DISCUSSION AND EXAMPLES OF ENTRY BARRIERS IN THE ELECTRICITY GENERATION MARKET

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EXAMPLE AND DISCUSSION OF ENTRY BARRIERS IN THE ELECTRICITY GENERATION MARKET

SECTION 1
INTRODUCTION

The electric utility industry in the U.S. has been undergoing gradual deregulation since the mid-1980s. The purpose of deregulating electricity generation is to encourage new entrants, under the premise that this will prompt both improved service and lower cost. Analogous experience with deregulation in industries such as telecommunications and airline transport, and the constant influx of new entrants in information technology suggest unfettered access by new players is key to achieving these ends.

In practice, the number of new entrants providing power generation has lagged the expectations of many observers. Kwoka (2008) has described from a fundamental economic viewpoint some of the key barriers to entry to power generation. This paper provides a real-world complement to the work of Kwoka, showing how various entry barriers in the electricity generation market have asserted themselves to discourage, if not prevent, new entrants.

The observations are most evident in the case of coal-fired generation. As widely reported, for the period from about 2006 through early 2008, plans for almost 60 coal-fired units have been abandoned or delayed. Environmental issues, particularly CO\textsubscript{2} emissions, receive the most attention for delays and cancellations, with escalation in capital cost also a factor. Conversely, natural gas fired power plants – the generating method of choice for both existing operators and new entrants in the early years of this century – have not encountered the same barriers. However, natural gas fired plants – although important to the U.S electrical generating infrastructure – serve a limited

\footnote{The open-source website “Sourcewatch” (www.sourcwatch.com) reports 59 proposed coal-fired plants have been cancelled, identifying concerns for CO\textsubscript{2} emissions a major factor.}
need. Plants that operate in baseload duty, such as those based on combined cycle
design, produce power at a price strongly related to natural gas cost. Consequently,
the power produced is susceptible to price volatility. Also, natural gas power plants
that operate in cycling duty – such as many simple cycle units – cannot economically
provide baseload capacity. Thus, although this category of generating equipment is
important to the U.S. power infrastructure, coal-based generation remains the
backbone, and is considered an important example.

This paper first overviews the power station permitting process. A discussion of how
four categories of entry barriers affect the timing and prospect of new generation is
subsequently presented. Finally, observations are offered based on a discussion of
selected plants cancelled. Not all plants that are reported as cancelled are addressed
in this document – the discussion mostly references cases for which material is readily
available. A more complete discussion of coal-fired plants planned and canceled can
be found in the open literature (NETL, 2008, and Sierra Club, 2008)
Securing environmental permits for a new power station is a process fraught with uncertainty. This discussion will consider as an example the case of fossil fueled systems, most notably coal.

As recently described by a veteran permit writer, the task of preparing an environmental permit application requires 4 to 8 months, and subsequently working with various state agencies to secure the permit requires an additional 12 to 18 months. Then, an additional one to three years (or more) can be required to attempt to resolve the lawsuits (Blankenship, 2008).

Numerous federal, state, and local agencies are involved in issuing permits for airborne emissions, water and liquid effluents, waste heat, and solid byproducts for a new coal-fired power station. State and local agencies invoke their right to require control of various emissions or effluents beyond that mandated by federal regulators. This is achieved by the application of best available control technology (BACT) for each major emissions species or effluent. The uncertainty lies in the definition of BACT – which depends on the details of each application, as determined by the site, fuel type, and other factors. As a consequence, the definition of BACT for any given plant is not always clear, and evolves over time – both federal and local environmental authorities exercise their mandate to continuously make BACT stricter.

Securing environmental permits for a new plant requires several steps. The process for each specific plant is different, but shares the same general steps. First, the proposed generating site is selected based on, among other factors, access to local power markets, transmission corridors, coal suppliers and transportation, and cooling resources. Second, a conceptual plant and environmental control system design is developed – specifying the targeted emission limits, using general information describing BACT in the public domain, and experience with evolving environmental controls. This conceptual design provides the basis to engage regulatory agencies regarding BACT. In parallel, steps to secure financing are conducted – which vary depending on whether the prospective developer is an investor owned utility (IOU), public entity, merchant owner, or another class of ownership.
Third, the environmental and operating permits are filed, initiating the approval process. A more specific, detailed design is developed, considering all site and field constraints. The approval process invariably involves the exchange of information between the agencies and prospective developers, and includes public participation and comments. If the prospective owner is successful in satisfying the needs of the agency, the permit is issued.

Almost without exception, a fourth phase begins – starting with legal action by interveners or petitioners to oppose the permit. Depending on the state, the method to intercede with the permit varies widely – requiring as a minimum a detailed review by a federal or state environmental board, or a trial heard by an administrative law judge to review the merits of the permit. As noted previously, this final step can last one to three years – and in at least one case the delays have extended beyond that. If the issued permit survives this last phase, and financing can be secured, construction can initiate.
SECTION 3
DISCUSSION OF ENTRY BARRIERS

There are four major categories of entry barriers in electricity generation. These are (a) traditional economic or cost basis, (b) regulatory approval, (c) demand and cost uncertainty that inhibit investment, and (d) evolving or changing policy for regulatory and/or environmental issues. Table 1 summarizes for each barrier category an explanatory observation or comment, and includes specific examples of units deferred or canceled.

Traditional Economic Barriers

Traditional economic barriers stem from strong economies of scale for coal-fired power generation equipment, which encourages building large units. A coal-fired unit designed to be competitive will feature a large generating capacity and high unit cost (e.g. $/kW) that translate into significant capital investment. The DOE estimates the capital cost for a new coal-fired unit, as published in 2007, to be almost $1,600/kW (DOE, 2007). Accordingly, a modest sized 500 MW unit will require $800M in capital; the commonly proposed 600-800 MW plants can require $1-1.3B. Investment of this magnitude favors developers with ready access to capital. Further, as will be discussed subsequently, this required capital cost is escalating rapidly – rendering some projects economically infeasible by the time environmental permits are issued and financing is sought.

Regulatory Approval Barriers

The process for securing a permit from the state public utility commission (PUC) and various state and local environmental agencies can pose a major barrier. State PUCs may not accept the developer’s determination of need for a new unit, in lieu of

2 As to be discussed subsequently, capital costs for power generation equipment are escalating rapidly. The role of escalation, as well as differences in equipment scope and how financing is treated, serve to confound comparing plant cost estimates from various sources, such as DOE and the Energy Information Agency. Accordingly, capital cost estimates cited by Kwoka (2008) and other sources will differ.
alternative options such as conservation or demand-side management. As discussed in the preceding section, securing the permit from the permitting authority is only a first step – almost without exception, interveners or petitioners act to overturn the permit, or otherwise stop construction.

The regulatory approval barrier addresses environmental mandates for which regulations are in place – such as emissions of SO₂, NOₓ, particulate matter (PM), and trace species such as mercury (Hg) and sulfur trioxide (SO₃). Mandates to limit CO₂ emissions, if adopted, would be imposed by proposed or pending legislation, or an executive order by a governor, and are discussed in a subsequent section.

Table 1. Summary of Barriers and Selected Specific Examples

<table>
<thead>
<tr>
<th>Category</th>
<th>Specific</th>
<th>Comment</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional:</td>
<td>High Initial Investment</td>
<td>Economies of scale, high capital, long lead time</td>
<td>Developers need good access to capital</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cliffside Unit 2, Excel IGCC, Buffalo Energy Partners</td>
</tr>
<tr>
<td>Regulatory Approval</td>
<td>Receiving permit, and permission to initiate construction</td>
<td>Legal challenges after permit approval and issuance have stopped several projects.</td>
<td>AEP/OG&amp;E Red Rock, APC Mountaineer, Bull Mountain, Duke Cliffside 2, Great Northern, Excelsior Energy, Indeck, Thoroughbred, Prairie State.</td>
</tr>
<tr>
<td>Escalation of Initial Capital Cost, Power Demand Uncertainty</td>
<td>Strong demand for world-wide services in engineering and materials has escalated costs.</td>
<td>Some projects have incurred escalation of initial capital by 70%.</td>
<td>Agrium, AEC Norborne, Alcoa, LS Power, Radar Acquisitions, Tondu, Southwestern Power.</td>
</tr>
<tr>
<td>Environmental Uncertainties, Technical</td>
<td>Lack of confidence in a 30-40 year time horizon for economic or regulatory certainty.</td>
<td>Most units in this category were canceled due to prospects for CCS.</td>
<td>OUC/Southern Co, Seminole, JEA, FP&amp;L, Tampa Electric, PacifiCorp, Sunflower, Energy NW, Dynegy/LS Power, RG&amp;E/Energy East, Xcel</td>
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Demand, Cost Uncertainty

Power generation ventures have, perhaps more than any other category of project, experienced escalating capital cost. This trend – prompted by strong world demand for basic construction materials and engineering and construction services – has introduced uncertainty into the economics of essentially all power generation projects. The demand for engineering, materials, and construction services required for power generation has escalated significantly since the year 2002. As an example, Figure 1 presents the escalation since the mid-1990s in a widely used cost index reflecting commercial process plants and power stations (Chemical Engineering Plant Cost Index). Even modest increases in capital cost over the basis upon which project finances are initially calculated – by 5-8% - can threaten the economic viability.

As the following discussion of specific examples notes, capital cost can escalate so much from project proposal to alter the economic feasibility, or prompt regulatory bodies to disallow such investments. Notably, Duke Energy recently announced the capital cost of their planned Edwardsport integrated gasification/combined cycle (IGCC) project as of May, 2008 to be equivalent to $3,700/kW. This capital requirement is well above early project estimates, and is approximately twice the cost projected by DOE (2007) for this category of generating equipment. Further, the advanced pulverized coal-fired unit proposed by Tenaska, which may be equipped with postcombustion CO₂ control, could require up to $3 billion for a 600 MW generating capacity – equivalent to approximately $5,000/kW (Energy Daily, 2008)

The escalation in new generating equipment capital cost was the topic of a July, 2008 presentation by the Federal Energy Regulatory Commission (FERC) Enforcement Office to the FERC commissioners (FERC, 2008). Figure 2 presents for several categories of generation equipment the range in cost observed in 2008 versus an earlier timeframe of 2003-2004. As noted by FERC staff, the reported costs must be considered approximate due to differences in scope, financing, and how charges such as allowance for funds used during construction are treated. Regardless of these limitations, this cost summary assembled by FERC staff clearly shows capital costs are escalating rapidly.

Examples of generating units cancelled due to escalating capital cost are discussed in a subsequent section of this paper.

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3 www.Che.com
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Figure 1. Increase in Chemical Engineering Cost Index: 1994-2007

Figure 2. Escalation in New Unit Generating Cost: 2008 vs. 2004/2004 (FERC, 2008)
Other Uncertainty Sources: Regulatory, Environmental Policy, Contractor

Additional uncertainties not addressed in prior discussions include energy policy, ability to secure cost recovery, future environmental requirements not presently mandated but anticipated, and uncertainty of next-generation equipment to perform as guaranteed. Of these, perhaps the most significant is prospects for CO$_2$ limits, presently not mandated but widely believed inevitable.

This category of barriers is best described by considering the specific cases examples in Section 4.
The proposed plants that encountered the entry barriers summarized in Table 1 are discussed in more detail in this section. Most plants were cancelled or delayed for more than one reason. Accordingly, assigning any one barrier as the principle cause for project delay or cancellation is somewhat arbitrary. Keeping this in mind, the discussion of real-world examples is illustrative.

Traditional: High Investment Cost

The following projects were cancelled reportedly due to (among other factors) high initial investment:

**Duke Energy Cliffside.** Duke Energy initially proposed two 800 MW coal-fired units as an expansion to the Cliffside site; escalating capital costs prompted the North Carolina Public Service Commission to approve only one unit. Further, the Commission challenged Duke’s assessment that both units were needed; the Commission believed at least some of the demand for a second unit could be provided by conservation. This decision can be as much attributed to regulatory uncertainty as to capital cost barriers.

**Buffalo Energy Partners.** High capital cost is cited as a key reason this IGCC plant planned for Wyoming has been cancelled. A second reported reason is that suppliers offered technology guarantees the prospective developer viewed as limited in scope, contributing to uncertainty.4

**Xcel IGCC.** Excel’s planned 600 MW IGCC plant for Colorado has been indefinitely deferred, due to high initial capital cost, and uncertainty over the market for power.5

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5 Clean Coal Plant Would Have Been a First”, Denver Post, October 31, 2007.
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Regulatory Approval

Regulatory agencies must certify the need for additional capacity (in a regulated environment) and determine environmental controls and emission limits.

Regarding additional capacity, as previously discussed the need for Duke Energy’s second Cliffside unit was challenged by the state PUC. Similarly, the Minnesota PUC denied that ratepayers in Minnesota should be required to purchase power from the proposed Excelsior Energy IGCC-based generator. Similar to North Carolina, the PUC questioned the need for power, compromising the basis for power supply contracts and financing.6

Regarding environmental issues, projects delayed or cancelled due to an inability to expeditiously acquire a permit are:

American Electric Power and Oklahoma Gas & Electric proposed the coal-fired Red Rock Station, which was ultimately rejected by the Oklahoma Public Service commission (PSC), who ruled the developer did not adequately consider alternatives such as natural gas-fired sources.7

Appalachian Power Company/Mountaineer. The Virginia State Corporation Commission (SCC), in considering the permit for a new IGCC unit at the Mountaineer station, ruled the plant was neither reasonable nor prudent, claiming cost projected by Appalachian Power Company (APC) did not reflect market conditions. APC and the SCC also differed on the cost to equip the proposed unit with carbon capture and storage (CCS) capability. In a reversal of usual practice, the office of the state attorney general estimated the cost to equip the proposed unit with CCS was greater than estimated by APC. Consequently, the SCC decision prevents APC from being able to recover costs from Virginia customers, challenging project viability.8

Bull Mountain/Roundup. Plans by Bull Mountain to develop a coal–fired generating unit near Roundup, Montana have been stayed as a state hearing officer revoked the

permit issued by the Montana Department of Environmental Quality (DEQ). The state ruled the DEQ used an improper process to issue the permit, and rendered the permit null and void, requiring the developer to restart the process.9

Dynegy and LS Power proposed a 500 MW coal-fired generating unit plant in West Deptford, New Jersey. Opposition based on environmental concerns prompted the developers to abandon coal and utilize natural gas.

Great Northern Power/South Heart. The air permit for this proposed 500 MW South Heart project in North Dakota as been withdrawn by the developer, due to objections by the National Park Service and numerous local agencies concerned for the possible impact of the plant on the nearby Theodore Roosevelt National Park. Actions to date suggest securing the necessary permits will be protracted and uncertain. Uncertainty in the local power market is also cited as a contributing factor to canceling the project.10

Indeck Energy Services/Elmwood. This independent developer received an initial permit in 2003 for the proposed Elmwood 600 MW coal-fired unit. The permit was eventually deemed inadequate and overturned by the Illinois Environmental Appeals Board; since this action the developer has cancelled the project.11 The proposed location of the plant – about 50 miles from Chicago and near the Midewin National Tallgrass Prairie – attracted many opponents. This uncertainty in obtaining a permit was likely the major contributor to rendering the project infeasible.

NRG. NRG and the New York Power Authority cancelled plans to build a 680 MW IGCC unit at the 90 year old Huntly Generating Station in Erie County. The project, which received considerable local support, was to be partially funded by New York State. Costs escalated beyond those projected in December of 2006 to where private and government funds were inadequate.

Peabody Energy Thoroughbred. Peabody Energy’s development subsidiary proposed twin 850 MW capacity units in Kentucky, for which construction permits were issued in December of 2003. Interveners filed a suit in 2004 which prevented construction. An administrative law judge ruled against the developer; this decision was overturned by the Kentucky Secretary of the Environmental and Public Protection Cabinet with

10 Dakota Counsel, August, 2007.
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minor changes to the permit. However, this decision is once again challenged by the same interveners through appeal; the delay is approaching 5 years.

Peabody Energy Prairie State Energy Campus. The same developer secured a permit for similar twin 850 MW coal-fired units in Illinois. Intervention by parties through the Illinois Environmental Appeals Board slowed but did not halt the project. Construction commenced in 2007.

Rochester Gas & Electric/Energy East. The developer elected to abandon plans to construct the 300 MW IGCC Russell station in Greece, NY, based on environmental concerns. The developer will instead opt for a natural gas-fired unit.¹²

Demand, Cost Uncertainty

Escalating capital cost beyond the initial estimated investment is cited as either partly or wholly responsible for the following delays or cancellations:

Agrium. This owner of a fertilizer production plant in Alaska cited escalating capital cost as the principle reason for canceling an IGCC unit to provide synthetic natural gas as fertilizer feedstock, and generate power.¹³ Investment beyond that originally planned reportedly complicated financing, and reduced the payback of using synthetic gas for fertilizer production.

Alcoa. This aluminum manufacturer proposed a 950 MW IGCC plant adjacent to a smelter facility in Maryland, at the former Navy Indian Head Naval Base. Escalating costs – by 70% since the initial proposal – reduced the value of the project to aluminum production.¹⁴

Associated Electric Co-Operative (AEC) Norborne. The projected cost for this proposed 600 MW merchant coal-fired plant in Missouri increased significantly over the three year planning stage, to more than $2 billion due to “…worldwide demand for engineering, skilled labor, equipment and materials”. The elevated cost combined with concerns for prospective CO₂ limits complicated financing. AEC withdrew the

project and will explore options to increase energy efficiency, and consider power from natural gas, renewable, or nuclear sources.\(^\text{15}\)

At least two proposed coal-fired plants in Colorado were terminated or cancelled in 2008. The developers are LS Power (High Plains Energy Station) and Radar Acquisitions (Buick Coal and Power). The specific reasons for canceling these projects were not disclosed.

\textbf{Southwestern Power,} in Arizona, citing regulatory uncertainties affecting CO\(_2\) and cost, abandoned plans for the 600 MW Bowie IGCC unit instead opting for a natural gas-fired generator.\(^\text{16}\) In addition to regulatory uncertainty, market economics were cited as a factor to switch to a natural gas-fired unit.\(^\text{17}\)

Tondu has abandoned plans to construct in Texas the Nueces IGCC unit, altering their proposal to pursue a natural gas–fired combined cycle, citing elevated construction costs and lack of performance guarantees.\(^\text{18}\)

\textbf{Other Uncertainties: Regulatory, Environmental Policy, Technical}

Perhaps the most significant of the barriers to entry is the prospect for CO\(_2\) control. The possibility of action by the U.S. Congress imposing a CO\(_2\) “cap”, or actions by individual states, has affected numerous proposed projects, prompting cancellation or conversion of coal-fired units to natural gas. In the past year, the governors of New York (Spitzer), California (Schwarzenegger), and Florida (Crist), as well as senators from Connecticut (Liebermann) and Arizona (McCain) have stated coal-fired plants must control CO\(_2\) emissions; accordingly developers are understandably uncertain.


\(^{18}\) Sierra Club national website (www.sierraclub.org/environmentallaw/coal/plantlist.asp)
Most notable is the cancellation of several units in Florida, in response to concern the governor would issue an executive order mandating carbon capture. Specifically:

**Florida Power & Light (FP&L).** The Florida Public Service Commission denied the permit for FP&L’s proposed 1960 MW Glades Power Plant, citing among other factors uncertainty in carbon regulations.\(^{19}\)

**Jacksonville Electric Authority (JEA) Taylor Energy Center.** The plants joint developers, JEA, Florida Municipal Power Agency, Tallahassee, and Reedy Creek Improvement District, suspended plans for an 800 MW coal–fired unit that, although using state of art technology, would be subject to concerns for CO\(_2\).\(^{20}\)

**Orlando Utilities/Southern Company.** The planned IGCC unit at the Stanton station was cancelled due to concerns over prospective CO\(_2\) limits. An executive order from the governor’s office was anticipated to require CCS, which in the opinion of the developers “raised the level of risk” for the project.\(^{21}\)

**Seminole Electric.** Seminole Electric withdrew plans for the 750 MW Seminole Unit 3, based on a perceived imminent executive order by the governor to mandate CCS.

**Tampa Electric Polk Unit 6.** The 632 MW proposed IGCC Unit 6 was cancelled, based on uncertainty for CO\(_2\) regulations in Florida, and the consequences for the ultimate cost for the project.\(^{22}\)

Separate from Florida, other units succumbing to pressure due to CO\(_2\) emissions include:

**PacifiCorp.** Two new units proposed for Wyoming’s Jim Bridger Station – a 527 MW pulverized coal addition and an IGCC unit with a CCS demonstration – were cancelled. A company spokesman cited the “…significant amount of uncertainty

\(^{19}\) Florida PSC website, June 5, 2007
\(^{20}\) Taylor Energy Center to Suspend Permitting Activities”, City of Tallahassee (tal.gov.com), July 3, 2007
about what climate change regulation might do to the cost of coal plants” as a major factor.\textsuperscript{23}

\textbf{Sunflower Electric Power Co-Operative.} The proposed 1400 MW Holcomb Units 1 and 2 were denied a permit by the Kansas Department of Health and Environment, based on concerns for CO\textsubscript{2} emissions. This decision, described as arbitrary by the project developer and a group of legislators within the Kansas legislature, is being challenged in court.\textsuperscript{24}

\textbf{Energy Northwest.}\textsuperscript{25} The proposed 793 MW IGCC unit in Washington state, Pacific Mountain Energy Center, was designed to permit carbon sequestration, once the technology becomes economically feasible. State regulators denied a permit because the development plan did not meet a new state law’s requirement to limit emissions.

\textbf{Xcel Energy} cancelled an IGCC plant planned for Utah suggesting technical uncertainty had a role. Excel reported their power generation choices “won’t include a cutting-edge plant (IGCC) until at least 2016”.\textsuperscript{26}

\textsuperscript{24} Power Plant Rejected Over Carbon Dioxide for First Time, Washington Post, October 19, 2007; page A01
\textsuperscript{25} “Power Plant to Drop New Coal Technology,” SpokesmanReview.com, December 23, 2007/
SECTION 5

COMMENTS ON NON-FOSSIL ASSETS

This discussion of barriers to entry for new generators has addressed solely fossil fuel assets; however non-fossil assets such as nuclear power and renewable technologies should not be ignored.

Nuclear Generation

A combination of several factors has historically excluded new entrants from providing nuclear generation, mostly capital cost and a regulatory environment that for several decades has been hostile to proposed new construction. However, the Nuclear Regulatory Commission (NRC) recently streamlined the process for licensing and permitting a nuclear generator, while the Energy Policy Act of 2005 has eased the financial burden through tax incentive, and loan guarantees. The NRC reportedly anticipates applications for 12 new reactors within the next several years, and up to 15 more after that time period. Developers are presently proposing 47 new reactors, with proposals in various stages of development (Burt, 2008).

Numerous factors can prevent new entrants from owning and operating nuclear power generation facilities. Nuclear facilities require complex operations on a day-to-day basis, and require extensive engineering efforts to secure permits and approval from the NRC. The latter requires successfully navigating numerous regulatory hurdles and safety procedures, a task that has eliminated all but a few qualified operators in the country. Both this demand for specialized, dedicated expertise and the significant capital cost have served to limit the number of new entrants. Further, existing nuclear plant operators have an advantage they can exploit – the option to add a new unit at an existing nuclear generating site, leveraging the existing infrastructure and safety features.

Capital cost estimates for nuclear plants – similar to coal-fueled units – are escalating in response to a demand for labor, equipment, and material. Figure 2 presented previously shows nuclear generating facilities are subject to the same cost pressures as fossil-fuel units. This escalation in capital cost is a major barrier to new entrants.
Renewable Generation

In 2006, over 5,000 MW of renewable-fueled projects “broke-ground” for construction. Further, over 80,000 MW are planned to initiate construction between 2008 and 2012, with most of these (87%) wind power (Burt, 2008). Capital costs for these facilities are high, but a combination of government subsidies through either direct grants or tax breaks, and the availability of venture capital is compensating for the usual capital barriers. It is not clear how long the offsetting subsidies compensating for high capital cost will be available.

In contrast to nuclear and fossil power, new entrants may provide a more significant role in renewable power generation. These entrants are enticed by significant growth rates (albeit from a small base) and the present interest in carbon-free power generation. A case in point is the story of Zilka Renewable Energy. This organization, which evolved from a father-and-son team in 1998, was acquired in 2005 by Goldman Sachs, and subsequently sold in 2007 to Energia de Portugal, a major Portuguese utility. The consequence of these transactions was to transform an authentic father-and-son operation to a major international utility, but an outsider to the U.S. market. There are analogous cases with solar and geothermal generation.

New entrants will likely continue to play a significant role in renewable power generation, particularly in the fast-growing solar “space”. These renewable projects provide an important role, but their contribution to total power needs of the U.S. remains small. Also, Figure 2 presented previously shows renewable generating equipment is not immune to escalating costs.
SECTION 5

OBSERVATIONS

The case of coal-fired generation provides numerous examples illustrating the role of barriers to new entrants, as well as to existing operators that plan to build additional units.

The record of cancellations suggests that some project developers, depending on their experience, may not anticipate the regulatory delays and capital cost barriers associated with coal-fired generation. Of the coal-fired generating units that were successfully permitted and are currently under construction, none are developed exclusively by coal-based developers. Developers for which prior experience is limited to natural gas may not have appreciated the complexity, or the resistance encountered, to a coal-based project.

This observation does not imply a lack of competence or readiness – well-established generators such as Southern Company, Florida Power & Light, Excel Energy, Tampa Electric, and PacifiCorp have terminated plans for coal-based generation. However, new entrants such as Agrium, Buffalo Energy Partners, Bull Mountain, Great Northern Power, Southwestern Power, and Tondu have acquired most of their experience in the natural gas-fired generation. As a consequence, these developers may not have fully appreciated the required investment and resistance to coal-fired projects. Further, the inability to procure satisfactory, meaningful guarantees for strict emissions control targets from equipment suppliers is another aspect perhaps not anticipated based on experience with natural gas-fired units.

Currently, two factors are particularly important in preventing new entry – and neither show signs of abating soon. These are the rampant escalation in capital cost, and the prospects for CO\textsubscript{2} emission limits. Both factors will influence the reliability of the U.S. power generation infrastructure for years to come.
**Author, Date** | **Reference** |
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