Incorporating Renewable & Energy Efficiency in Utility Planning

Integrating Resource and Resilience Planning in Tanzania and Ghana

2015 USAID Infrastructure Workshop

Building to Last: Strengthening the Sustainability and Resilience of USAID Infrastructure Projects

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Integrated Resource and Resilience Planning (IRRP)

- Traditional IRP planning focuses on supply and demand issues over the long-term.
  - The most narrow reviews lack attention to transmission, distribution, do not integrate demand side alternatives, and do not consider risk elements.
  - The broadest reviews tend to lack attention to distribution sector, resilient, reliability, and climate risks.
- IRRP expands IRP to include review of issues to ensure greater resiliency for long-term investment alternatives.
  - Significant benefits to developing systems considering long-lived investments, e.g. transmission life (+40 years), hydro generator life (+40 years)

Integrated Resource and Resilience Planning

Supply Side

Transmission

Demand Side

Existing & New Sources
Hydropower
Coal, Oil
Natural Gas
Renewables
Electricity Imports

Existing and New Lines
HV Transmission Lines
New line build options

Electricity Demand
Industrial,
Commercial, Residential
Energy Efficiency
DSM

Performance and Cost Characteristics

Least-Cost Planning Model
Power and/or other fuels: Scenario Modeling
addressing selected sensitivities, policies, risk mitigation options

Resilience Assessment and Planning
Environmental, Social, Financial Impact Analysis
Risk Analysis and Management; Stakeholder Interactions
(Regulatory, Financial, Environmental, Climate Change, Upstream, Infrastructure, Political)

Power Sector Master Plan

Traditional Benefits of IRP

- A long-term, system view (vs. short-term, project-based view)
- Consideration of all resources and evaluations done on a level-playing field
- Explicit recognition of a broader range of potential risks, including climate change
- Broad stakeholder engagement
- Robust plan to support investment and other decision-making

IRP Analysis Supports Independent Developer Participation

- IRP analysis provides the structure needed to evaluate proposed projects
- IRP informs potential market participants and provides transparency regarding sector needs

Elements of IRRP	Benefits
Demand forecast	Transparency in assessing type, location, and quantity of load growth
Supply Analysis and Expansion Plan Projections	Evaluate alternate build and procurement options, assess dispatch needs versus resource size and value
Distribution and Transmission Plans	Identify reliability issues and plan for development of solutions
Cost Recovery Plan for Power Sector	Provide checks and balances for funding mechanism, promote investor confidence
Rate Making	Determine cost and return requirements

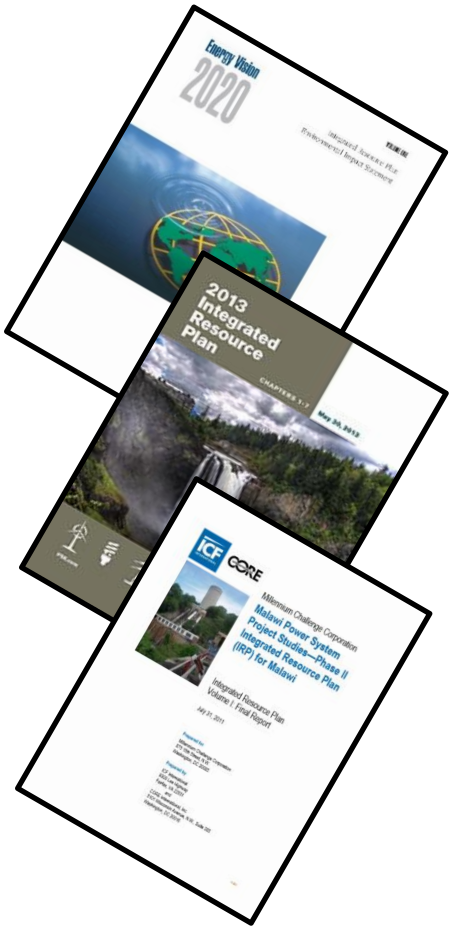
Lack of Planning Limits Development

- IRP analysis provides critical information for utilities and regulators to plan toward and measure against.
- Lack of information results in limited investor interest and less than optimal investment strategies.
- Lack of information can slow electric access and impact climate/sustainability.
- Lack of structure allows for potential gaming.

Area	Historical examples of development failures related to lack of IRRP information availability and planning structure
Brazil	Lack of integrated resource planning pitted base-load thermal against hydro, plants not economic for private partners to operate and government carried fuel, offtake risks at a loss.
India	Non-transparent, non-competitive procurement of IPP led to poor planning and operation of overly complex PPA. Government nationalized plant after Enron bankruptcy.
Indonesia	Non-transparent, non-competitive, corrupt procurement led to oversized asset development. After currency crisis and regime change, new government renegotiated and cancelled contracts at investor expense.

Examples of IRP

- Most states in the U.S. require an IRP to support the procurement of new generation
- The 2011 South Africa IRP was used to identify its new generation projects for the period 2010 to 2030. It is considered to be “living plan” with regular updates
- In 2015, Tennessee Valley Authority in the U.S. developed their Energy Vision 2020 using an IRRP process
- In 2013, ICF supported the development of an IRP for the Malawi Power System that has been instrumental in identifying new power projects that are being supported by the MCC



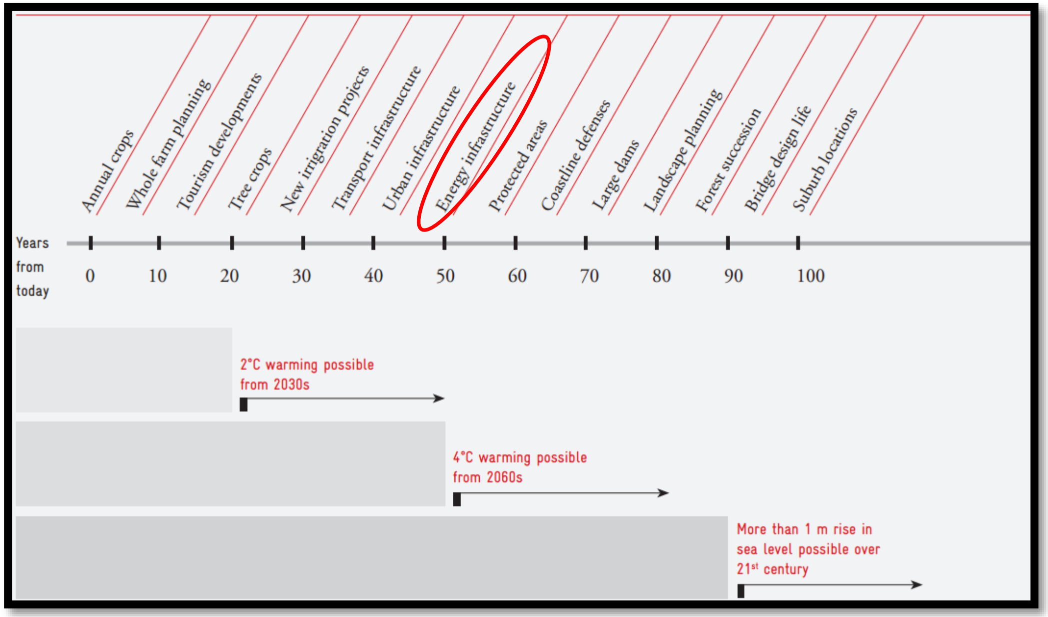
Expanding to IRRP Yields Greater Consumer Benefit and Sustainability

Managing Risks and Increasing Resilience

- **Fuel Price and Investment Risks**: Singular focus on gas-based capacity expansion in the U.S. in 1990s resulted in price risks and volatility in early 2000s
  - IRRP can increase fuel diversity
- **Climate Risks**: Frequent drought in Tanzania and Ghana has reduced hydro-electricity generation and increased cost of service
  - IRRP can help optimize the hydro contribution to the portfolio
- **Demand-side risks**: Rapid demand growth and poor load factor increases load shedding, resulting in customer dissatisfaction
  - IRRP can manage demand growth, improve load factor, increase revenue and improve customer satisfaction

Climate Risk is Relevant

- Climate is changing now: *Better management of climate risks today, builds resilience to future climate risk*
- Decisions based on historic climate data are no longer robust: *infrastructure investments may be at risk of underperforming in future conditions*



Climate adaptation should be integrated into **core business risk management and planning** processes **today**- to improve decision makers understanding of risks, and of options to manage them

IRRP Produces Reliable and Resilient Infrastructure

- Accommodates the optimal resource mix
- Supports policy goals, e.g. renewable or distributed resource targets
- Enables efficient utilization of resources in real-time
- Operates reliably under probable contingency conditions
- Hardened and resilient to withstand impact of extreme events

Direct, Indirect, and Compounding Impacts

Industries | Fri Jun 26, 2015 7:11am EDT

Related: ENERGY, NON-CYCLICAL CONSUMER GOODS

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BY KIZITO MAKOYE

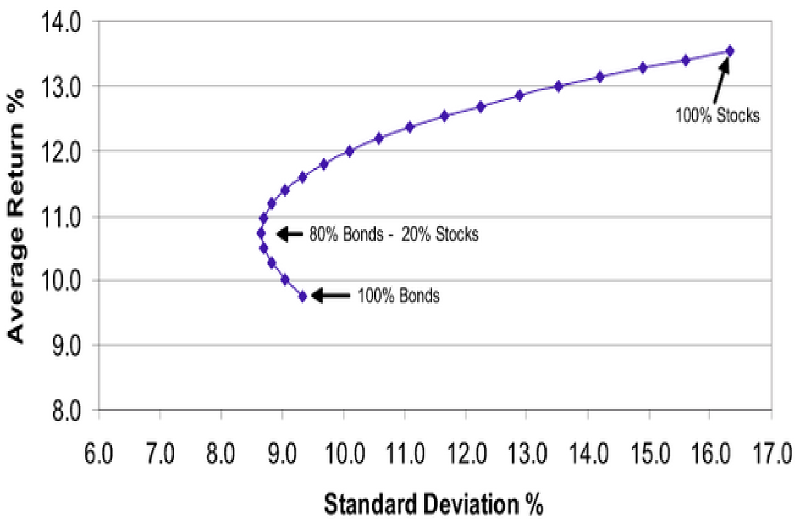
Climate Change: Increasing intensity and frequency of heatwaves and drought, reductions in water supply, increases in energy and water demand → impact on energy reliability

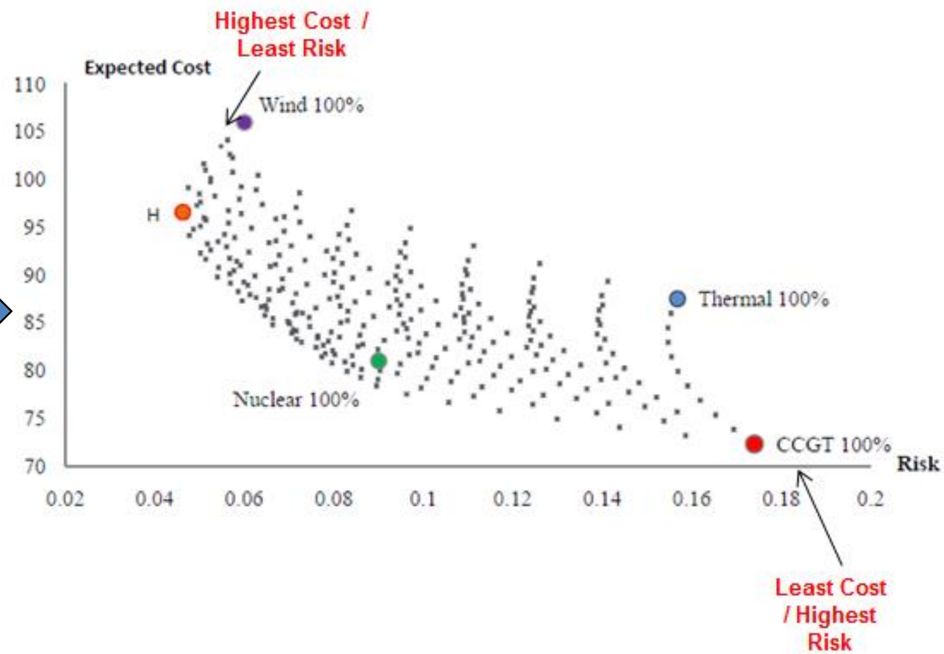
Options for Managing Climate Risks to Improve Reliability

- Increasing energy and water use efficiency:
  - Developing demand-side/conservation management
- Increasing capacity:
  - Increasing water supply, peak generation, power storage capacity
- Increasing resilience:
  - Improving reliability of grid systems through back-up power supply, intelligent controls, and distributed generation
  - Insulating equipment for temperature extremes
  - Hardening, building redundancy into facilities
  - Relocating vulnerable facilities

Portfolio Optimization Enhanced

Evaluating decision criteria for multiple risks enhances planning results





- Approach produces “least regrets” determination versus least cost determination.

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Stage Specific Planning

Regulatory Review

Results Validation and Feasibility Determination

Consider Risks
- Fuel Prices
- Load Growth
- Unit Performance
- Transmission Contingencies
- Environmental Factors
- Climate Factors

Evaluate Cost / Benefits of Options
- Gas Resources
- Coal Resources
- Renewables
- Hydro
- Distributed Resources
- Efficiency
- Demand Response
- Transmission and distribution
- Contracting Options
- Environmental Impact
- Reliability Impact

Determine Input Data and Decision Criteria

- Implement
- Evaluate
- Repeat

IRRP

Questions and Answers

Contact Info

Maria Scheller is a Vice President in ICF's Energy Advisory Services practice area with 20 years of experience in long-term planning; electric market fundamentals; economic analysis; market operations; rate impact analysis; competitive procurement; resource planning; forward market modeling; and financial analysis of wholesale power assets. Ms. Scheller manages work including asset valuation, due diligence, litigation, and strategic studies. This work involves review and creation of economic and technical aspects of power supply including: avoided energy supply cost determination; forward price curve analysis; plant dispatch analysis; power sector restructuring; power plant siting, revenue forecasts and financial performance of assets in competitive and deregulating markets; expansion and strategic planning for generation companies. Ms. Scheller received a B.S. in Economics from The Pennsylvania State University

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