Transmission Technical Analysis: Risks and Conflicts

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Three Stories – the "why"

- *Transmission system reliability analysis*
- *Uncertainties*
- *Why reliability affects (often conflicts with) other objectives*

The Transmission System

All blackouts are caused by failures of these.

A man-machine system of three elements:

- *Current-carrying hardware*
- *Control and protective devices*
- *Practices and procedures*

Planning analysis – my topic – fits here.

A sad PJM story

Year of study	Year when 765-kV PATH line is needed
2007	2012
2008	2013
2009	2014
2010	2015
early 2011	Suspended – not needed for [at least] several years beyond 2015.

"[W]e are certainly disappointed by the . . . uncertainties created by the PJM planning process."

Michael G. Morris
President, AEP 2/28/2011

". . . greater uncertainty . . . complicating the analysis of future reliability needs . . . factors add complexity to analyses . . . planning studies have become volatile . . .

[We] are evaluating current planning criteria and considering better ways to [do] transmission planning."

Terry Boston
President, PJM 2/28/2011

Uncertainty

Two fundamental models

- *Probabilistic*
- *"Unknown but bounded" without probabilities*

Important Uncertainties

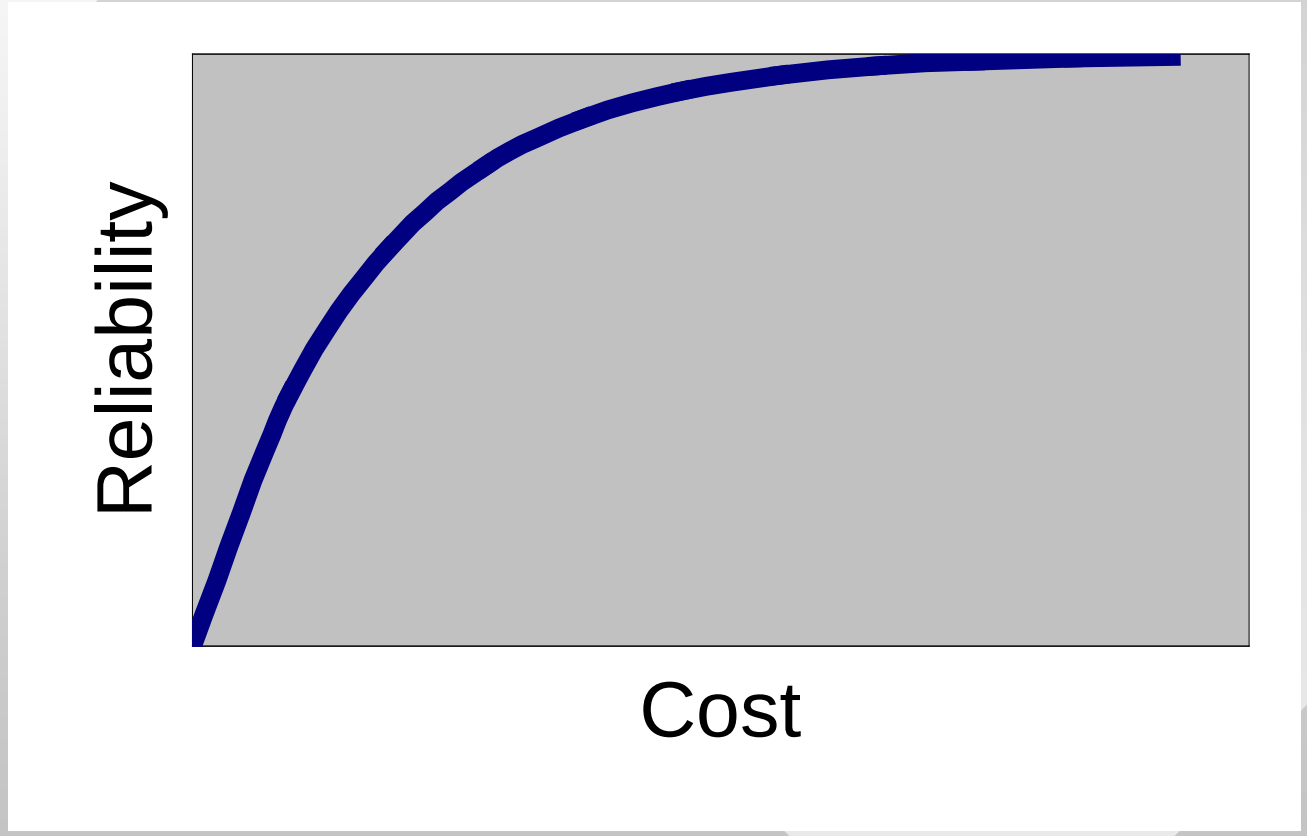
- *Contingencies*
- *Status of generators (on or off)*
- *Load*
- *Load growth*
- *New generators*
- *Demand-side options*
- *Regulatory changes*

Planning objectives

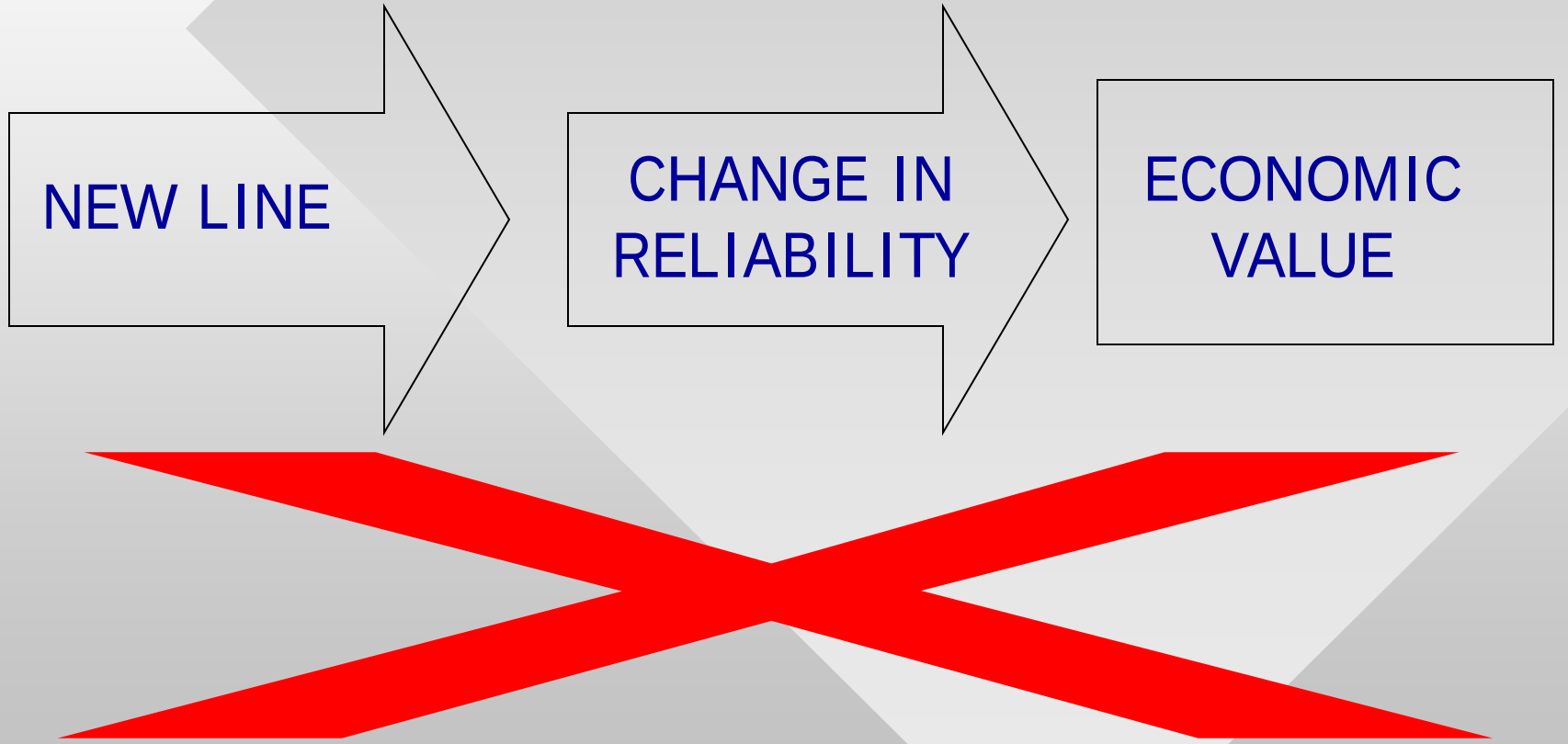
Word occurrences in PJM's 2008 RTEP report (322 pages)

Words	**Occurrences**
reliable, reliability	495
economic, economical	89
environment, environmental	11
greenhouse	0
CO_2	7
carbon	1
subtotal, five environmental terms	19

Reliability versus . . .



Can’t measure this . . .



Ratepayer Costs for New Transmission Facilities

- *Not just the cost of the facility itself.*
- *Also includes taxes.*
- *Also interest and equity return on unrecovered (undepreciated) investment.*
- *Annually about 20% of "as-built" cost of facility.*
- *May be socialized over wide area, not just those who benefit from the facility ('postage stamp rate")*

Reduce Congestion

- *Reduces high spot prices in constrained areas.*
- *Raises low spot prices in unconstrained areas.*
- *Also generally reduces "congestion cost" or "FTR revenue" rebates to ratepayers.*
- *Reduces generators' fuel costs.*
- *In LMP markets, this saving is <u>not</u> passed on to the ratepayers.*

Congestion Cost Example: 502 Junction – Loudoun 500 kV line

$ Millions	**Ratepayer Effects**
621	Decrease in gross ratepayer payments
790	Decrease in FTR rebates to ratepayers
169	Net increase in ratepayer costs

$ Millions	**Generator Effects**
169	Increase in revenue
140	Decrease in production (fuel) cost
309	Net increase in generator income

The FERC has said:

"[A]n accurate measure of actual load [ratepayer] benefits must consider the effect of transmission projects on the value of transmission rights" [FTR revenues or congestion costs]

126 FERC 61,152, 02/20/2009, p. 3

Other Effects

- *What does transmission do to emissions?*
- *What does it do to local property taxes for power plants?*
- *What does it do to local power markets?*

The Take-home Message

- *Managing reliability is a key element of the man-machine transmission system.*
- *Our reliability measures are imperfect.*
- *Reliability, yes, but can conflict with economic, environmental, and other objectives.*