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The Energy Sector Management Assistance Program

Climate Change in Europe and Central Asia

- *Energy Sector Vulnerability*

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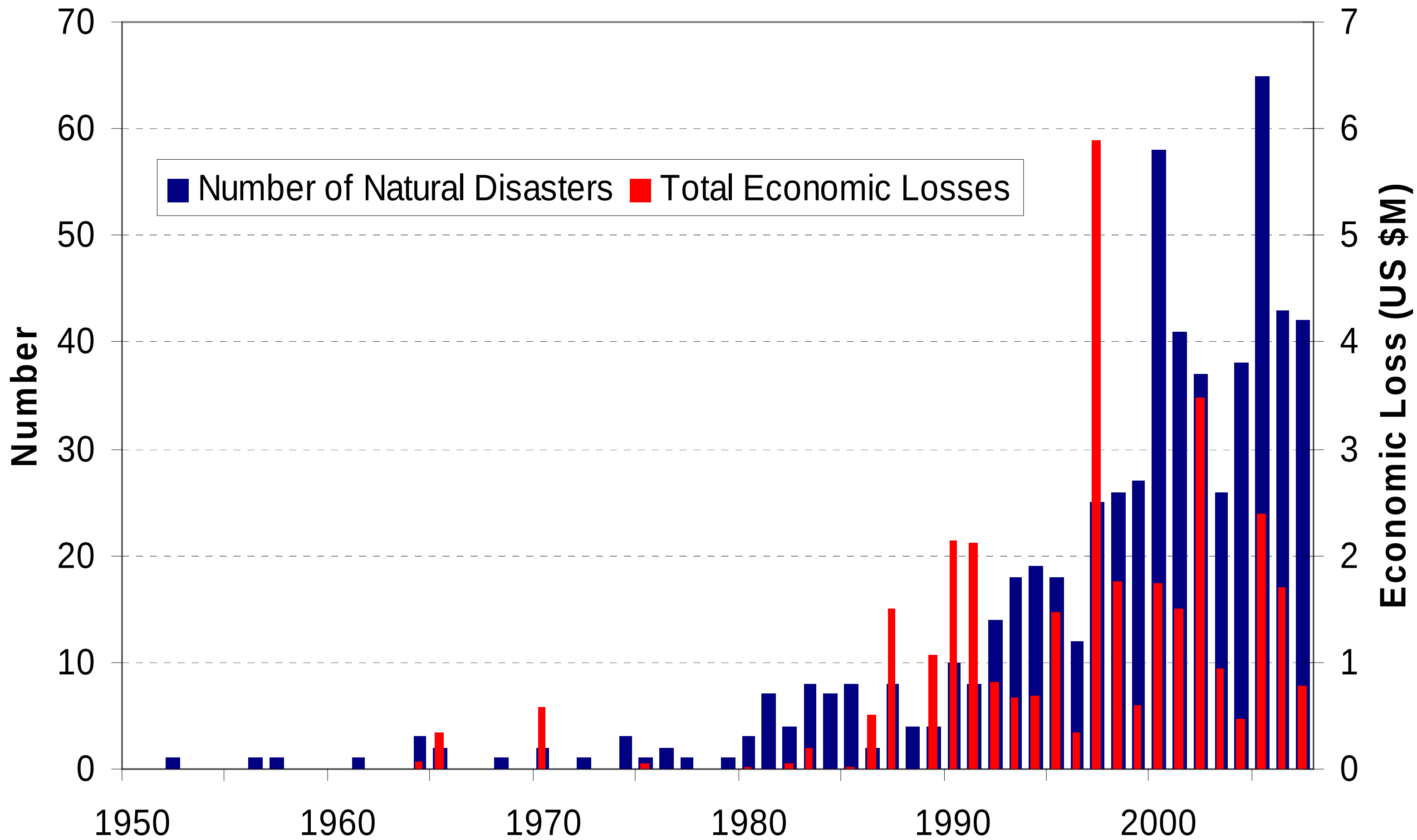
A call to action

- Europe and Central Asia (ECA) is significantly threatened by climate change
- Vulnerability is driven by socio-economic and environmental legacy issues
- Energy is one of the most weather dependent sectors of the economy
- There is a window of opportunity to make development more resilient while reaping co-benefits.

ECA is significantly threatened by climate change:
The climate is already changing – natural disasters



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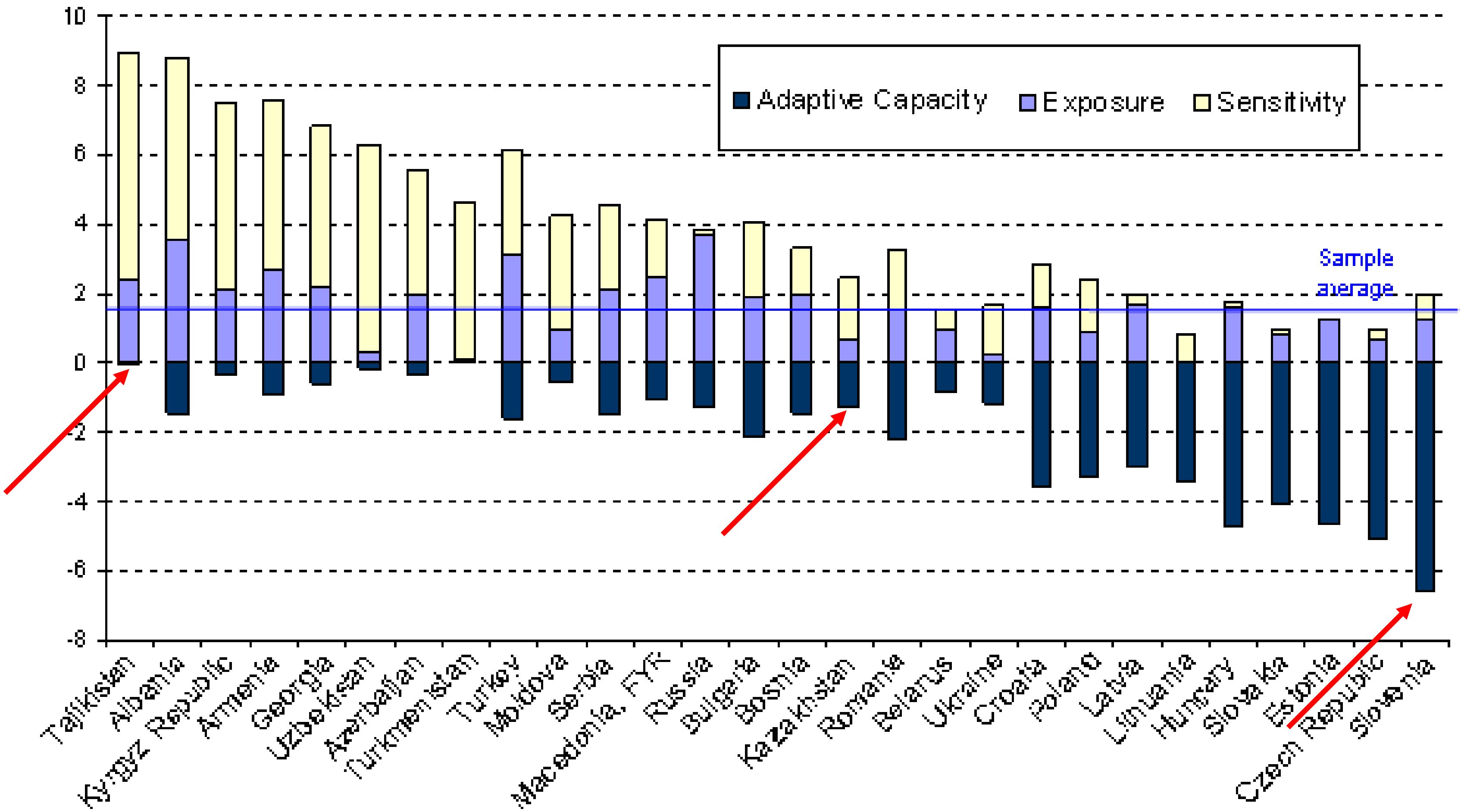
Understanding vulnerability -

Sensitivity is particularly high in Central Asia and the Caucasus
High adaptive capacity can help offset high exposure and sensitivity



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Among all clients of weather services

- Energy is one of the most weather-dependent sectors (others include agriculture, transport, construction);
- Energy sector is *also* one of those most sensitive to weather *information:* (has the infrastructure to make use of better information e.g., by managing reservoirs, timing and routing deliveries, buying/selling on spot market, etc.)
- Energy sector is willing and able to pay for information that others need but cannot pay for (spatially and temporally resolved basic forecasting at all time frames)

The energy sector and weather dependence

- Low income countries are heavily dependent on weather-sensitive renewables such as hydropower and biomass
- The least wealthy are the most dependent
- Stable hydropower output year-to-year seems to be linked to prosperity.

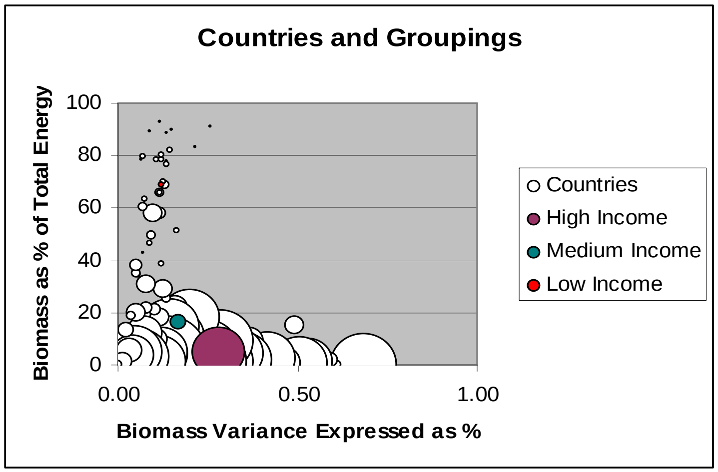

Figure 1. Biomass as a share of energy use. (*Source:* WDI Online)

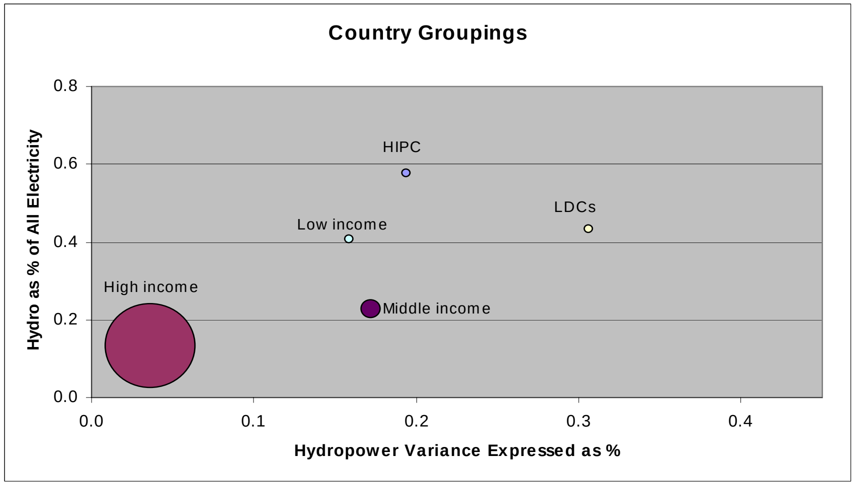

Figure 2. Hydropower as a share of electric power. (*Source:* WDI Online)

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The energy sector depends on
- strong basic forecasting -

Forecasts of temperature, visibility, wind speed and direction, icing	Needed to manage fuel transport: pipelines, transmission lines, marine, road and rail
Basic weather forecasts and forecasts of natural illumination/ cloudiness	Used to forecast energy usage
Hydrological forecasts	Used in optimal hydropower production.

The energy sector depends on - strong climate services -

Expected solar irradiance	Siting and design of solar energy generation
Expected wind speed	Siting and design of wind power generation
Expected extremes of hot and cold	Projected power from thermal power stations
Expected wind and icing	Siting and design of transmission lines
Expected river flow	Siting and design of hydropower plants

The energy sector depends on - new forecasting services -

Long-range weather forecasts	Will enable more-efficient reservoir operations and hydropower sales on spot markets
Satellite imagery	Will improve max/min temp forecasts and in turn load forecasts

Additionally, climate change scenarios to support decision making for planning, and O&M

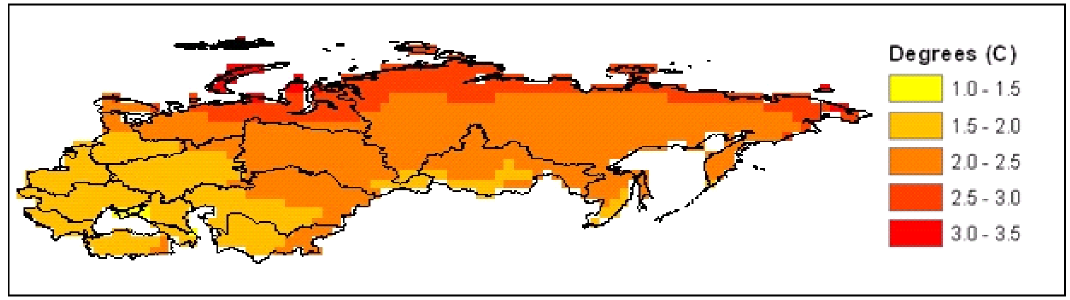
Global trends affect use of weather services

- Trend 1. Climate itself is changing.
- Trend 2. The skill of weather/climate services is generally rising globally.
- Trend 3. Other sectors are joining the energy sector as users of skilled weather/climate services.
- Trend 4. Skill gaps are emerging between countries that have invested and those that have not.

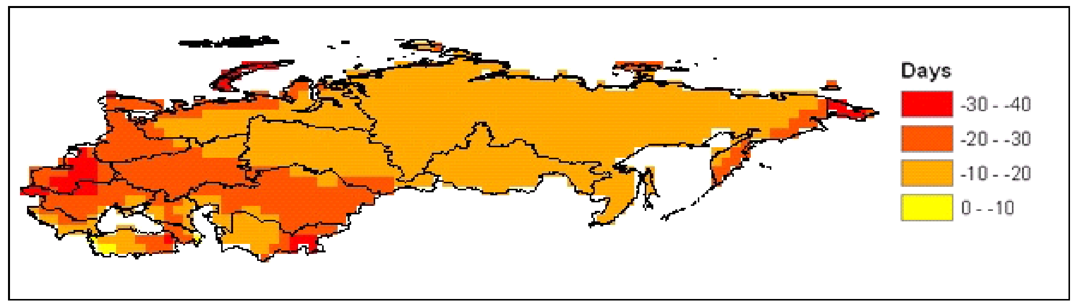
ECA is significantly threatened by climate change:
By 2030, it will be much warmer…

- Warmer everywhere - +1.6 to+2.6 by mid century
- Fewer frost days (- 14 to 30 days)
- More heatwaves: Poland and Hungary to experience same number hot days as Sicily today
- Implications
  - Melting glaciers; less snow
  - Melting permafrost, arctic ice
  - Sealevel rise (except Caspian)

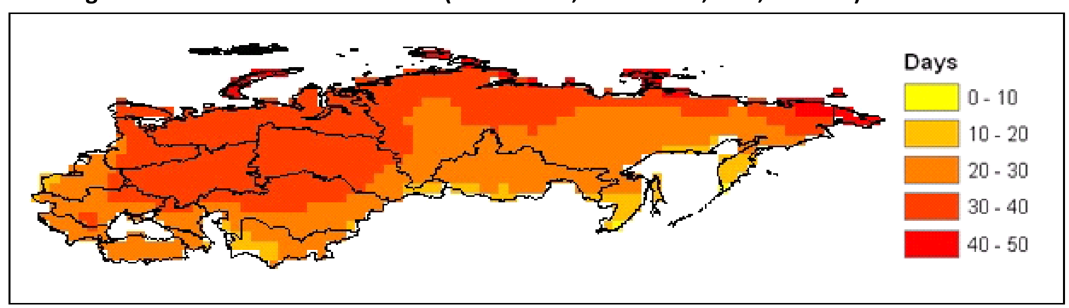
a. Change in Mean Annual Temperature (2030-2049; 1980-1999; A1B; 8 GCMs)



d. Change in Number of Frost Days (2030-2049; 1980-1999; A1B; 8 GCMs)



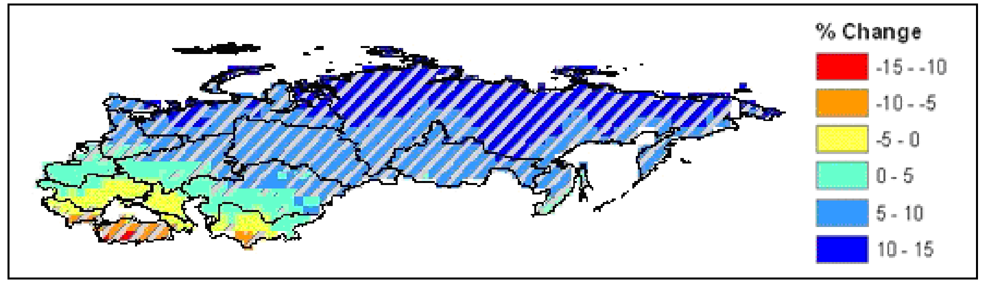
e. Change in Heat Wave Duration Index (2030-2049; 1980-1999; A1B; 8 GCMs)



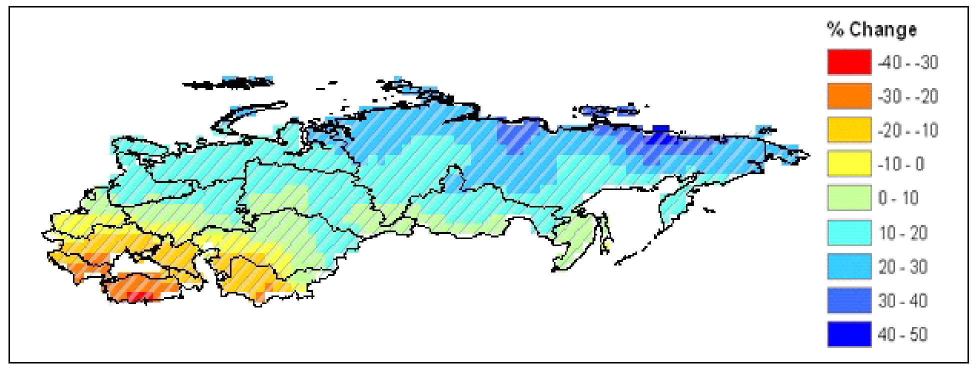
ECA is significantly threatened by climate change:
.. with more droughts and floods…

- Precipitation will increase everywhere but in Southern ECA and Central Asia
- But water availability will decrease everywhere but Russia
- Increased precipitation intensity almost everywhere

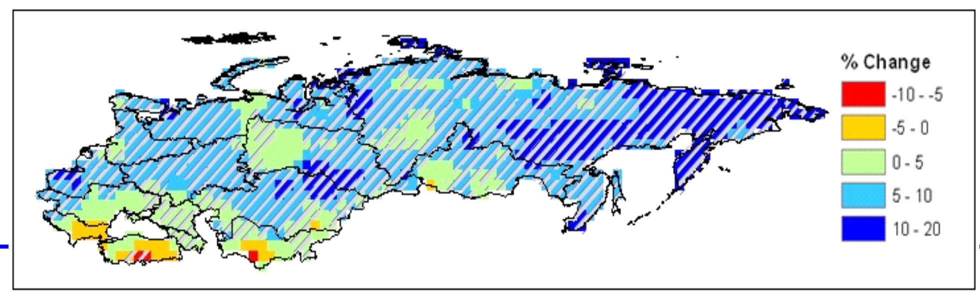
a. Change in Mean Annual Rainfall (2030-2049; 1980-1999; A1B; 20 GCMs)



b. Change in Runoff (2041-2060; 1900-1970; A1B; 8 GCMs)



d. Change in Daily Maximum 5 Day Rainfall (2030-2049; 1980-1999; A1B; 8 GCMs)



Hatching indicates where at least 2/3 of the models agree with the sign of the change.

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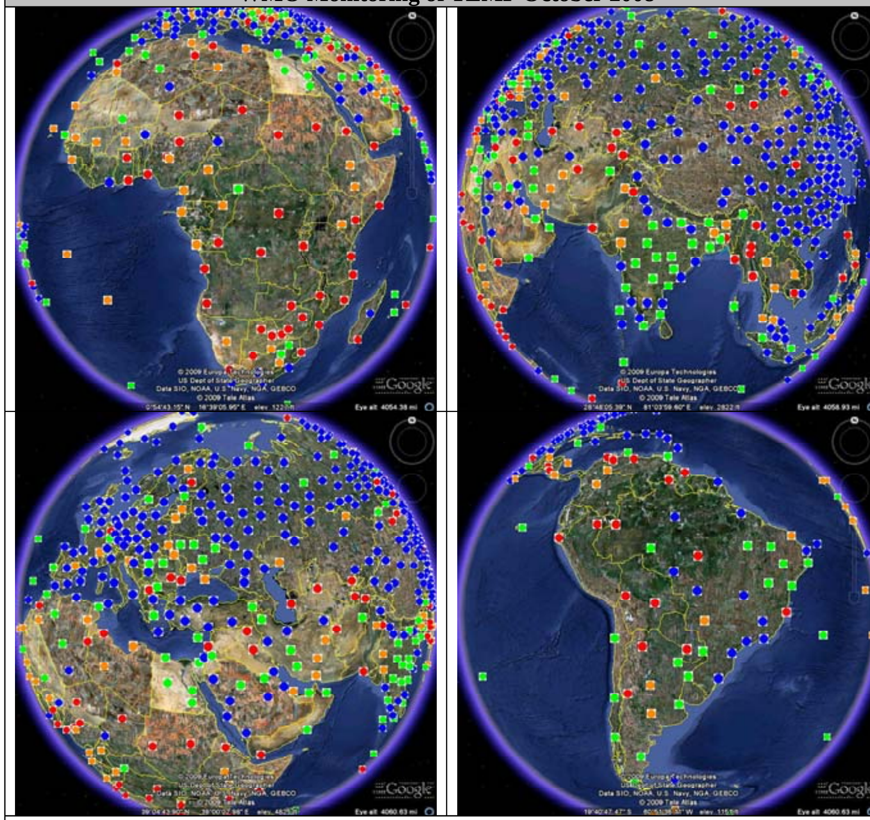
Emerging gaps…

- These maps present snapshots of upper-atmosphere data availability.
- These data are provided to the World Meteorological Organization by its member countries around the world.
- Most silent stations are in LICs.

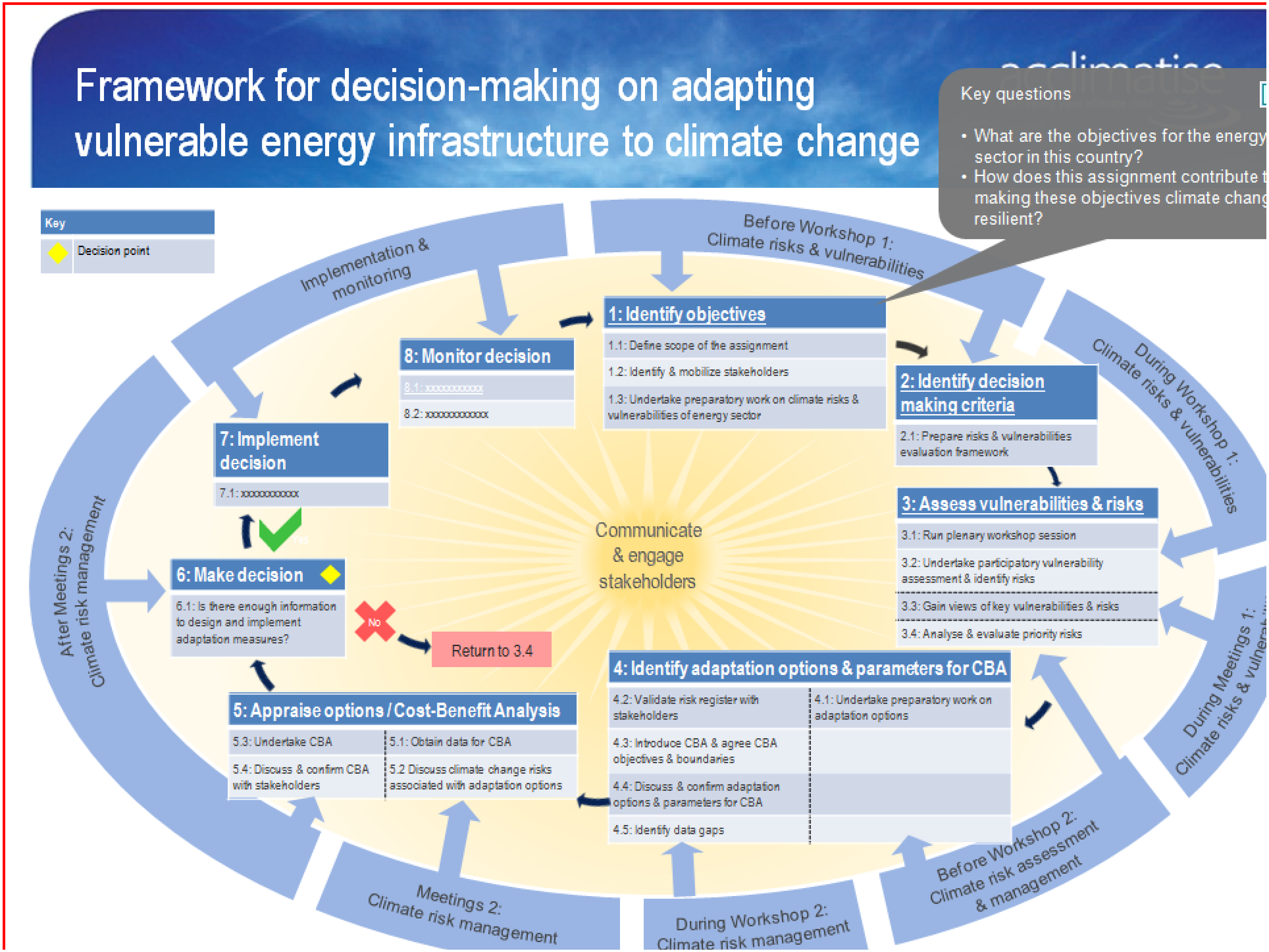
WMO Monitoring of TEMP October 2008



BLUE: stations for which more than 90 percent of the reports were received
GREEN: stations for which 45 to 90 percent of the reports were received
ORANGE: stations for which less than 45 percent of the reports were received
RED: silent stations.

How to manage?

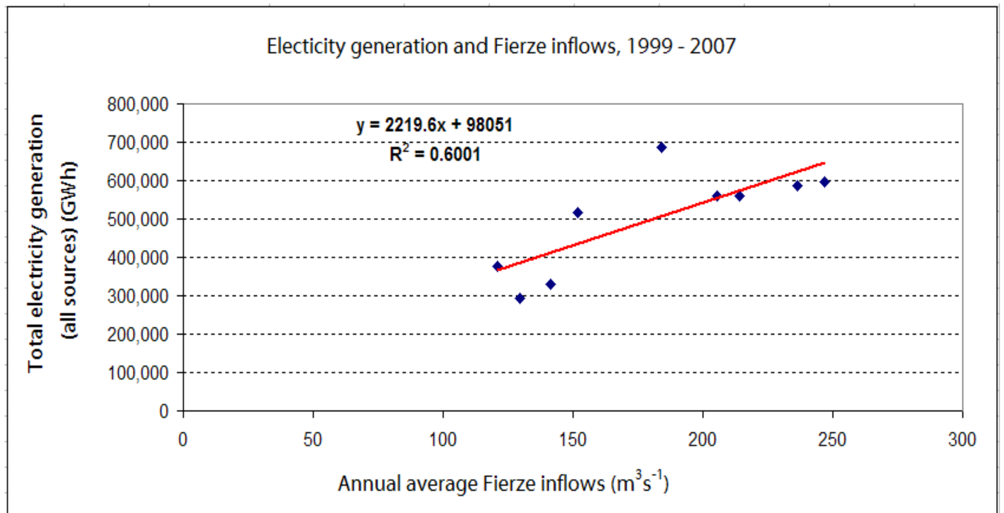
Toolkit for hands-on climate vulnerability and adaptation assessments of the energy sector in Europe and Central Asia

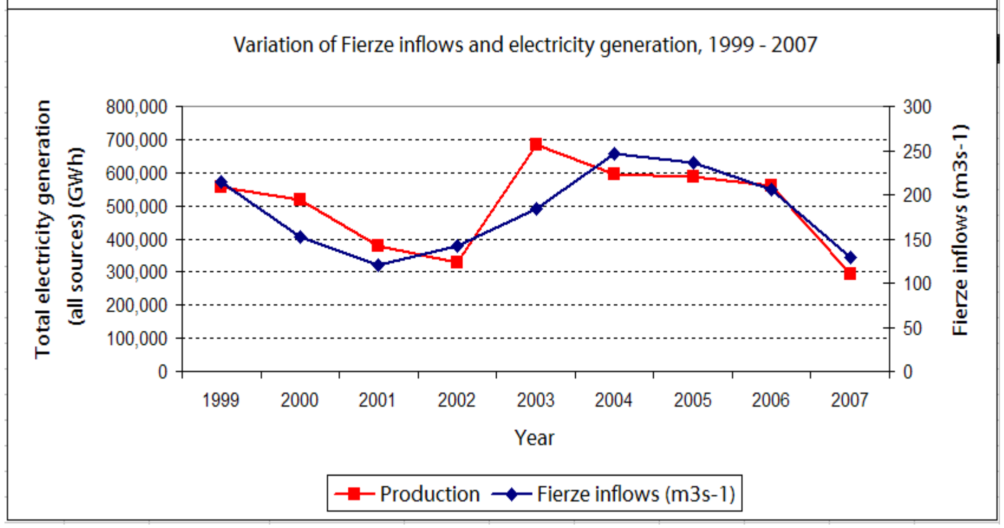


Framework for decision-making on adapting vulnerable energy infrastructure to climate change
Key questions
• What are the objectives for the energy sector in this country?
• How does this assignment contribute t making these objectives climate chang resilient?
Key
Decision point
Implementation & monitoring
Before Workshop 1: Climate risks & vulnerabilities
During Workshop 1: Climate risks & vulnerabilities
During Meetings 1: Climate risks & vulner
Before Workshop 2: Climate risk assessment & management
During Workshop 2: Climate risk management
Meetings 2: Climate risk management
After Meetings 2: Climate risk management
1: Identify objectives
1.1: Define scope of the assignment
1.2: Identify & mobilize stakeholders
1.3: Undertake preparatory work on climate risks & vulnerabilities of energy sector
2: Identify decision making criteria
2.1: Prepare risks & vulnerabilities evaluation framework
3: Assess vulnerabilities & risks
3.1: Run plenary workshop session
3.2: Undertake participatory vulnerability assessment & identify risks
3.3: Gain views of key vulnerabilities & risks
3.4: Analyse & evaluate priority risks
4: Identify adaptation options & parameters for CBA
4.1: Undertake preparatory work on adaptation options
4.2: Validate risk register with stakeholders
4.3: Introduce CBA & agree CBA objectives & boundaries
4.4: Discuss & confirm adaptation options & parameters for CBA
4.5: Identify data gaps
5: Appraise options / Cost-Benefit Analysis
5.1: Obtain data for CBA
5.2 Discuss climate change risks associated with adaptation options
5.3: Undertake CBA
5.4: Discuss & confirm CBA with stakeholders
6: Make decision
6.1: Is there enough information to design and implement adaptation measures?
No
Return to 3.4
7: Implement decision
7.1: xxxxxxxxxxx
8: Monitor decision
8.1: xxxxxxxxxxx
8.2: xxxxxxxxxxx
Communicate & engage stakeholders

Energy Security in the Face of Climate Change
- The Case of Albania

- The river Drin is the main source of electricity (90 percent)
- Rainfall among most variable in Europe
- *HP production varies between 2900 GWh in very dry years to twice that amount in unusually wet years*
- Limited regional interconnectivity
- Significant inefficiencies in domestic energy supply, demand and water use
- In 2007, a drought in the Drin's watershed led to severe electricity shortages and blackouts



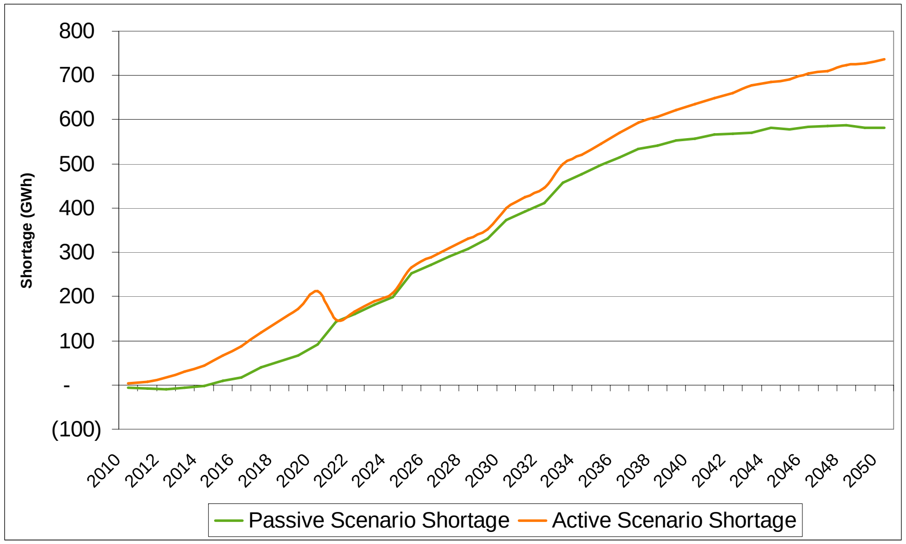


Emerging results: *Albania's Energy Sector*

- ➢ Affirmed significance of climate impacts
- ➢ 20% reduction in surface water runoff by 2050
- ➢ Means 15% less energy generation from large HPPs
- ➢ Means 20% less from small HPPs
- ➢ Shift in winter/summer energy use
- ➢ Important issues on distribution & efficiency
- ➢ Affirmed relevance of National Energy Strategy
- ➢ Most ambitious "active" scenario
- ➢ SWOT analysis outlines further risks; + and –
- ➢ SWOT also assesses ease of implementation
- ➢ Even with NES, shortfalls will remain
- ➢ Options outlined to meet shortfall
- ➢ Stakeholders continue to engaged in process

✓ *PROMISING TRANSFER OF ANALYTICAL APPROACH FROM U.K. & AUSTRALIA*

Estimated electricity shortage due to climate change



Supply Side

➢lower run-off and less hydropower generation

➢Reduced efficiency of thermal power plants and also transmission and distribution networks

➢Losses from transmission and distribution networks

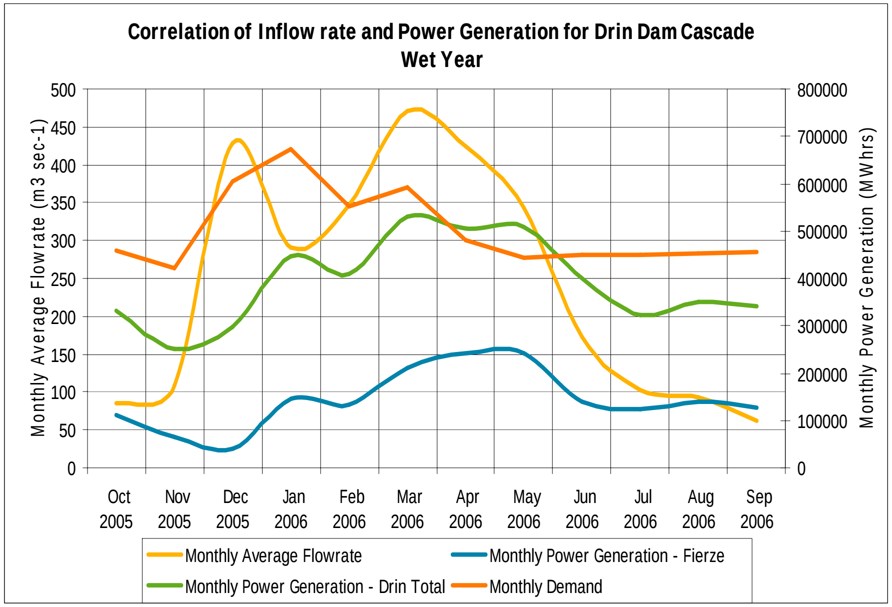
➢Increased output of solar power plants

Demand Side

- ➢ Increasing summer cooling of residential and commercial properties
- ➢ Reducing winter heating of residential and commercial properties
- ➢ Estimated net reduction in annual demand of approximately 0.1% per year.

NOTE

➢annual decrease may disguise a more significant impact due to changing seasonal demand



Planned adaptation measures in Albania …

- Knowing that droughts occur and will recur in the Drin watershed, Albania's hydropower managers are adapting their operations
  - Working with weather and climate experts
  - Planning to install a network of river-level sensors and a system for collecting regional weather forecasts
- This will assist:
  - Accurate forecast of the level of the Drin
  - Timing the filling and release of water from reservoirs to draw the most energy from the flowing river without endangering the dams (built in the 1960s-80s)

Emerging Needs

- **Increase investment in and coordination of meteorological, hydro-meteorological and hydrological monitoring, modeling and forecasting**

  - Support in country development, or access to, weather and climate forecasts that are appropriate for energy sector planning including: short-range forecasts (1-3 days ahead), medium-range forecasts (3-10 days), seasonal forecasts and regional downscaled climate change projections. Short-range and medium-range forecasts should be made available to decision-makers in real time, to help in optimizing the operation of the energy system.

  - Apply New Technologies for accurate and longer range forecasting - satellite imagery, ocean data sensors, weather balloons, meteorological radars, remote stations with telecom connections, etc.

- **Facilitate better interaction between meteorological/ hydro-meteorological experts and energy sector decision-makers.**

  - Strengthen regional/ cross-country cooperation on sharing of monitoring data and forecasts especially in relation to shared watersheds.

  - For hydro power, for instance, encourage energy sector stake-holders to work in partnership with other water users (such as the agricultural sector) to undertake climate risk assessments that are integrated across these sectors and to devise agreed strategies for managing shared water resources.

Emerging needs

- Address current adaptation deficit, increase robustness of energy system
  - Improve EE and DSM
  - Integrate adaptation measures into investments that are underway or being planned
  - Upgrade existing assets
  - Consider how to structure incentives for adaptation as electricity sector privatizes
- Involve stakeholders

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