Identify a clear objective (e.g., What is the best way to provide energy security in the face of climate change)
  - Identify a wide range of distinct options to meet the objective (e.g., Build new HPPs, enhance existing SHPP etc).
  - Identify the key aspects (risks and constraints) that are related to the options (e.g., water value or energy price)
  - Agree parameters (e.g., time line for the analysis and lifecycle)
- Follow-up after the workshop
  - Collate data into a risk matrix
  - Conduct a high level cost benefit analysis
  - Provide a summary of the outcomes for consideration by Albania's policy / decision makers

Template for summary of workshop

WorleyParsons resources & energy — EcoNomics Delivering profitable sustainability

EcoNomics™ Assessment — Framing Workshop

CSG:	
LOCATION:	
PROJECT #:	
PROJ TITLE:	
DESCRIPTION:	

WORKSHOP SUMMARY

DATE:		TIME:
ATTENDEES:		
ANALYSIS:	☑ WHOLE PROJECT	☐ MARGINAL
OBJECTIVE:		

OPTIONS TO BE ASSESSED:	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
EXTERNAL ASSETS TO BE VALUED:		

EVALUATION PARAMETERS	
Planning Horizon:	
Other Planning Horizons:	
Internal Rate of Return:	
Social Discount Rate:	
Other Parameters:	

ESMAP Energy Sector Management Assistance Program

acclimatise managing your climate risks

EcoNomics™

Output - Risk Mapping

Risk Map
Before Treatment

				Consequence				
				Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Likelihood	A	Almost Certain	95%					
	B	Likely	80%					
	C	Moderate	50%					
	D	Unlikely	20%					
	E	Rare	5%					

ESMAP Energy Sector Management Assistance Program
acclimatise managing your climate risks
EcoNomics™