



Transmission Cost Escalation: Summary and Analysis

*Attachment to the Prepared Statement of James J. Hoecker before the
Committee on Energy & Natural Resources*

Prepared by WIRES Ad Hoc Committee on Transmission Costs (2007)

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Introduction

- ◆ ***PURPOSE.***

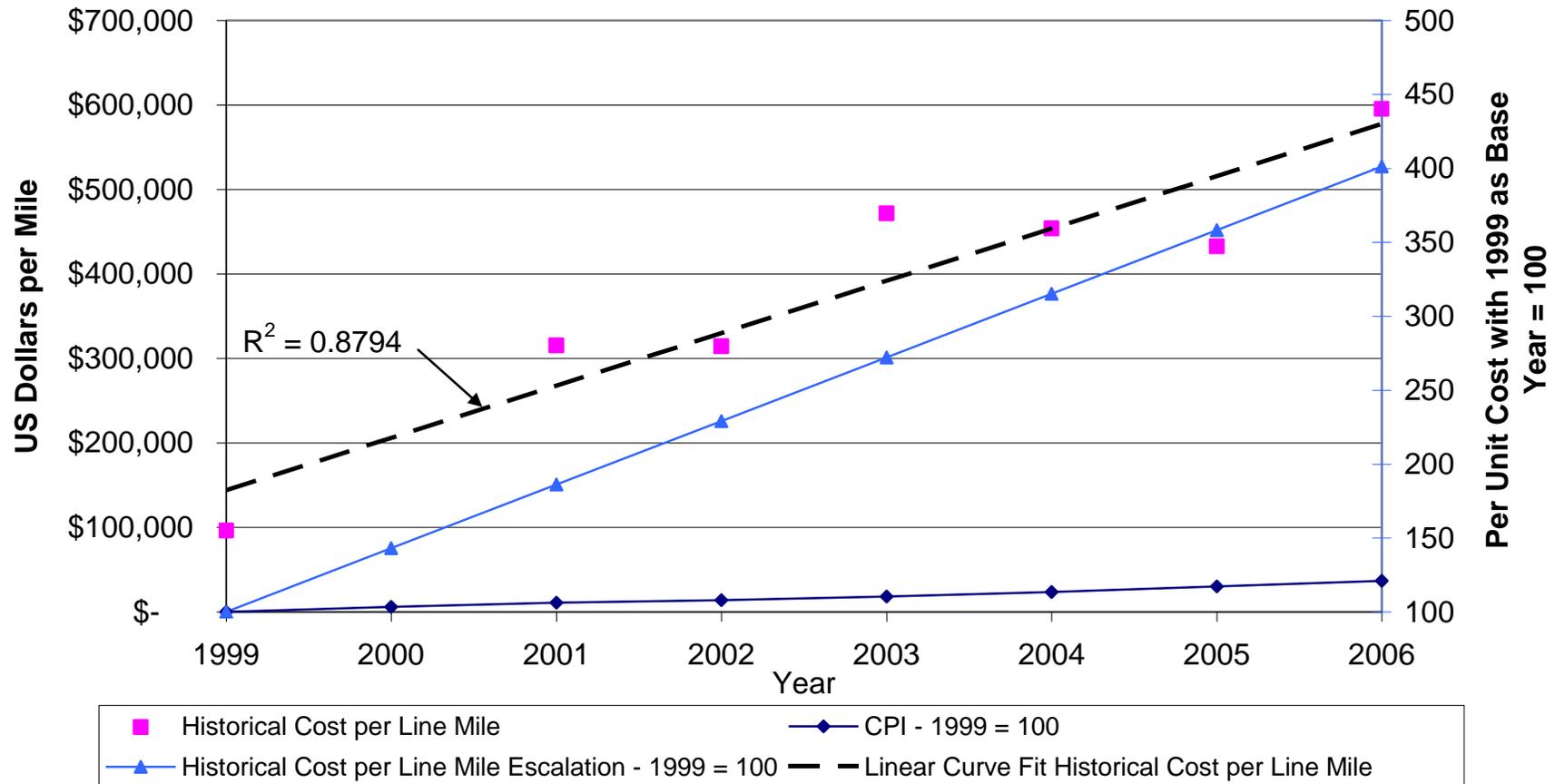
- ◆ Consumers, regulators and advocates for new transmission investment in the United States need to be aware of the cost escalation that is taking place in the industry.
- ◆ Increases in the cost of labor and materials, as well as the costs attributable to financing and delays in construction, are all contributing to the escalation of costs currently facing builders of transmission.
- ◆ This document is intended as part of the dialogue regarding the need for new transmission infrastructure.

- ◆ ***OPTIONS FOR ACTION.***

- ◆ Further analysis is proposed regarding the issues surrounding relative cost escalation
 - Implications for choices among transmission-dependent generation options; integrated resources planning
 - Implications for transmission investment versus other infrastructure investment
 - Effect on the sector's risk profile

Historical Upward Trend in Transmission Costs

New 230, 345 & 500 kV Overhead Line Construction Cost
Based upon FERC Form 1 Data for 322 Lines
(Excludes Land Costs)



Observations:

- ◆ Builders of transmission paid nearly \$600k/line mile (excluding substations) in 2006
- ◆ Cost per line mile is escalating more than 20% per year

Four Transmission Cost Drivers

There appear to be four primary cost drivers that will continue to impact the cost to build transmission.

◆ LABOR

— Consists of two workforces:

- Direct – workforce employed by companies building transmission, often white collar engineers, project managers, etc.
- Indirect – union and non-union contract workforce, includes skilled craft labor

◆ MATERIALS

— Materials required to build the infrastructure, impacted by raw material prices

◆ REGULATORY AND STAKEHOLDER FACTORS

— The cost of delays in the regulatory or siting process

- Includes the time value of money and how it impacts the feasibility of a project. A delay in the in service date can turn the economics (and potentially financing) upside down

— The impact of not being able to transfer CWIP to plant in service (and rate base) for those unable to recover CWIP

— Carrying costs

◆ LAND ACQUISITION

— The cost of acquiring right-of-way and easement

Direct costs (labor and materials) often make up approximately 50-60% of a project's total cost. The remaining 40-50% include indirect costs such as regulatory and stakeholder proceedings, land acquisition, environmental, engineering consulting, etc.

1. Labor Costs

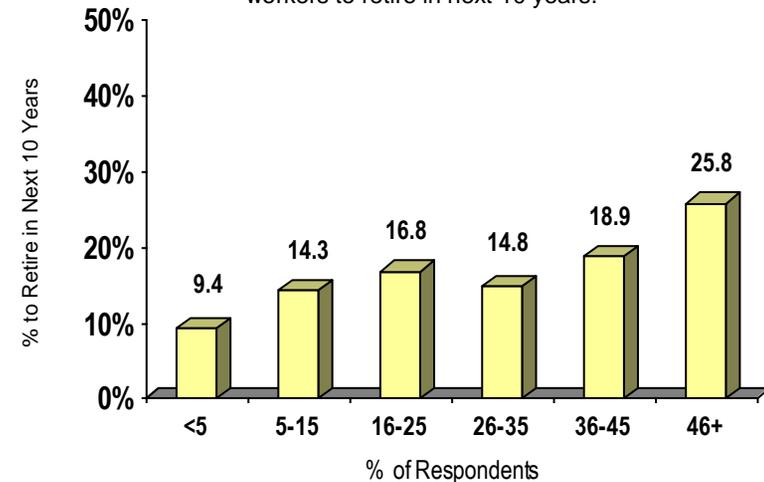
- ◆ The issue of 'aging workforce' has been on the minds of utility executives for many years, however, few companies have taken a proactive approach to address it within their ranks
- ◆ As a result, shortages in key portions of the workforce are starting to appear:
 - Underground engineers
 - System operators
 - Reliability coordinators
 - Transmission line engineers
- ◆ The industry is facing a huge infrastructure build in both transmission and generation at the same time shortages are beginning to appear in key engineering positions
 - In addition to the infrastructure build in the electric utility industry, other industries such as petrochemicals will draw on the skilled labor pool
 - While generation and petrochemical projects will not generally draw on the same types of skilled labor as transmission, implying that the current pools of labor are somewhat fixed, they will compete for new entries to the labor market
- ◆ An important consideration is the fact that the tight labor market is not only impacting utilities, it also extends to those companies to which utilities are contracting this work
- ◆ Because labor markets are largely regional, simultaneous projects will compete for a limited supply of workers
- ◆ As the labor markets tighten, these increased costs will force an escalation in the cost of transmission projects and maintenance. The analysis of transmission project costs indicates that this is already occurring

Aging Utility Workforce

- ◆ Close to 80% of utility workers are older than 40 years of age
- ◆ 2002 Nuclear Energy Institute study found:
 - Nuclear stations will require 29,000 replacement workers between 2002-2015
 - Nuclear industry suppliers will require 58,000 new workers between 2002-2015
 - Key shortages forecast in nuclear engineers, health physicists
- ◆ A 2006 survey by the Sierra Energy Group for Black & Veatch found:
 - Most utilities are addressing workforce development needs with traditional methods; little urgency
 - Most utilities believe aging workforce will increase labor costs 5-25%, but almost 1/3 expect no increase

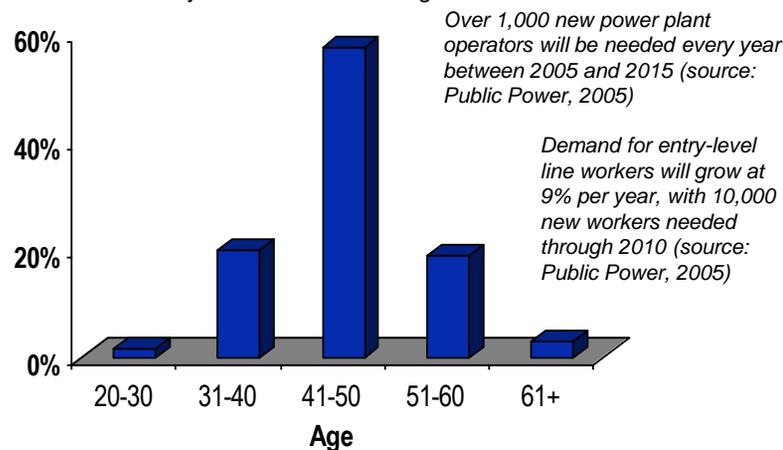
Percent to Retire in Next 10 Years

More than 25% of survey respondents expect 46% or more of workers to retire in next 10 years.



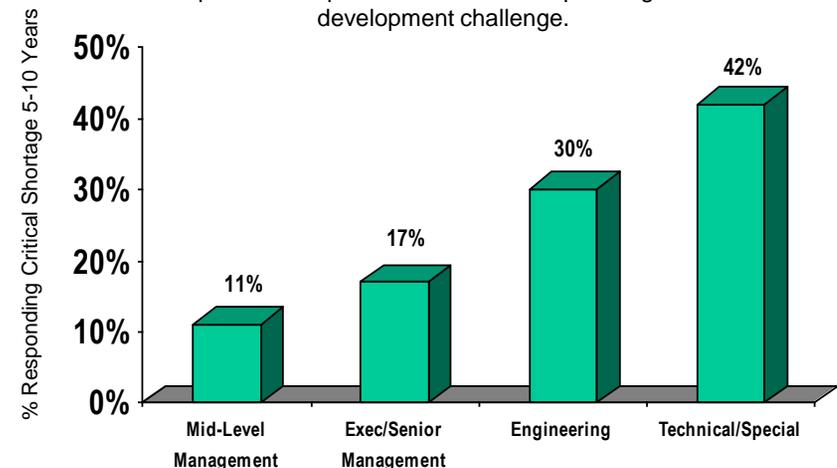
Average Age of Workers

Nearly 4 out of 5 are over age 40.



Shortages Most Critical in 5-10 Years

Tech/Specialists expected to be the most pressing workforce development challenge.



Engineering Labor Costs

Position	General Contractor Salary			Position	General Contractor Salary		
	2006	2007	%Δ		2006	2007	%Δ
Superintendent	75,496	80,319	+6.4	Sched. Engr. (Inexperienced)	47,621	55,644	+16.8
Asst. Superintendent	57,003	60,629	+6.4	Sched. Engr. (Experienced)	62,108	65,878	+5.7
Proj. Superintendent	88,315	95,237	+7.8	Sr. Sched. Engineer	77,274	81,963	+6.1
Proj. Mgr./Estimator	84,792	85,209	+0.5	Scheduling Mgr.	96,139	93,468	-2.8
Construction Mgr.	109,475	116,015	+6.0	Group Average			+6.5
Project Mgr.	91,821	95,437	+3.9	Contract Admin. (Inexperienced)	36,722	41,468	+12.9
Sr. Proj. Mgr.	120,840	N/A	N/A	Contract Admin. (Experienced)	45,659	55,886	+22.4
Group Average			+5.2	Sr. Contract Admin.	69,638	77,634	+11.5
Field Engr. (Inexperienced)	47,090	50,542	+7.3	Group Average			+15.6
Field Engr. (Experienced)	57,636	58,975	+2.3	Quality Control Specialist	56,763	58,758	+3.7
Chief Field Engineer	77,155	82,037	+6.3	Quality Control Mgr.	78,898	83,935	+6.4
Proj. Engineer	64,635	65,365	+1.1	Quality Control Safety Dir.	83,084	86,068	+3.6
Group Average			+4.3	Asst. Quality Control Safety Dir.	60,789	59,370	-2.3
Estimator (Inexperienced)	51,713	52,775	+2.1	Group Average			+2.9
Estimator (Experienced)	67,773	72,615	+7.1	Business Development Mgr.	93,625	111,725	+19.3
Sr. Estimator	89,815	95,407	+6.2	Business Development Dir.	122,351	147,019	+20.2
Chief Estimator	118,536	125,807	+6.1	Business Development Sales Rep.	60,153	65,154	+8.3
Group Average			+5.4	Business Development Acct. Mgr.	77,213	81,896	+6.2
Cost Engr. (Inexperienced)	45,944	49,165	+7.0	Human Resources Mgr.	78,942	83,773	+6.1
Cost Engr. (Experienced)	59,720	64,028	+7.2	Group Average			+12.0
Chief/Sr. Cost Engineer	77,821	78,703	+1.1	Total Average			+6.9
Cost Engineering Mgr.	100,220	104,625	+4.4				
Group Average			+4.9				

Source: PAS, Inc., quoted in ENR 6-26-06; 6-18-07

Observations:

- ◆ The largest one-year salary increases have occurred in the contract administration (15.6%) and business development (12.0%) areas
- ◆ On average, engineering general contractor salaries have increased 6.9% over the last year

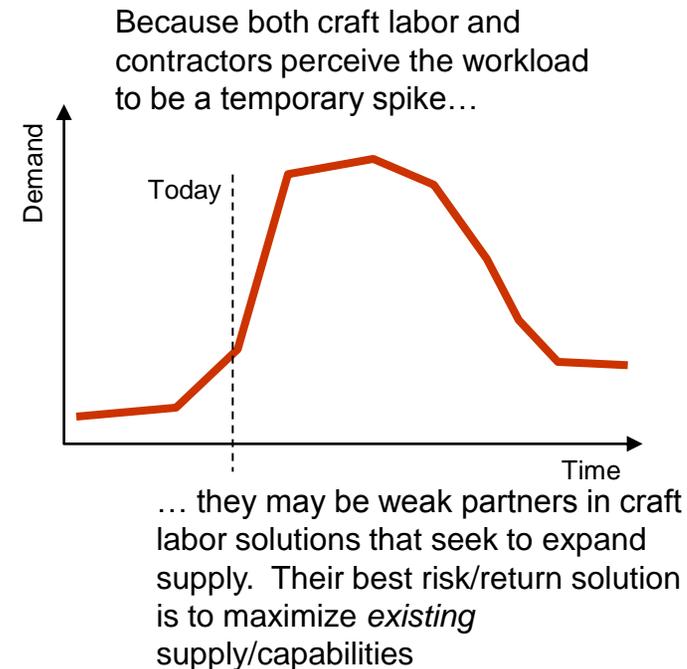
Why the Indirect Labor Challenge Matters to Utilities

The traditional approach to acquiring necessary indirect (i.e., craft) labor has generally been to rely on independent contractors to acquire workers from a deep and liquid pool; however, in the emerging craft labor market, contractors and labor supply sources may not, on their own, create solutions in time to meet utility needs.

Observations:

- ◆ Industry demographics are working against improvements in the supply of craft labor
- ◆ Craft-labor organizations are behaving in ways that fail to expand supply; seeking higher wages instead of higher aggregate employment
- ◆ Contractors (and suppliers) are behaving in ways that maximize use of existing capacity without expanding existing capacity

Hypothesis



Skilled Labor Costs

Hourly Union Pay Scales September 2006	20-City Average (\$/hr)	
	Rate	%Δ
Bricklayers	40.09	+3.4
Carpenters	39.35	+2.9
Cement Masons	38.02	+2.7
Electricians	47.88	+3.9
Elevator Constructors	50.38	+7.9
Glaziers	40.58	+3.6
Insulation Workers	43.99	+3.6
Ironworkers Reinforcing	43.00	+5.2
Structural	44.04	+4.2
Laborers Building	31.37	+4.5
Heavy & Highway	31.29	+3.8
Millwrights	41.48	+2.7
Operating engineers Crane Operators	42.50	+5.8
Heavy Equipment	42.15	+6.1
Small Equipment	39.11	+5.8
Painters	36.52	+2.7
Pipefitters	46.56	+5.1
Plasterers	38.22	+5.3
Plumbers	46.34	+5.6
Roofers	35.24	+4.5
Sheet Metal Workers	46.42	+3.7
Teamsters Truck drivers	34.48	+3.9

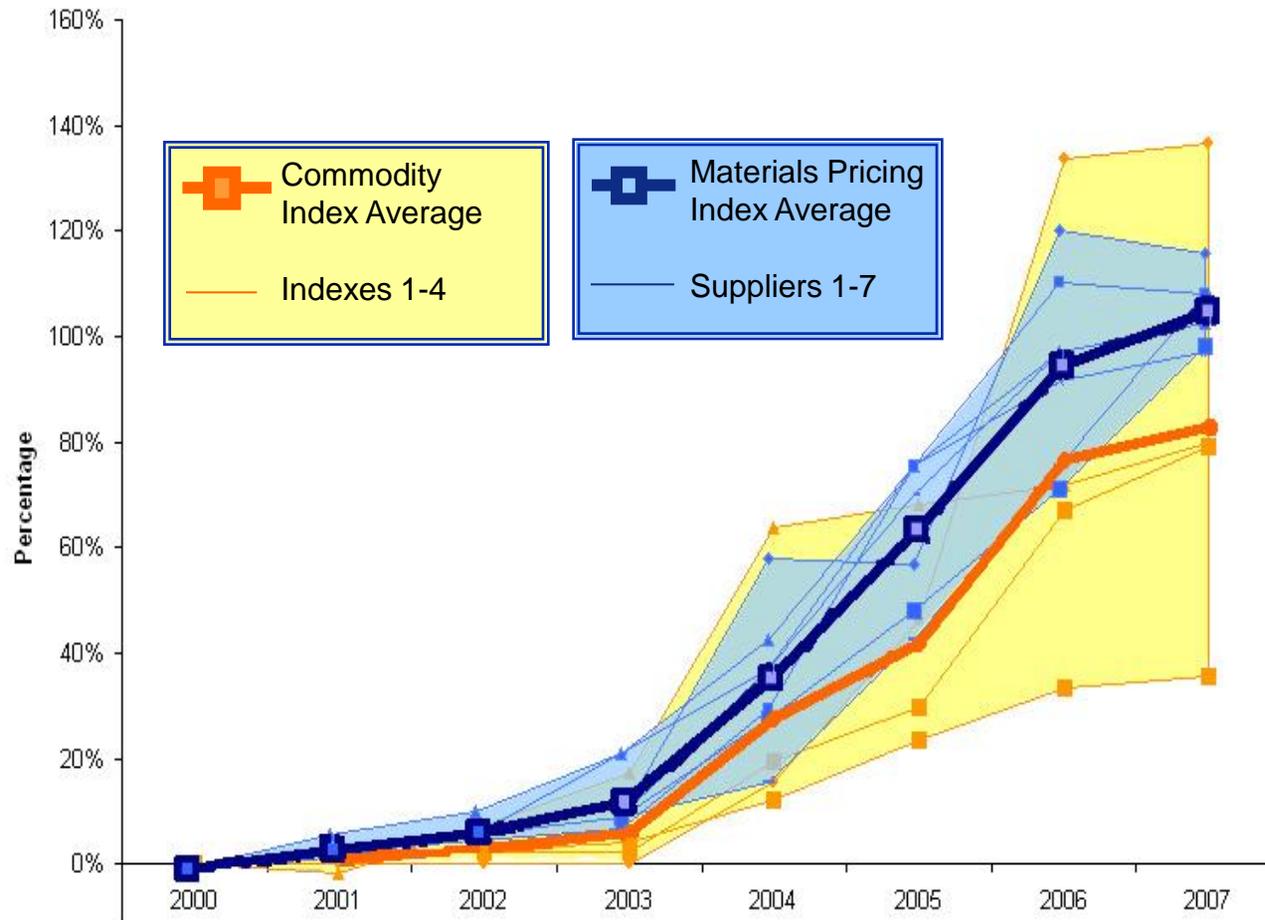
Source: ENR 9-25-06



Source: ENR 9-25-06

- ◆ Unemployment is at 5.9%, down significantly from the recent high of 7.4% in 2002
- ◆ 7.8 million blue- and white-collar workers are employed in the construction industry
 - Non-residential (industrial) employment increased 3.4%
 - Specialty employers accounted for 5 million workers

2. Materials Costs



- ◆ In an attempt to correlate the upward trend in the installed cost of large (≥ 345 kV) transmission projects with the upward trend in material cost escalation, ten major manufacturers of transmission products (conductor, large power transformers, steel structures, etc.) were polled regarding their pricing for these types of products since 2000. Seven of these manufacturers responded
- ◆ Using 2000 as a “base year” the product price trends received were compared to a group of BLS commodity index trends that include the iron and steel, aluminum, copper, and concrete product indices for the same period

Materials (Cont'd)

Observations and Conclusions:

- ◆ Commodity indices and product prices tracked very closely between 2000 and early 2004
- ◆ From 2004 through 2007 both the commodity indices and product prices escalated significantly
- ◆ While there is little measurable difference between the rate of escalation of the averages for the commodity indices and equipment prices, after 2004 the average increase in equipment prices led the average commodity increases by several percent
- ◆ The attraction of new technologies (e.g., smart grid technologies or undergrounding) can result in significant cost escalation when compared to traditional methods. For example, installation of underground cable costs anywhere from five to ten times equivalent above-ground installation, plus materials are in shorter supply

3. Regulatory and Stakeholder Factors

Inadequate regional planning processes

- ◆ Over twenty states have no established siting processes, leaving development in the hands of local authorities
- ◆ In RTO or bilateral markets, oblique or disorderly processes can increase the risk of unanticipated environmental or political opposition
- ◆ Transmission providers have frequently failed to get the story out about the need for, or benefits of, particular projects

Delays caused by regulatory and stakeholder challenges force project costs up.

- ◆ To the extent that materials are ordered but not used, the transmission builder accumulates carrying costs, which are unrecoverable in most cases
- ◆ If the purchase date is delayed, the cost of both materials and labor continue to increase through the delay period. If transmission line costs continue to escalate in the range of 10-15% per year, this escalation will have a significant impact on total project cost

Cancellation of projects leaves unrecoverable sunk costs.

- ◆ Significant work must be put into a transmission project prior to placing orders for equipment or issuing contracts for labor
- ◆ As regulatory and siting issues cause the cancellation or indeterminate delay of a project, the costs incurred in legal proceedings, environmental, consulting and design work may become unrecoverable

4. Land Acquisition Costs

Landowners are receiving higher levels of compensation.

- ◆ Transmission providers are sometimes required to pay not only for the cost of the land they acquire for right-of-way, but to compensate the owners of the land or adjacent land for the reduced value arguably due to the presence of a new transmission corridor

There are no more straight lines in transmission.

- ◆ Intervenors in the regulatory processes to challenge use of larger swaths of land in the right-of-way process, forcing up costs as utilities adjust line-routing to avoid areas of intervenor concern
- ◆ There are areas where transmission simply cannot be built (parks, other public areas), and transmission builders must eventually site a much longer line that avoids certain restricted areas or to entertain the possibility of undergrounding the facilities

Mitigating Factors

- ◆ The trends in cost escalation discussed make generalized assumptions across the United States. There are factors which could increase or decrease the escalation rate of the four primary cost drivers
- ◆ Examples of potentially mitigating factors appear below:

Cost Driver	Mitigating Factor	Potential Impact
Labor	◆ Region	◆ Certain regions, such as the Southeast, are experiencing labor shortages. Areas with high unemployment may be less impacted and may see a slower rate of labor cost escalation
	◆ Labor agreements	◆ To the extent that these are available, long-term contracts with suppliers which restrain escalating costs help stabilize labor costs
	◆ Proactive union negotiations	◆ When unions have the right incentives, they may be able to assist in filling the skilled labor pipeline and helping to train the needed workforce
	◆ Training programs and relationships with trade schools	◆ In some regions, utilities have taken a proactive approach to working with local high schools, trade schools, and universities to develop a pipeline for future workforce needs (both direct and indirect)
	◆ Management of attrition	<ul style="list-style-type: none"> ◆ Some companies are working to keep their existing workforces through the use of part-time employment and contract positions for retirees ◆ Knowledge transfer programs can also help mitigate the impact of attrition

Mitigating Factors (Cont'd)

Cost Driver	Mitigating Factor	Potential Impact
Materials	◆ Long-term supplier relationships	◆ Suppliers will tend to focus resources on customers who have been loyal, not necessarily the 'spot buy' customer, unless there are excess resources and/or there is a large premium
	◆ Cost containment	◆ Skilled project management can help anticipate shortages, lead times and ensure access to key materials
	◆ Project planning and forecasting need	◆ Given the queues for certain materials (e.g., large transformers), identifying needs and ordering early will be key
Land	◆ Regional cost	◆ Much of the land acquisition cost will be dictated by the cost of land in the region and level of urban development
	◆ Historical precedent	◆ To the extent that precedents have been set with regard to severance payments to landowners, the ability of landowners in future cases to obtain ever-increasing compensation may be limited
Regulatory & Stakeholder	◆ Streamlined state siting process	◆ For projects located in states with straightforward, quick siting processes, costs due to regulatory delays may be mitigated
	◆ Streamlined internal siting and stakeholder management process	◆ The more proactive a company is in managing the stakeholder involvement process in siting, the more this risk can be reduced (i.e., GTC/EPRI siting methodology) ◆ Both ATC and NU have shown how proactive stakeholder management can pay off for everyone

Transmission Versus Generation Costs

Will the rate of transmission cost increase surpass that of generation cost increases?

- ◆ 1st Scenario – the rate of increase of transmission costs surpasses that of generation; transmission makes up a larger part of the bill
- ◆ 2nd Scenario – the rate of increase of transmission costs keeps pace with the increase in generation costs; the entire bill increases and transmission and generation maintain their existing proportions
- ◆ 3rd Scenario – the rate of generation cost increases surpasses that of transmission; transmission becomes a smaller part of the bill

The level of uncertainty surrounding the build out of generation makes this nearly impossible to predict.

- ◆ While nearly all NERC regions need to build significant amounts of generation, uncertainty around climate change regulation has begun to shift the debate
 - Location-constrained clean energy resources will require major grid expansion
 - Generation investment between now and 2030 could reach \$500 billion, while optimal transmission investment may be less than half that amount (Brattle Group)

Conclusions

- ◆ The “direct” costs of transmission system construction have risen dramatically, especially in the last three years (Brattle Report)
- ◆ Total costs of the linear portion of transmission installations have risen very sharply since 1999, as measured in total installed costs per circuit mile
 - Driven partially by the elimination of the “low hanging fruit”
 - Driven partially by higher costs associated with the “non-direct” costs of transmission construction. For many projects “direct” costs may be only about 50-60% of total costs
- ◆ If a company uses historic costs as a basis for future estimates, they will likely underestimate the cost of a new project dramatically
 - Brattle reports that “direct” costs increased at a rate 4X faster than the GDP deflator over the past three years
- ◆ The supplier base is straining to keep up
 - Construction and engineering firms are working with universities, unions, and “career colleges,” struggling to just replace attrition, let alone expand the workforce
 - Lead times are longer than just a few years ago
- ◆ Suppliers are also trying to determine how long this period of high transmission investment will last
 - They are likely to look for confirmation that a new spending cycle is “real” before expanding capabilities
 - Currently, skilled labor is in a position to extract scarcity rents until or unless new labor resources enter the market

Implications

- ◆ Suppliers are willing to bid for new work, but don't expect them to be the aggressive bidders they were three to four years ago
 - Their prices will be higher
 - They are unlikely to shoulder uncompensated risk
 - Risks they do agree to bear will be fully priced, and then some
- ◆ The combination of rising costs and larger overall investment suggests that the transmission component of the average bill could rise
- ◆ Historical context in other industries suggests that “no tree grows to the sky” in terms of cost escalation
 - Attempt to “see through” the escalation occurring now to the new plateau of costs