

Water, Energy, and Food Nexus in Pakistan: Implication for Adaptation

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- Pakistan's agriculture depends on irrigation
- Agriculture uses over 90% of water resources
- 80% of cultivated area irrigated
- 90% of agricultural output from irrigated land
- About 50% households depend on irrigated agriculture for their livelihood
- Wheat & rice are the main staples; both are highly water intensive
- Increased demand for water for food & energy

Food, Water, and Energy Security

- Pakistan stands 76th of 107 countries in Global Food Security Index
- 58% of households food insecure, 19% moderate hunger, 9% severe hunger
- Water stressed – 1/3 people lack safe drinking water
- 30% of population lacks electricity, 50% rely on biomass for cooking
- Shortfall in electricity more than 5,000 MW
- Climate change – additional impact on WEF

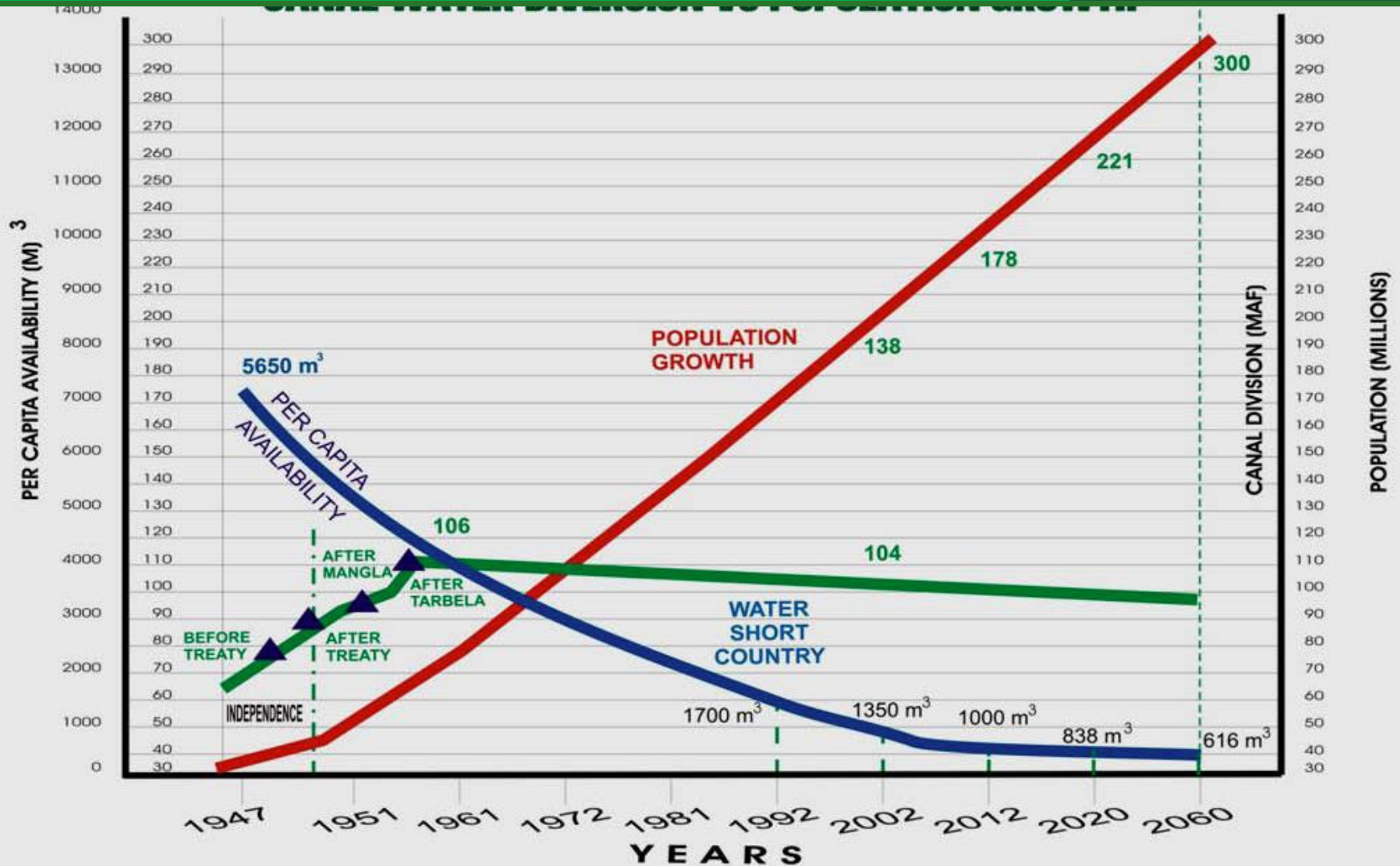
Increasing Food Demand

- Population growth, urbanization, economic growth, growing middle class, changes in lifestyle & resource use patterns
- By 2030:
 - Population **240 million**, Cereal demand up by **60%**
 - Food production need to be increased ~ **2%**
 - Water demand up by **55%**
 - Increasing water & energy intensity in agriculture
- Changing dietary patterns
 - Per capita consumption **of rice, meat**, fruit, vegetables increasing; wheat consumption slightly decreasing

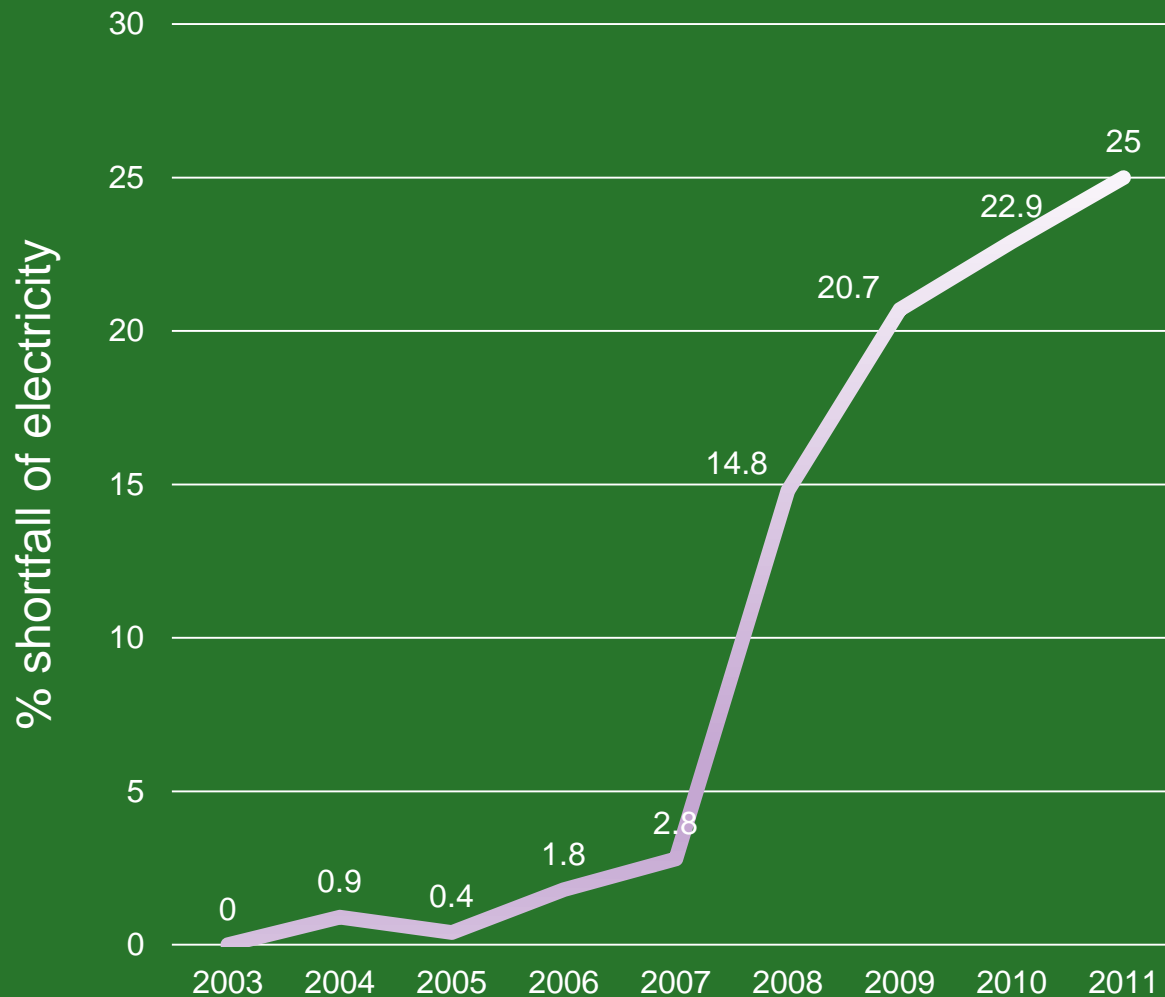
Increasing Water Stress

- Growing demand for water for agriculture, energy, industry, environment & domestic water use
- Declining water availability
 - Current annual per capita water availability ~**1,090 cu.m**
 - By 2030, may decrease further
- High water withdrawal (**74%**) leads to environmental risks
- Groundwater depletion in certain areas
- Water shortage may become a **limiting factor for food production**
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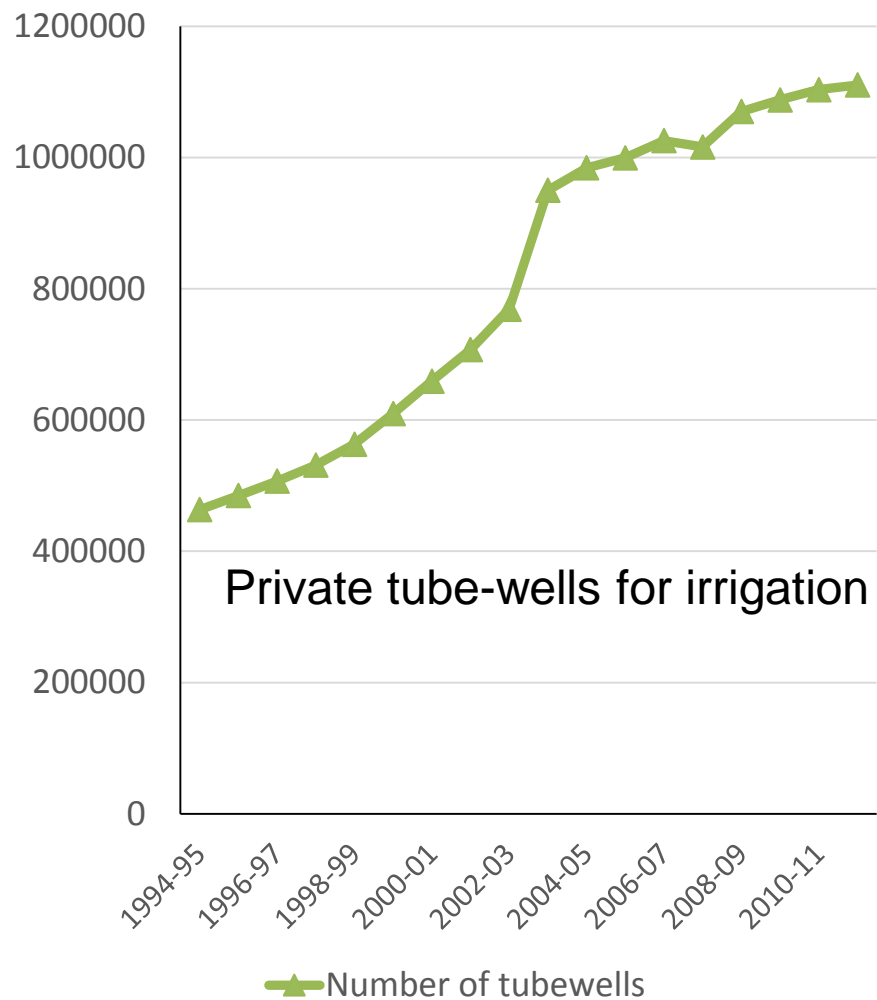
Population growth vs Water Availability



Intensifying Energy Crisis

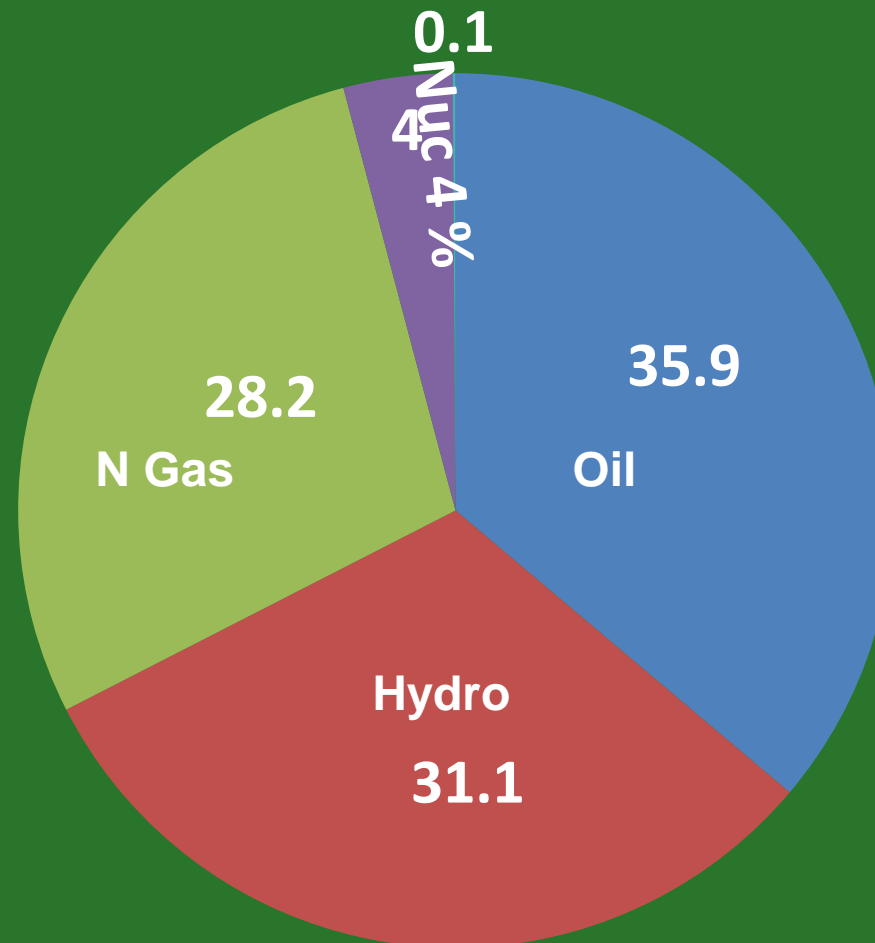


- Electricity shortfall now about 25%
- Energy shortage has crippled economic growth



- Pakistan's irrigation becoming energy intensive
 - **Surface water irrigation decreasing**
 - Groundwater irrigation & mixed (surface + groundwater) **irrigation increasing**
 - Over 60% of irrigation is either groundwater or mixed
 - 11% of irrigation is use
- Increased use of groundwater for irrigation leads to higher energy demand

Fuel Mix 2012-2013



- Increasing population pressure
- Shrinking water resources
- Climate change- uncertainty in water availability
- Ageing irrigation infrastructure
- Inefficient irrigation
- Overexploitation of ground water
- Shortage of electricity -High diesel cost
- Energy intensity high, efficiency low

Cereal yield (t/h)

France	7.60
Egypt	6.0
China	5.9
India	2.9
Pakistan	2.7

Productivity of water (kg/m³)

America	1.56
China	0.80
India	0.39
Pakistan	0.13

Increasing water intensive crops

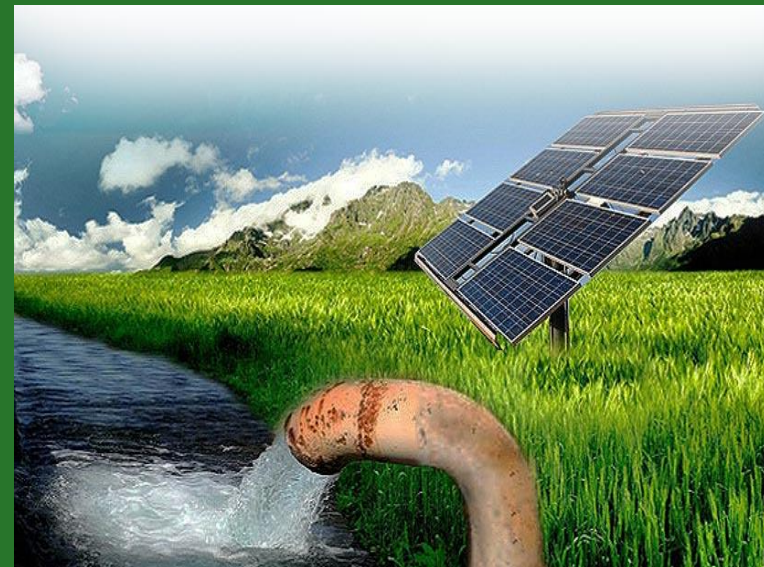
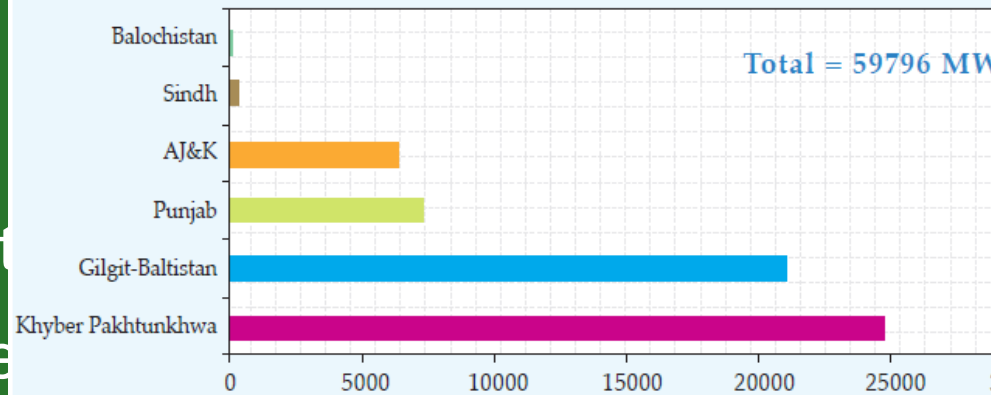
Utilization of water in major crops

Crops	Area (million ha)	Water (million cu.m)	Water intensity (cu.m/ha)
Rice	2.4	70.5	29.2
Cotton	3.0	51.4	17.4
Wheat	7.6	51.4	6.8
Sugarcane	1.1	48.9	46.2

Adaptation Options

- Supply side options
- **Increase water storage capacity**- Mangla & Tarbela have lost 25% storage capacity
- Sustainable use of hydropower potential (micro & macro), (60,000 MW)
- **Repairing, maintaining irrigation infrastructures**
- Multipurpose use of water
- Diversifying energy resources- Solar pumped irrigation

Hydropower Resources of Pakistan

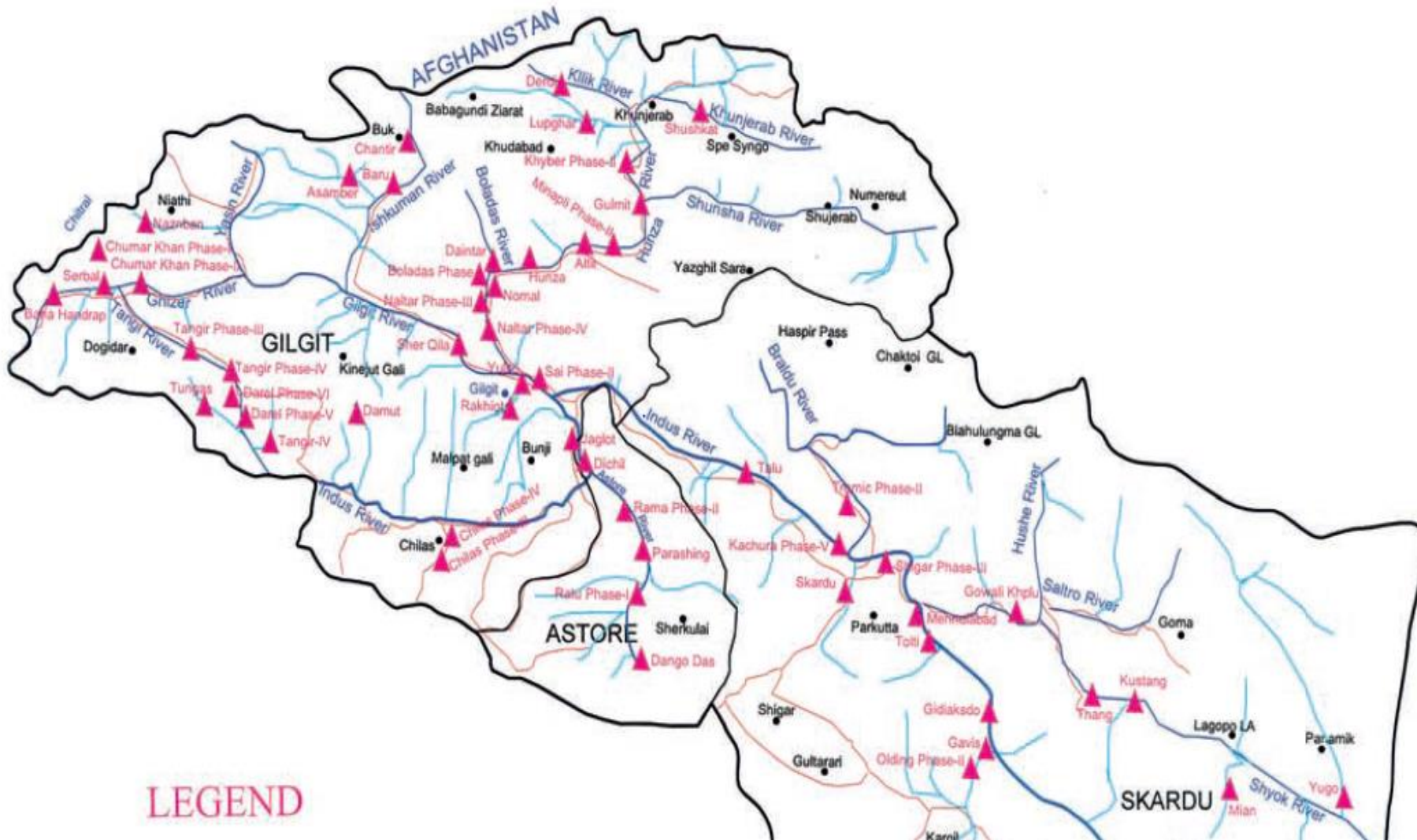


Optimum use of water storage & hydropower potentials

Potential Hydropower sites in KPK



Potential Hydropower Sites in Gilgit-Baltistan



Demand Management

- **Demand management of Water & Energy**
 - Water use efficiency- In Pakistan, by increasing 10% irrigation system efficiency could bring about 2 million ha land under irrigation
 - Productivity Enhancement
 - Adoption of water saving technologies/practices
- Increasing water use efficiency:
 - China increased irrigation efficiency by 20% -
 - In Malaysia, farmers increased water productivity 45%

Demand Management

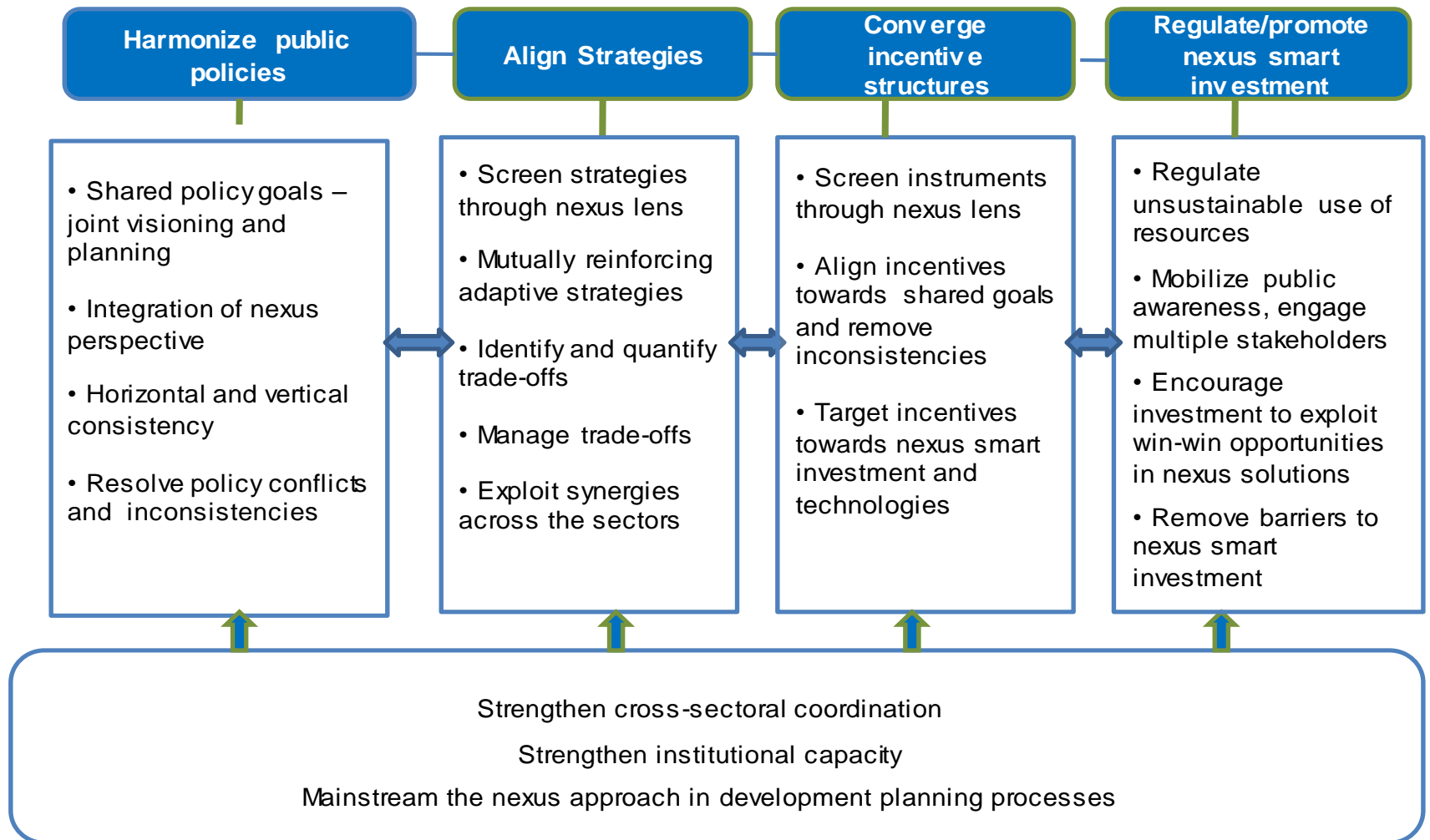
- Engage private sector- In Australia, Coca Cola company invested in water use efficiency both in operation & management of watersheds- reduced per unit of water use in beverage production & improved quality of watersheds
- Switching to less water demanding crops
- Break Sectoral Silos- From sectoral approach to a holistic approach

Break Sectoral Silos



- From sectoral approach to a holistic approach
- Complementarities & synergies among the three sectors
- Systemization of planning & decision making at national level
- Nexus smart infrastructure, multifunctional ecosystems & innovative technologies

Towards a policy framework for adaptation in food-water-energy nexus



Thank you

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