

## Research Task / Overview

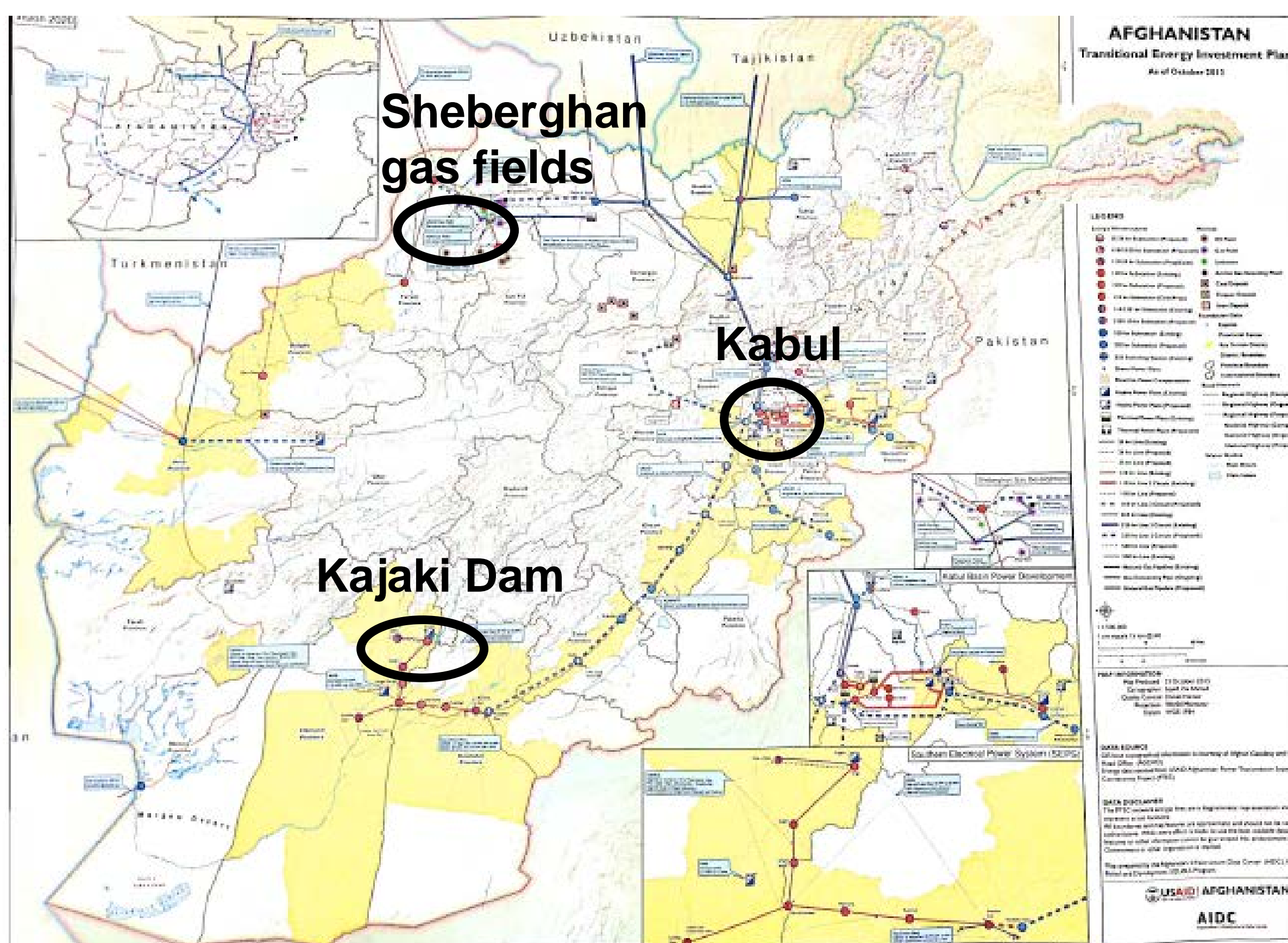
Identify, monitor, and address the emergent and future conditions that most disrupt a \$200m capacity expansion of the power grid of Afghanistan, a ten-year effort of systems engineering with several ministries of Afghanistan, Combined Security Transition Command - Afghanistan, US Agency for International Development, Asian Development Bank, and a half-dozen donor nations.

## Data & Analysis

Data inputs sourced from various agencies, e.g. Combined Security Transition Command - Afghanistan (CSTC-A) and US Agency for International Development.

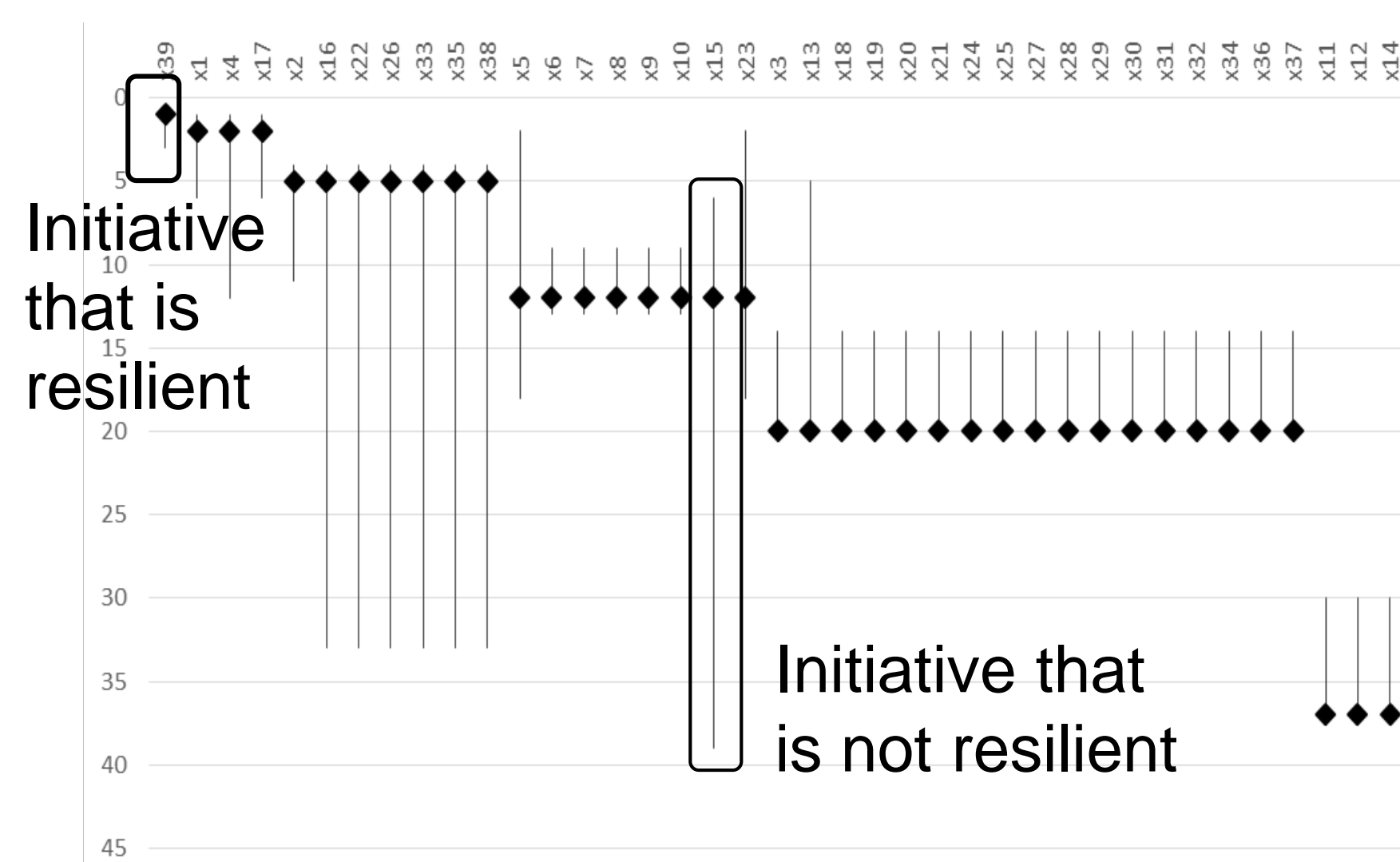


Total of 39 initiatives, 6 risk scenarios and 2 sets of success criteria



- Initiatives include
- transmission lines
  - generation
  - substations
  - management assistance
- Initiatives support
- Reliability
  - cost-effectiveness
  - energy security

**Sensitivity analysis of initiative ranking.** Height and direction of whiskers indicate threats and opportunities



### Initiatives and risk scenarios for further investigation

Key insight	National government criteria	Independent auditors criteria
Most resilient highly prioritized initiatives within criteria set	$x_{39}$ : Contracting and enforcement mechanisms	$x_{39}$ : Contracting and enforcement mechanisms
Least resilient highly prioritized initiatives within criteria set	$x_5$ : Kajaki Dam Unit 2, $x_{23}$ : Gereshk hydropower plant rehabilitation and upgrade	$x_{16}$ : Tranche 4 preparation, $x_{22}$ : DABS management assistance, $x_{26}$ : Tranche 3 implementation and supervision con,
Most disruptive stressor	$s_2$ : Unsatisfactory local governance	$s_2$ : Unsatisfactory local governance
Least disruptive stressor	$s_1$ : Insufficient power supply	$s_1$ : Insufficient power supply
Most resilient initiative across criteria sets	$x_{20}$ : Kabul distribution network, $x_{39}$ : Contracting and enforcement mechanisms	
Least resilient initiative across criteria sets	$x_3$ : Salang Tunnel substation, $x_{18}$ : Chintala to South West transmission line, $x_{29}$ : Andkhoy and Sheberghan substations, $x_{30}$ : Mazar Sharif substation expansion, $x_{32}$ : Pul-e-Alam and Gardez substation equipment	

## Goals & Objectives

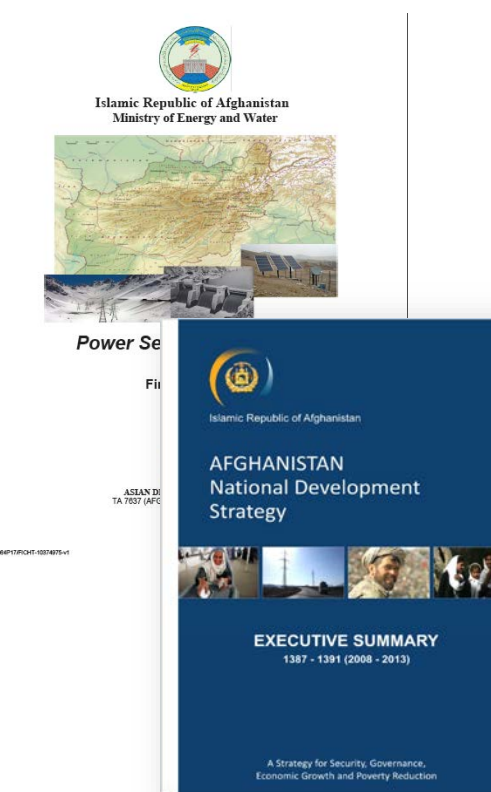
Identifying planned and proposed *initiatives* contributing to a safe and reliable power grid in Afghanistan.  
 Describing what overarching stakeholder *success criteria* these initiatives are meeting.  
 Establishing the prioritization of the initiatives in terms of their coverage of the goals.  
 Delineating *scenarios* that most affect the prioritization of initiatives enhancing the expansion of the power grid in Afghanistan.

## Methodology

Assessing the coverage of criteria by initiatives

- - Significant coverage
- - Marginal coverage

Sample of initiatives



- Sheberghan gas development
- Arghundy to Kandahar transmission line
- Salang Tunnel substation
- Kabul power system rehabilitation
- Kajaki Dam Unit 2
- CASA-1000
- TUTAP Kabul to Pakistan transmission line
- Turkmenistan interconnection Phase 1

Sample of criteria	Sample of initiatives				
	Security	Justice	Governance	Energy	Private Sector Devel.
Sheberghan gas development	○	○	○	●	●
Arghundy to Kandahar transmission line	○	○	○	○	○
Salang Tunnel substation	○	○	○	○	○
Kabul power system rehabilitation	○	○	○	○	○
Kajaki Dam Unit 2	○	○	○	○	○
CASA-1000	○	○	○	○	○
TUTAP Kabul to Pakistan transmission line	○	○	○	○	○
Turkmenistan interconnection Phase 1	○	○	○	○	○

- ↑ - Criterion increases in importance
- ↓ - Criterion decreases in importance

Sample of risk scenarios

- Mismanaged funds
- Insufficient power generation
- Disruption of electricity import
- High-level government corruption
- Insurgency damage

Sample of criteria	Sample of risk scenarios				
	Security	Justice	Governance	Energy	Private Sector Devel.
Mismanaged funds					
Insufficient power generation			↑		
Disruption of electricity import	↑		↑		
High-level government corruption		↑	↑		
Insurgency damage	↑			↓	

Importance adjustment of criteria for scenarios



## Future Research



Kajaki Dam, essential for hydropower generation and industrial development

- Monitoring and buy-down of sources of risk through the \$200M, 10-year investment lifecycle
- Support Asian Development Bank as the agent for resilience/risk management
- Extend method to other development tasks such as transportation, communications, humanitarian aid, etc.

## Contacts/References

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