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Integrated Resource Planning

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March 6, 2017

What is an IRP?

- Long-range planning **process** resulting in an investment plan.
Period of 20 years usually, updated every 2 years
- Typically utility-led with broad stakeholder participation.
- Evaluates a wide range of potential supply- and demand-side resource options to meet energy (MWh) requirements and peak demand (MW), plus a reserve margin.
- Purpose is to minimize present and *future* costs of meeting energy requirements while considering impacts on utilities, governments, and society.

Why are IRPs worth supporting?

- This is a good governance approach.
- Risk: The electricity industry is changing rapidly--risk analysis is complex and increasingly more necessary (natural gas price uncertainty, RE price declines, energy security).
- Long-term dynamics: Assets are long lived and need to support an affordable, cost-reflective sector.
- Mechanism to balance multiple objectives (not just least cost)
- Supports/enables clean energy building blocks

Coal Overcapacity in China

>200 gigawatts under construction at the end of April 2016--Yet, most plants are sitting idle more than half the time with nuclear and renewables are covering additional demand. Waste is projected at \$148 billion by 2020.

Why?

No planning process to determine the “right” amount of generation capacity to meet reliability needs, and there are neither planning processes nor market price signals to guide where new investments are made.

“Tanzania Turns Off Hydropower as Drought Bites”

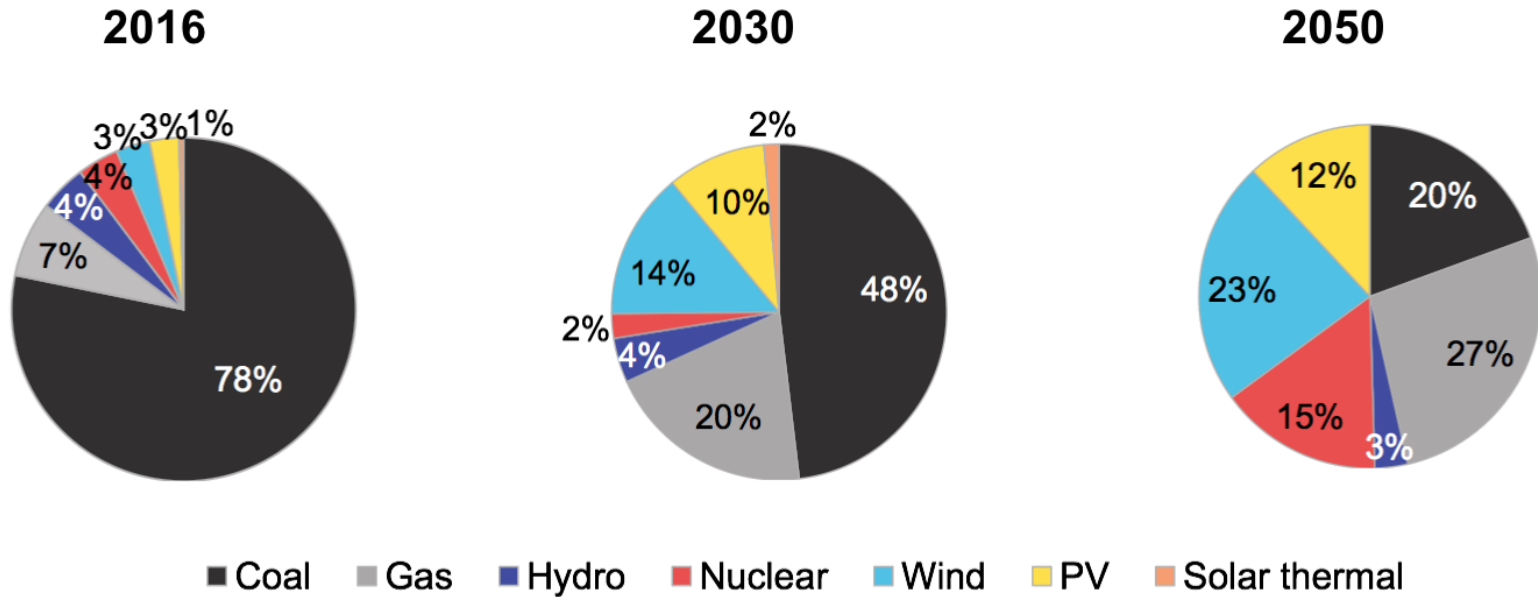


In December, despite 561 MW of capacity, Tanzania’s hydropower plants generated only 110 MW.

TanESCO suffered losses of about \$230,000 daily.

“There’s nothing we can do other than waiting for the rains to come.”

Long-term planning in South Africa



Source: South African Department of Energy,
Bloomberg New Energy Finance

Building Blocks to Scale Clean Energy

- Strategic Energy Planning
- Smart Incentives
- Grid Integration
- Renewable Energy Zones
- Competitive Procurement
- Finance

Testing Smart Incentives in IRPs

NWPP approach:

Resource strategies (actions and policies over which we have control)

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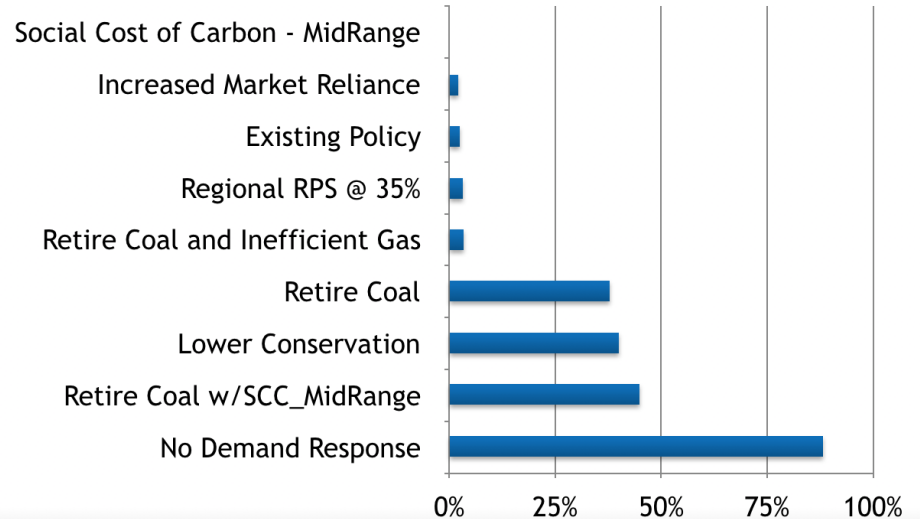
Futures (no control:

load/resource/market uncertainty)

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Scenarios (combos used to “stress test” resilience to changes in future)

Probability of Needing New Natural Gas Generation by 2021



IRP's Opportunity for Grid Integration

South Africa is currently developing its IRP through 2050 and revolutionizing its capacity expansion modeling approach to better address the growing role of variable renewable energy:

- **Incorporating power system flexibility**
 - Defining system-specific flexibility metrics (e.g., VRE curtailment; ramp magnitude and frequency, loading, and startups/shutdowns on conventional generators); and
 - Using a short-term dispatch model to evaluate these flexibility metrics on the projected fleet determined in the long-term capacity expansion model.
- **Incorporating explicit consideration of transmission costs and constraints when optimizing generation resource planning in the long-term capacity expansion model.**
- **Improving the temporal representation of the power system**, resulting in a more accurate representation of time-varying VRE resources and conventional generator ramps/cycles.
- **Improving the representation of the geographic and temporal diversity of VRE resources.**
 - Improving the representation of VRE enables the capacity expansion model to better choose among different VRE sites and technologies to reduce issues such as curtailment, rather than focusing exclusively on resource quality/capacity factor.

IRPs Support Large-scale Energy Auctions

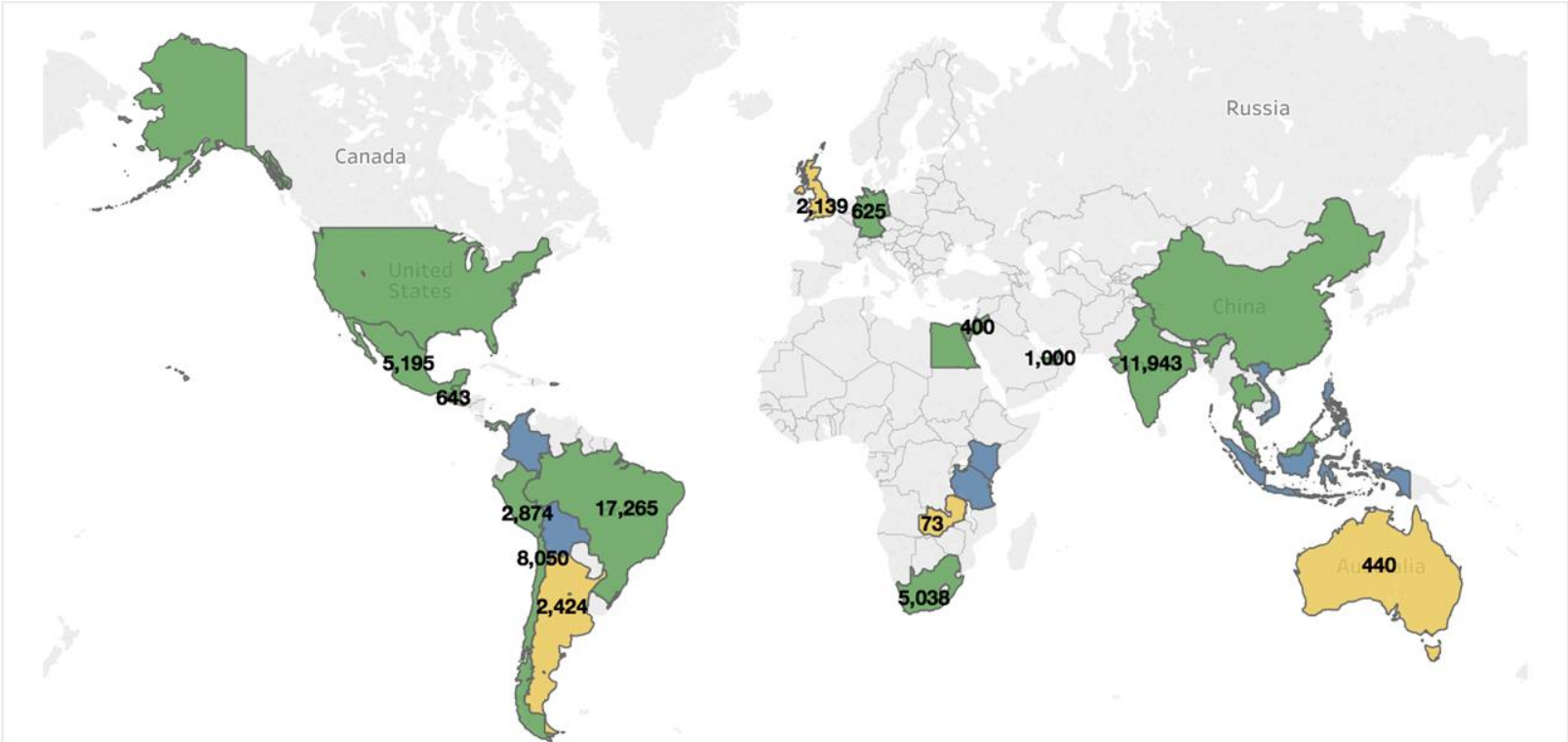
Plan/Auction

Auctions

Both

Plan

Countries with RE Plans and Auctions



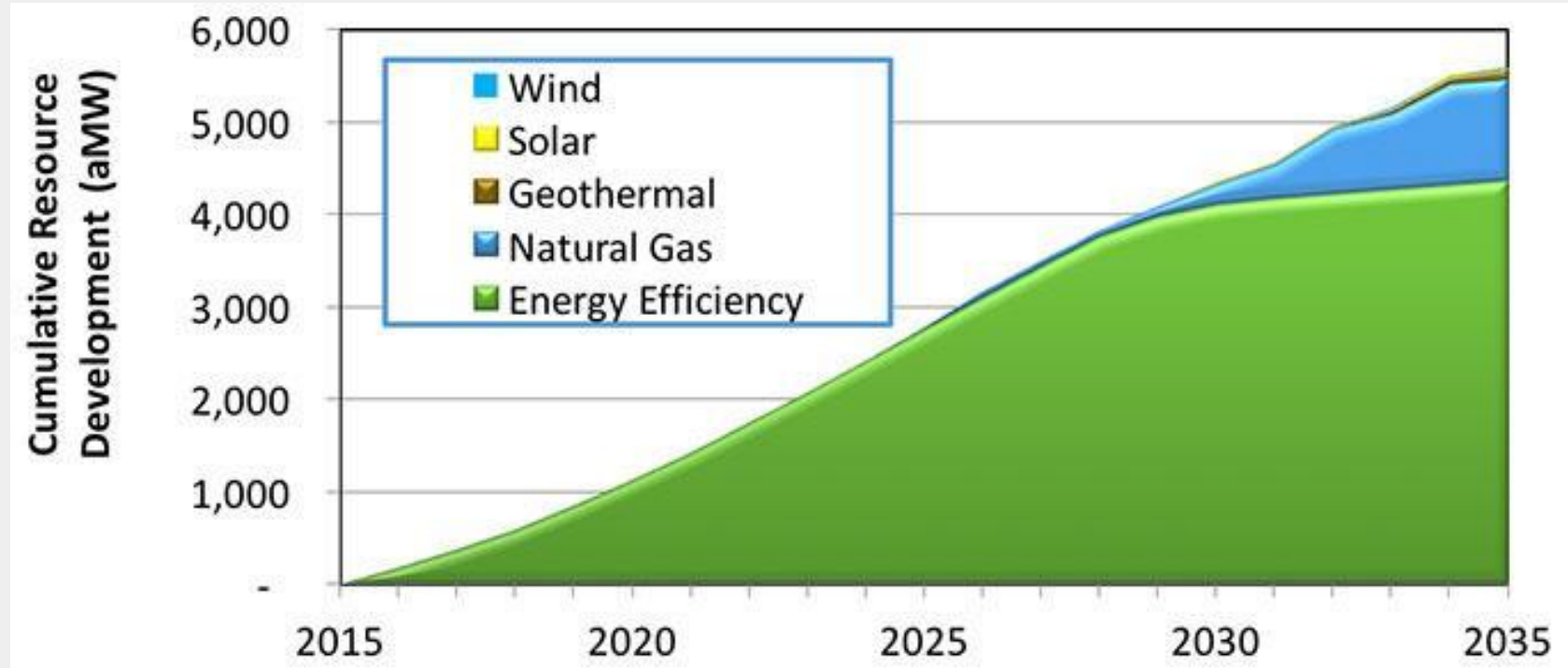
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How do IRPs help scale RE?

- IRPs can set the overall generation procurement strategy and provides the framework against which individual projects are evaluated.
 - Provides market signal of a long-term government commitment
- Scenario planning and sensitivity analysis help test smart incentives
- Incorporation of grid integration considerations (e.g. flexibility and grid support services as criteria in project screening)
- Can also incorporate analysis for locational concentration.
- Can provide a technical and economic rationale for pursuing clean energy (RE and EE).

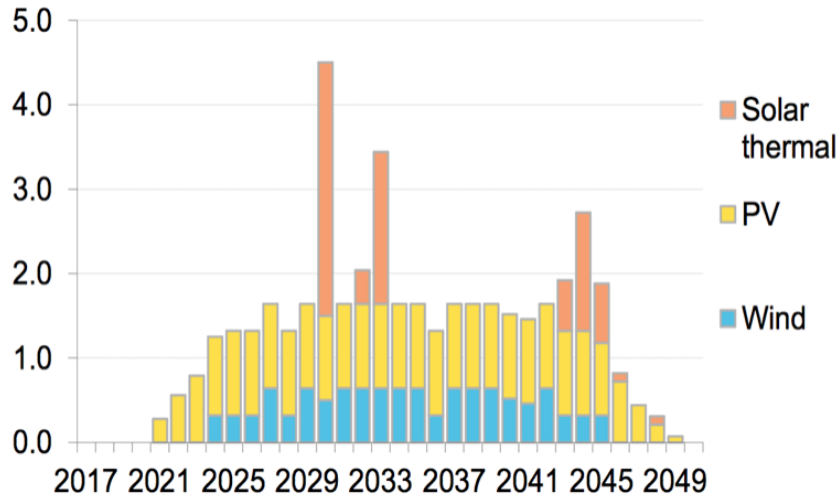
Example result: 7th NW Power Plan

Least cost resource strategies for meeting forecast demand

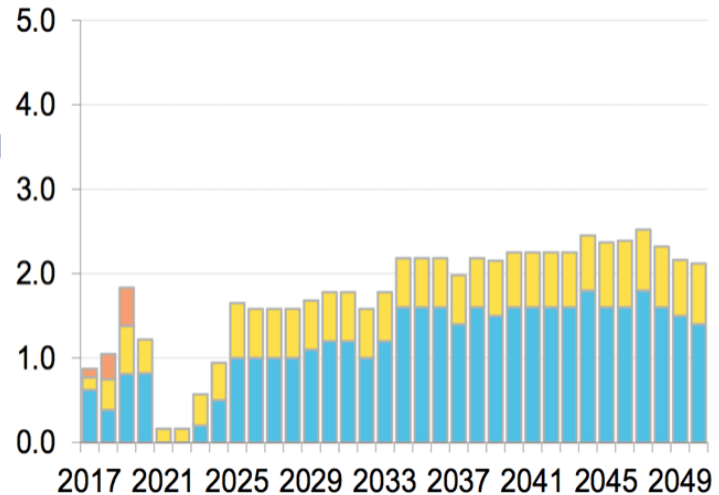


IRP is a Process: South Africa

Update 2013 (base case, step 5)



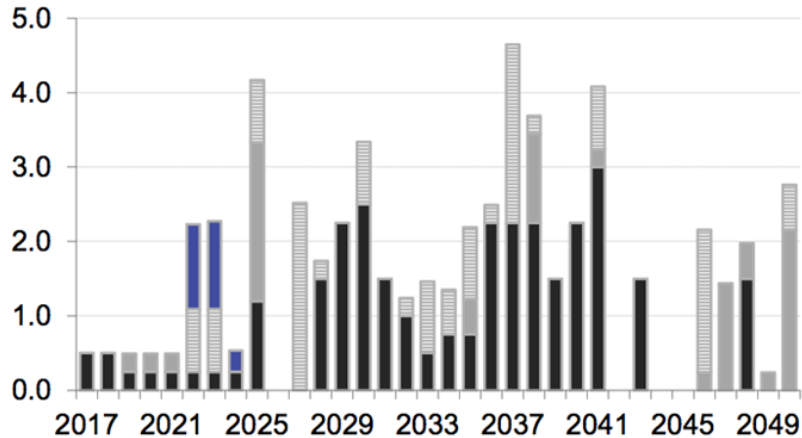
Draft IRP 2016 (base case)



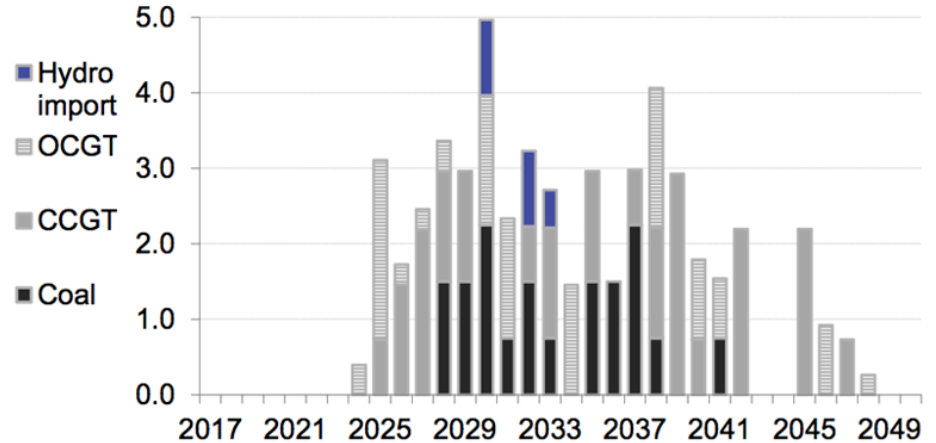
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IRP is a Process: South Africa

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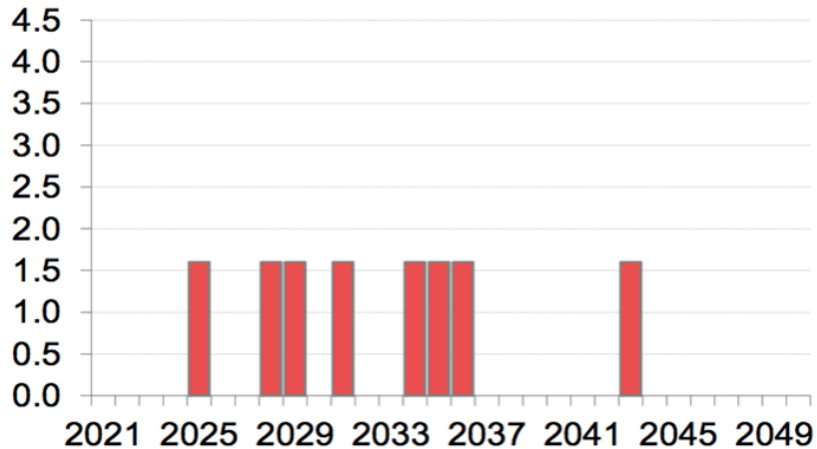


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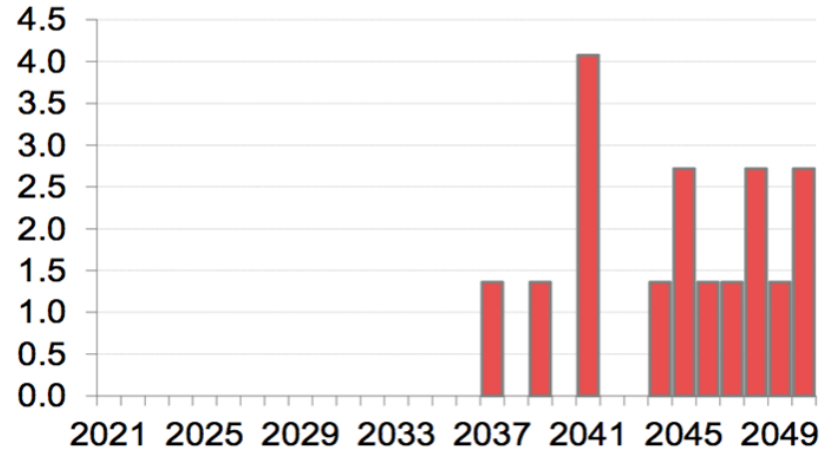


IRP is a Process: South Africa

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Questions?

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