



ACR Powering Alberta White Papers

The white papers are intended to provide high-level overviews of industry perceptions, concerns and aspirations regarding the policy and regulatory climate as the transition unfolds. The perspectives reflect priorities from both producers and consumers of electric power. The white papers do not presume to present prescriptions or recommendations for success, rather they are an invitation to all stakeholders to engage in effective dialogue. The odds for a successful transition are greatly increased when all the players – government, regulators, operators and consumers – are contributing expertise, wisdom and commitment at every step. Each white paper presents perspectives leading up to a summary “Key Points – for Further Dialogue”.

Included in this package are four White Papers:

Paper #1 | Powering Alberta - Overview

Paper #2 | Maintaining Investor Confidence

Paper #3 | Learning from the Experiences of Other Jurisdictions

Paper #4 | Planning an Orderly Transition

Powering Alberta - Overview

In early 2016, responding to shifts in societal values at the provincial, national and international levels, the Government of Alberta mandated the elimination of coal-related carbon emissions, effectively setting a course to retirement of the present coal generation capacity by 2030. That capacity is to be replaced by biomass, wind, solar, geothermal, hydro generation, etc. (“renewable generation”) plus natural gas generation. This is an ambitious change agenda with considerations of technological change, investment attraction and construction logistics. Figure 1-1, System Load and Available Energy, illustrates the transition. The red line shows the anticipated load (expressed as annual total energy load) with coal starting to ramp down in 2019 and new renewables and new gas starting to ramp up.

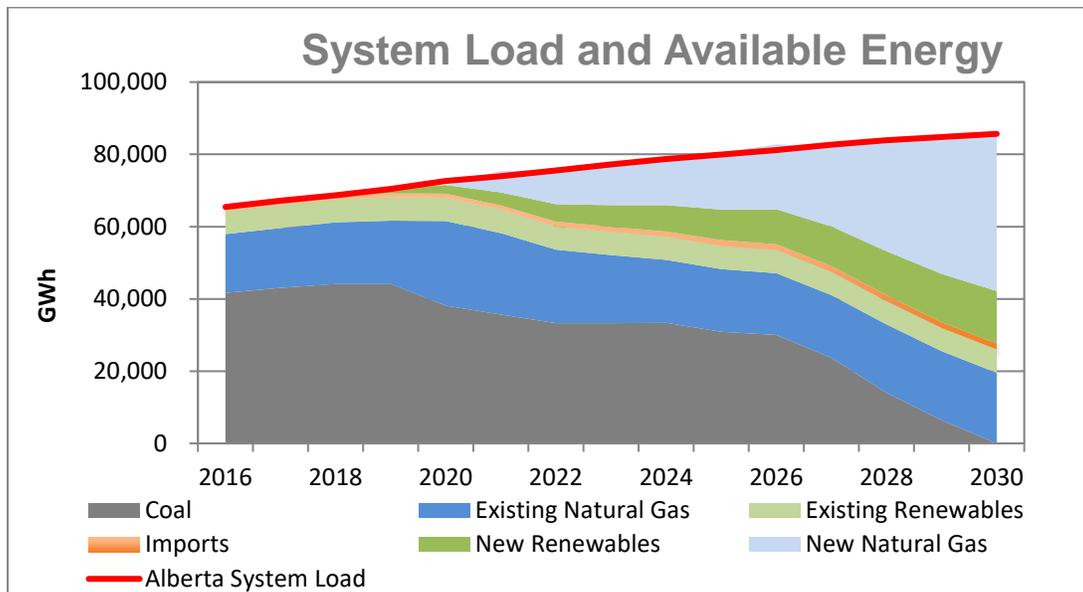


Figure 1-1 System Load and Available Energy
(Courtesy of BECL & Associates Ltd.)

Beyond the electricity marketplace, these changes will affect the whole provincial economy. The upside is considerable: Alberta could earn a brand as a responsible jurisdiction, which is competitive in attracting investment to generate growth and diversification. However, the downside is real: if the transition is suboptimal, the longstanding Alberta advantage of reliable, affordable electric power could slip away, impairing the province’s competitive position.

Virtually, all coal and gas power generated in Alberta is provided by Alberta Chamber of Resources (ACR) member companies; similarly, most ‘behind the fence’ co-generation in Alberta occurs at member company sites. About eighty per cent of wind power comes from projects owned or co-owned by ACR members. On the other side of the equation, ACR member companies are typically heavy consumers of electric power, both because of the nature of their businesses as well as the scale: the largest operations each estimate 2016 consumption at or above a terawatt-hour. Collectively ACR members account for a substantial proportion of the industrial load in Alberta.

ACR Powering Alberta White Papers White Paper #1

Priority Points

The white papers are intended to provide high-level overviews of industry perceptions, concerns and aspirations regarding the policy and regulatory climate as the transition unfolds. The perspectives reflect priorities from both producers and consumers of electric power. The white papers do not presume to present prescriptions or recommendations for success, rather they are an invitation to all stakeholders to engage in effective dialogue. The odds for a successful transition are greatly increased when all the players – government, regulators, operators and consumers – are contributing expertise, wisdom and commitment at every step.

Each of the white papers present perspectives leading up to a summary “Key Points – for Further Dialogue”. The summary below outlines the points which ACR believes have priority for discussion early in the engagement process.

Priority Points – for Further Dialogue

- *The transition of the Alberta electric system is an ambitious change agenda.*
- *For the transition to succeed, and for the overarching Climate Leadership Plan to succeed, they must be implemented in ways that retain investor confidence.*
- *Creating a policy and regulatory climate of stability, fairness, transparency, directional clarity, due process, procedural propriety, contractual integrity and action in good faith, must be a top priority for Alberta’s regulators and government.*
- *It is recognized that targeted policy instruments, such as the Renewable Energy Program, are necessary to shape the transition. Given that framework, market-based innovation should be encouraged by otherwise subjecting all forms of generation to the same policies and regulations – a “level playing field”.*
- *The construction challenges are substantial and the critical path must be identified and addressed immediately if an orderly transition is to be achieved.*
- *Robust planning is essential and must start with engagement and dialogue between government, regulators, investors, operators and consumers.*
- *Two major components of future electricity price increases can be mitigated by: establishing an appropriate policy and regulatory environment (minimizing the investment risk premium), and leading an effective planning process (minimizing potential for suboptimal project delivery).*

Powering Alberta Working Group

Noting that the public discourse in the first half of 2016 was primarily between the Government of Alberta and power producers, ACR decided to add to the discussion, with strategic perspectives from resource sector companies which include large power consumers as well as large coal, gas and renewable power producers.



ACR Powering Alberta White Papers White Paper #1

This series of white papers (listed below) is intended to convey those perspectives and broaden the dialogue with the Government of Alberta and all electric system stakeholders:

1. Powering Alberta - Overview
2. Maintaining Investor Confidence
3. Learning from the Experiences of Other Jurisdictions
4. Planning an Orderly Transition

All of the white papers are available online for download at www.acr-alberta.com.

Alberta Chamber of Resources

ACR, originally founded in 1936 as the Alberta and Northwest Chamber of Mines, is a member-driven organization involved in resource development in Alberta. ACR members include mining, energy, and forestry sector companies - those that create resource-based products and that provide the diverse infrastructure, products and services essential to resource development. Among Canadian and international resource industry organizations, ACR is unique in its focus on Alberta; in bringing together companies across sectors and functions, as well as creating space for communication and collaboration among the members and between resource companies and development stakeholders.

ACR Powering Alberta White Papers White Paper #2

Maintaining Investor Confidence

This white paper is intended to provide a high-level overview of industry perceptions, concerns and aspirations regarding the policy and regulatory environment as the Alberta electric system undergoes a major transformation. The Government of Alberta has mandated the elimination of coal-related carbon emissions, effectively setting a course to retirement of the present coal generation capacity by 2030, to be replaced by renewable generation plus natural gas generation to backstop the intermittency characteristics of renewable generation and accommodate anticipated load growth. In a recent study commissioned by the Industrial Power Consumers Association of Alberta¹, it is estimated the transition will require substantial new private sector investment in the order of \$25 to \$30 billion. Maintaining the confidence of capital markets is critical.

Priority Points

- *For the transition and for the overarching Climate Leadership Plan to succeed, they must be implemented in ways that retain investor confidence.*
- *Creating a policy and regulatory climate of stability, fairness, transparency, directional clarity, due process, procedural propriety, contractual integrity, and action in good faith must be a top priority for Alberta's regulators and government.*
- *Recognizing that targeted policy instruments, such as the Renewable Energy Program, are necessary to shape the transition, to the maximum extent practicable market-based innovation should be encouraged by otherwise subjecting all forms of generation to the same policies and regulations – a “level playing field”.*

For the transition and the overarching Climate Leadership Plan to succeed, they must be implemented in ways that retain investor confidence. Alberta must be seen as a jurisdiction with a stable and attractive investment climate within its competitive electricity system. From the phase-out of coal to the procurement of renewables, to the design of the carbon levy, to the transition to a capacity market; the implementation of government policy should be done in a way that retains and enhances investor confidence.

The prize for a successful transition is that Alberta citizens and companies will enjoy a modernized and reliable electric system with an affordable price tag. Alberta will earn a brand as a responsible jurisdiction, which is competitive in attracting investment to generate growth and diversification.

Companion white papers in the Powering Alberta series are as follows:

- #1 Powering Alberta - Overview
- #3 Learning from the Experiences of Other Jurisdictions
- #4 Planning an Orderly Transition

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¹ IPCAA, a review of the Alberta Climate Leadership Plan, August 5, 2016.

ACR Powering Alberta White Papers White Paper #2

Achieving an Orderly Transition

The transition plan for the Alberta electric system is an ambitious one, with considerable construction challenges compounded by the interrelationship between ramping up renewable and gas generation and ramping down coal generation.

The implementation of the transition plan hinges on the disciplined and efficient delivery of about 20 major energy projects over the next 14 years. As described in White Paper #4, Planning an Orderly Transition, the construction critical path to 2030 must start immediately for both renewable generation and gas generation. A key assumption of meeting the critical path, is that the capital needed for the initial plants will be available (i.e. financing delays will not immediately push the critical path beyond 2030).

Interrelated with the availability of capital is the price of capital: lack of clarity and investor apprehensiveness, regarding the policy and regulatory environment, increase the base return on utility investment, perhaps by one-third or one-half on top of returns for stable, predictable markets.

It should be noted, that investor confidence is as much about engagement as it is about investment risk premiums. The philosophy of dealing fairly with investors, operators and stakeholders leading to solid working relationships is foundational to effective planning and efficient delivery of the approximately 20 major energy projects. As well, an engaged private sector is essential to stimulate cost-saving and environment-saving innovations. A successful transformation will require both the expertise and the capital of the private sector.

While most attention to date has been on retirement of coal plants, it must be stressed that coal generators will continue to be essential players on the team. Reliable operation of the remaining coal plants and the provision of baseload generation during the period of transition until 2030 is vital.

It is recognized that targeted policy instruments, such as the Renewable Energy Program, are necessary to shape the transition. Given that framework, market-based innovation should be encouraged by otherwise subjecting all forms of generation to the same policies and regulations. A level playing field for all electricity generation and transmission options will empower stakeholders to bring forward innovative solutions and recommendations that align with the policy goals for existing and future generation.

Robust engagement and dialogue between all the players in the Alberta electric system – government, regulators, investors, operators and consumers – is foundational to identifying optimum solutions and thoughtful trade-offs, and to reacting to the inevitable unanticipated consequences of major societal change. Factual background information, policy options, etc. should be shared openly to bring all participants to a common level of understanding. The evolution of the market, in particular the design of the capacity market and the implementation of both renewables and capacity procurement, should be open, transparent and engage all stakeholders. The roles of agencies, departments and political decision-makers should be clear and their decisions and milestones should be visible to all stakeholders.

Risks to Investor Confidence

Alberta's electricity market has traditionally relied on the private sector to finance new generation and transmission infrastructure. Companies operating in the electric sector have raised debt and equity from banks, institutional investors, their own balance sheets and other sources to finance the required projects. Naturally, there is a reasonable expectation of a fair return on capital invested by the companies themselves and by the banks, institutional investors, shareholders, etc.

ACR Powering Alberta White Papers White Paper #2

The continuing downturn in oil, gas and other sectors means that demand has fallen below supply for a sustained period, with dramatic decrease in revenues and returns and a corresponding increase in business uncertainty.

It is in this context, that the major policy initiative, the Climate Leadership Plan, was announced. The operating cost of coal generators and, to a lesser extent, gas generators will be increased by the carbon levy, and several relatively new coal generating plants will be retired before their service life (investment amortization) is reached.

Suddenly, in addition to competitive market volatility, there were several new factors which caused concern for investors and impacted their perceptions and confidence:

- **Fair Treatment of Existing Investors.** The Government of Alberta stated an intent to implement the coal phase-out in a way that would avoid “unnecessarily stranded capital” and would treat affected workers, communities and companies fairly. During the summer and fall months of 2016, as this white paper was being drafted, industry had no visibility on how these principles would be reflected in negotiations between generators and the government or whether the result would be perceived as fair by capital markets. The announcements of November 2016 have addressed many of the investor concerns and initial reaction of the capital markets appears to be positive.
- **Future of Gas-fired Generation.** Investors will make judgements about the likely operating lives of new facilities, specifically whether they may be truncated by future policy. The proposed federal standards for gas plant emissions provide some medium-term clarity for investors – but will Alberta move more proactively? The federal aspiration that electric generation be emission-free by 2050 could affect the service life of gas plants being constructed as part of the transition.
- **Clear Price Signals.** Future investors will judge their potential returns by forecasting electricity prices based on projections of supply and demand. Even with the capacity market concept, investors must assess what portion of returns will come from capacity payments versus energy prices. Questions remain about whether the introduction of subsidized renewable generation will be timed in a way that minimizes distortions to energy prices.
- **Market Transparency.** Future investors will gauge the attractiveness of Alberta based on the design of the electricity market itself. The recent announcement of a capacity market approach appears to have received positive initial response. Will the Government of Alberta continue to provide clear and consistent statements about its future intent which markets can rely on? Will the government provide forward guidance that gives confidence to consumers, particularly large industrial consumers, that the market will continue to provide reliable supply?

These were not theoretical concerns. For instance, in a recent Q3 Results Release², two of the major participants in the Alberta electricity system confirmed that “*Capital Power, and its partner ENMAX Corporation, are moving the Genesee 4 and 5 project decision to proceed to the first quarter of 2017. The decision to proceed at that point in time will continue to be contingent on fair compensation being announced for the proposed accelerated closure of the Company’s coal facilities and favorable conditions existing within the Alberta electricity market*”. Other Alberta Chamber of Resources (ACR) member companies were having similar deliberations in their respective board rooms.

² Capital Power – 2016 Third Quarter Results (www.bit.ly/2guKppS)

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These uncertainties during the summer and fall have been equally concerning for established Alberta operations, as well new firms investigating the transition opportunities.

The lesson to be drawn from the past few months is this: creating a policy and regulatory environment of stability, fairness, transparency, directional clarity, due process, procedural propriety, contractual integrity, and action in good faith, must be a top priority for Alberta's regulators and government.

The success of Alberta's Climate Leadership Plan will depend in large part on the willingness of private capital to invest in transforming the electricity system. Maintaining investor confidence is essential to maintaining a reliable electricity supply, and achieving a lower-cost implementation path for new renewables:

- Treat existing and future investors fairly – policies and regulations must be seen by investors (both renewable generators and gas generators) and capital markets as fair and reasonable.
- Provide clarity re: gas generation – appropriate and reasonable assurances about facility service life / investment amortization life and long-term policy treatment of emissions.
- Avoid distorting electricity markets – the design of renewables procurement (both timing and volume) should avoid distorting electricity prices and be clearly communicated in advance.
- Commit to market and policy transparency – implement the Climate Leadership Plan with policies that visibly maintain market stability (for instance, early development of the Carbon Competitiveness Regulations would avoid possible erosion of investor confidence). Effectively engage with stakeholders to inform and encourage input to robust design of the new capacity market.

The approach taken to the transition will have ripple effects in other sectors. The Alberta economy is heavily dependent on the natural resource sectors, which require significant capital investments in world-scale projects: these investors will be taking note of government policies and actions in the electric sector. Likewise, albeit on a smaller scale, as the province seeks to attract diverse industries set up shop, new firms will be extrapolating business and investment risk based on observed behavior.

Key Points – for Further Dialogue

- A major determinant of future prices will be delivering a fair return to the investors who will provide the estimated \$25 to \$30 billion needed for the transition. Additional components of the price include the magnitude of the risk premium associated with investor uncertainty about policy and regulatory risks, as well as effectiveness of the planning and efficiency of delivery of projects. The latter two components are largely within the control of the Alberta Electric System Operator (AESO) and the Government of Alberta – establishing an appropriate policy and regulatory environment (optimizing the investment risk premium), and leading and communicating an effective planning process (minimizing potential for suboptimal project delivery).
- The prize for a successful transition is that Alberta citizens and companies will enjoy a modernized and reliable electric system with an affordable price tag. Alberta will earn a brand as a responsible jurisdiction, which is competitive in attracting investment to generate growth and diversification.
- It is recognized that targeted policy instruments, such as the Renewable Energy Program, are necessary to shape the transition. Given that framework, market-based innovation should be

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encouraged by otherwise subjecting all forms of generation to the same policies and regulations – a “level playing field”.

- For the transition to succeed, and for the overarching Climate Leadership Plan to succeed, they must be implemented in ways that retain investor confidence.
- Creating a policy and regulatory climate of stability, fairness, transparency, directional clarity, due process, procedural propriety, contractual integrity, and action in good faith must be a top priority for Alberta’s regulators and government.
- ACR member companies – which own or partner in virtually all the traditional power generation and about 80 per cent of the current renewable power generation in Alberta, are prepared to engage collectively to contribute perspectives and experience to encourage a policy and regulatory climate of stability, fairness, transparency and directional clarity.

Learning from Experiences of Other Jurisdictions

This white paper is intended to provide high-level examples of learnings which can inform and ease the transition of the Alberta electric system from predominantly coal-fired generation to a substantial portion of renewable generation. The Government of Alberta has mandated the elimination of coal-related carbon emissions, effectively setting a course to retirement of the present coal generation capacity by 2030, to be replaced by renewable generation plus natural gas generation. This is an ambitious change agenda where comprehensive planning is vital to achieving an orderly transition, a stable electricity marketplace and the confidence of investors. Learning from the challenges and successes experienced in other jurisdictions is a productive starting point for planning.

Priority Point

- *This white paper is intended as a starting point for deeper interaction among stakeholders.*

The prize for a successful transition is that Alberta citizens and companies will enjoy a modernized and reliable electric system with an affordable price tag. Alberta will earn a brand as a responsible jurisdiction, which is competitive in attracting investment to generate growth and diversification.

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The learnings outlined below are not a final product, rather a template for further dialogue between the Government of Alberta, Alberta Electric System Operator (AESO) and the industry. With the co-operation of all stakeholders, learnings can be identified which provide genuine value to the transition and future system design.

Applicable Learnings

The operation and regulation of utility marketplaces are complex. There are many moving parts – market design, technology shifts, consumer responses, economic cycles – occasionally compounded by increased logistics and reduced certainty during times of transition as described above. Learning from others is a good strategy, however, lessons learned in other jurisdictions may not be applicable to Alberta, in whole or even in part; judgement must be exercised.

Characteristics of our marketplace, which must be considered, are as follows:

- Small market.
- Existing energy-only market design; transitioning to a capacity market design beginning in 2021.

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- Low interconnectivity with adjoining jurisdictions (and differences in market structures that complicate policy-making, market impacts, etc.).
- High proportion of industrial load – constant on hourly, daily and monthly basis.
- Robust transmission backbone – generally point generation to point consumption.
- Transition in progress – need to manage renewable ramp up together with coal ramp down.

Overarching Principles

All stakeholders desire an Alberta electricity marketplace which functions efficiently and transparently (as benchmarked against other leading jurisdictions); provides reasonable electricity costs to retail and industrial consumers; provides reasonable and appropriate returns to electricity, infrastructure and service providers and provides flexibility for future technology and market evolution. The desirability of adopting lessons from other jurisdictions should be evaluated against this aspiration.

It is recognized that targeted policy instruments, such as the Renewable Energy Program, are necessary to shape the transition. Given that framework, market-based innovation should be encouraged by otherwise subjecting all forms of generation to the same policies and regulations. The desirability of adopting lessons from other jurisdictions should be gauged against this standard (i.e. a level playing field).

An effective engagement process must draw all stakeholders to the common goal of reliable supply and stable pricing of electricity. Engagement needs to be a genuine quest for optimum solutions and thoughtful trade-offs – meaningful, transparent, regular and procedurally fair. Optimization of the complex system will require diverse perspectives and diverse innovations, starting from the common knowledge of lessons learned.

Learnings Matrix

In considering how learnings might inform the Alberta marketplace, the following matrix was used:

- **Long-term Electricity Prices.** Relative competitiveness of retail and industrial rates versus key jurisdictions over time.
- **Attraction of Sufficient Capital and Quality Companies.** Clear and timely signals regarding growth opportunities (or need for rationalization).
- **Long-term Market Stability.** Reasonable supply/demand balance; transparency; investor confidence.
- **Transition Supply Reliability and Market Stability.** Clear vision, effective planning (effective stakeholder engagement), efficient construction execution, consumer and investor confidence.
- **Future Flexibility.** Evolving loads; evolving technologies; evolving societal priorities.

Initial learnings gleaned from journals and discussions with industry experts are summarized in Attachment 3A: Table 3A-1 Challenges Identified and Table 3A-2 Solutions Proposed / In Progress. As noted in the introduction, these tables are intended as a starting point for deeper interaction among all stakeholders. For instance, a Lessons Applicable Workshop organized by AESO or the Department of Energy.

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Generic Learnings

System Design

- Intermittency of wind power generation, also timing - higher concentration of generation in the off-peak hours - should be evaluated for system impact. Experience in other jurisdictions suggests a mix of wind and solar could be appropriate, even with the higher initial cost per MWh of solar.
- Other jurisdictions have had significant issues with negative pricing (i.e. when the spot market is over supplied). Depending on the market design selected, a balance will need to be struck in the generation portfolio to assure system reliability (appropriate investment) and fair returns to non-renewable generators (stability of system participants).
- When evaluating options, capital costs for renewables and natural gas should be fully costed, including lifecycle costs assessment, life span and system impact.

Market Design

- Certain jurisdictions have struggled with unclear market/investment signals due to a large proportion of low to zero variable cost generation from renewables. Depending on market design, appropriate incentives will be needed to bring on new generation and provide investors an opportunity to earn fair return given the higher proportion of renewables.
- In jurisdictions which contract based on Renewable Energy Certificates (versus Contracts-for-Differences), generators have greater incentive to invest in higher quality power sources (with output that is less correlated with existing renewables) and to maintain and improve upon unit availability and output.
- Typically, the addition of renewable generation requires an equal capacity of backup generation. The cost of this reserve capacity should be borne by consumers as an integral component of the system, until alternatives (e.g. commercially viable storage) are available to replace backup generation, then transitioned out (treating unused service life fairly).
- In designing the new capacity market, changes being considered should be thoroughly evaluated in terms of both cost analysis and impacts analysis on system reliability, existing generation and loads. Options considered should maintain a level playing field for existing and future generation. To the maximum extent practicable, the design process should effectively engage stakeholders and be transparent for investors.

Transition

- Ontario is one example where electricity prices have risen much more than original expectations. To avoid surprises, a robust modeling capability should be developed as an assessment tool for a base case, plus a range of scenarios. All scenarios should be costed on a lifecycle basis and the system-wide impact assessed (e.g. transmission implications). Specifically, worst case scenarios should be contemplated so risks can be identified, monitored and mitigated.
- Clear accountability should be assigned within the regulatory framework for monitoring and managing risks associated with the transition.
- Significant transmission costs have resulted from the addition of renewables in other jurisdictions. Alberta should manage the balance of optimal wind resource and transmission costs as well as

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possible, but should prepare for cost escalation in any event. The market should provide cost signals to renewable generators to maximize the use of existing transmission infrastructure.

- Other jurisdictions have experienced negative pricing as a result of overabundant renewables bidding into spot markets. Learnings suggest being cautious with the pace of renewable additions.
- The AESO has identified a three-stage renewables procurement process: RFEI-RFQ-RFP. Experience in other jurisdictions suggest that an insufficiently stringent RFQ stage can lead to unrealistically low bids at the RFP stage – with high risk of non-performance by bidders which lack technical or financial capacity to deliver.
- The AESO should be prepared to work with generators to manage the risks of over/undersupply at some point(s) during the transition. Early retirements that are not lined up with supply additions, have potential to result in system reliability issues.
- The Government of Alberta could consider the maximum costs per MWh that would be allowed during this transition to ensure Alberta does not lose its competitive advantage among industrial consumers.
- Even a well-managed transition is likely to necessitate increased electricity prices. It is important to invest in excellent communications to inform and engage consumers and the public, at every step, in this societal transformation.

Key Points – for Further Dialogue

- The prize for a successful transition is that Alberta citizens and companies will enjoy a modernized and reliable electric system with an affordable price tag. Alberta will earn a brand as a responsible jurisdiction, which is competitive in attracting investment to generate growth and diversification.
- This white paper is intended as a starting point for deeper interaction among stakeholders - perhaps a Lessons Applicable Workshop.
- A robust modeling capability should be developed as an assessment tool for a base case, plus a range of scenarios. All scenarios should be costed on a lifecycle basis, and the system-wide impact assessed (e.g. transmission implications, both large system upgrades and underutilized assets). Specifically, worst case scenarios should be contemplated so risks can be identified, monitored and mitigated.
- The Texas ERCOT (The Electric Reliability Council of Texas) market is redesigning the Ancillary Services and establishing a separate marketplace to add new services that are better able to balance the intermittency of renewables.
- Alberta Chamber of Resources (ACR) member companies, and individual experts within the companies, have substantial experience in other jurisdictions and are prepared to engage collectively to understand all nuances of the experiences in other jurisdictions and how they apply to Alberta.

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Attachment 3A

Table 3A-1: Challenges Identified

	Ontario	California - CAISO	Texas - ERCOT	Other
Long-term Electricity Prices	Increases have exceeded initial expectations. Consumers are paying for energy + delivery + differential between energy price and contract price for capacity (reportedly \$112/MWh for average residential consumer in October 2016).		Significant transmission costs to connect wind to Dallas & Houston.	
Sufficient Capital & Quality Companies				Brazil: Spot energy market cannot emit correct market signals
Long-term Market Stability	Political objectives have appeared to supersede electricity system objectives and technical requirements.	Renewables pricing into spot market creates unsustainable low prices.	Renewables pricing into spot market creates unsustainable low prices (infrequent negative prices).	Germany: Renewables pricing into spot market creates unsustainable low prices (occasional negative prices).
Transition Supply Reliability & Market Stability	Potential for insufficient supply in low interconnect areas during transition: portable generators mobilized.			Germany: Electricity oversupply – low, volatile prices.
Future Flexibility				

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Table 3A-2: Solutions Proposed / In Progress

	Ontario	California - CAISO	Texas - ERCOT	Other
Long-term Electricity Prices	Provincial sales tax removed from electricity.			
Sufficient Capital & Quality Companies	Generation now procured via long-term contracts-for-differences.			Brazil: Avoid spot market. Prices set by competitive auction among fixed cost (hydro) generators.
Long-term Market Stability		Mandating the development of energy storage solutions to mitigate intermittency of renewables.	Redesigning ancillary services, establishing separate marketplace and adding new services to better balance intermittency of renewables.	Germany: Export excess baseload power. Germany: Moving to establish capacity market (capacity levels set by gov't). Iberian Peninsula: Prices set by competitive auction among fixed cost generators.
Transition Supply Reliability & Market Stability			Large existing fleet of flexible gas generators.	Germany: Proposed elimination of renewables subsidy (slow down rate of renewables growth).
Future Flexibility			Decreasing cost of utility-scale solar plants. "Technology agnostic" competitive market.	Europe: "Supergrid" interconnection under construction, but very expensive. Denmark & Norway: Emphasis on robust day-ahead forecasting of wind capacity to enable accurate dispatching of backup generation.

Planning an Orderly Transition

This white paper is intended to provide a high-level overview of industry perceptions, concerns and aspirations regarding the transition of the Alberta electric system from predominantly coal-fired generation to a substantial portion of renewable generation. The Government of Alberta has mandated the elimination of coal-related carbon emissions, effectively setting a course to retirement of the present coal generation capacity of 6,200 MW be retired by 2030, to be replaced by renewable generation plus natural gas generation. The mix of energy sources at 2030 is to include 5,000 MW of renewable generation capacity (which will deliver 1,650 MW at a 33% availability factor), plus new high-efficiency natural gas generation required to backstop the intermittent characteristics of renewable generation and accommodate anticipated load growth.

Priority Points

- *The transition of the Alberta electric system is an ambitious change agenda.*
- *Robust planning is essential, and must start with engagement and dialogue between government, regulators, investors, operators and consumers.*
- *The construction challenges are substantial and the critical path must be identified and addressed immediately if an orderly transition is to be achieved.*
- *Two major components of future electricity price increases can be mitigated by establishing an appropriate policy and regulatory environment (minimizing the investment risk premium), and leading an effective planning process (minimizing potential for suboptimal project delivery).*

Given the 2030 goal, this is an ambitious change agenda, with technological, logistical, investment and market dimensions: comprehensive planning is vital to achieving an orderly transition. The prize for a successful transition is that Alberta citizens and companies will enjoy a modernized and reliable electric system with an affordable price tag. Alberta will earn a brand as a responsible jurisdiction, which is competitive in attracting investment to generate growth and diversification.

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Stakeholder Engagement

Robust planning must start with engagement and dialogue between all the players in the Alberta electric system: government, regulators, investors, operators and consumers. Understanding the interrelationships between the components of the system, particularly the unprecedented high proportion of renewable generation, will require diverse perspectives and innovative solutions.

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Regardless of the varied positions of each stakeholder, the engagement process must draw them into their common interest in stable supply and pricing of electricity. Engagement needs to be a genuine quest for optimum solutions and thoughtful trade-offs – meaningful, transparent, regular and procedurally fair.

It is essential to advise stakeholders with an appropriate lead time of the objectives and scope of the engagement sessions so they can consider and prepare. Factual background information, policy options, etc. should be shared openly to bring all participants to a common level of understanding. It is recognized that targeted policy instruments, such as the Renewable Energy Program, are necessary to shape the transition. Given that framework, market-based innovation should be encouraged by otherwise subjecting all forms of generation to the same policies and regulations

Positive Investment Climate

In a recent study commissioned by the Industrial Power Consumers Association of Alberta¹, it is estimated the transition will require substantial new private sector investment, in the order of \$25 to \$30 billion, to retire and replace existing coal generation with renewable and natural gas generation. Companies will not commit to expenditures in Alberta (or any other jurisdiction) unless they have a high level of confidence in the policy and regulatory climate. How existing investors are treated will set the expectations for future investors; unfair experiences weigh heavily when evaluating investment attractiveness of a jurisdiction. This is equally true for established Alberta operations, as well new firms investigating the transition opportunities.

Maintaining investor confidence is addressed in more detail in White Paper #2, Maintaining Investor Confidence. It is reiterated here to underscore that investor confidence is as much about engagement as it is about investment risk premiums. The philosophy of dealing fairly with investors, operators and stakeholders, leading to solid working relationships, is foundational to effective planning and to stimulating innovation. Solid planning, value-adding innovation and efficient delivery of power projects means savings in the pockets of retail consumers and competitive input costs for industrial consumers.

Creating a policy and regulatory environment of stability, fairness, transparency, directional clarity, due process, procedural propriety, contractual integrity, and action in good faith, must be a top priority for Alberta's regulators and government.

Envisioning the Future

Tangible plans start with a tangible end in mind. Planning for an orderly transition must look beyond retiring a few coal plants and building a few renewable ones. High proportions of renewable generation will impose unprecedented stability requirements on the transmission system. While the backbone elements of the Alberta system are robust, other nodes may need upgrading to accommodate the intermittency of wind and solar generation. New investment in additional distributed connections to renewables projects will likely be needed. For new gas generation facilities, every effort should be made to “recycle” the backbone transmission connections, cooling facilities and water use at existing generation sites. Additionally, those areas are home to the large, highly skilled workforces needed for new facilities.

On the demand side, the integration of micro-grids, electric car demand and local energy storage are emerging technologies that will impose system requirements different from today. Currently, coal, hydro and gas generation provide most of the ancillary services consumed in Alberta. In the near future, the

¹ IPCAA, a review of the Alberta Climate Leadership Plan, August 5, 2016.

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changing demands may require these facilities to modify how they operate, as well as to introduce new technologies to maintain system reliability. Planning an orderly transition that delivers supply and price stability for Alberta's electric system requires forethought for Alberta's requirements well beyond 2030.

Critical Path for an Orderly Transition

Even with stakeholders fully engaged and productive working relationships in place, the transition by 2030 presents challenges which must be met head-on.

In the IPCAA study, it is estimated that \$25 to \$30 billion will be needed to retire and replace existing coal generation with renewable and natural gas generation. This is a substantial amount of construction activity, particularly given that planning and permitting typically require several years of lead time, so the construction spend will likely be well over \$2 billion per year from 2020 to 2030.

For instance, the largest wind facility built in Alberta, Blackspring Ridge, added 300 MW of maximum capability (i.e. 100 MW available capability at 33% availability factor), took six years to plan, permit and build (initiated in 2008, paused for several years, started construction in 2013, came online in 2014). The most recent power plant built in Alberta, the Shepard Energy Centre, added 870 MW of natural gas generation maximum capability (i.e. 700 MW available capability at 80 per cent factor), took six or eight years to plan, permit and build (initiated in 2007, paused due to the 2008/09 economic crisis, started construction in 2011, came online in 2015). Permitting and construction durations are optimistically two years for large wind generation projects and four years for large gas generating facilities. However, as illustrated above, realistic project development cycles are significantly longer. Wind generation sites typically require three years of specific meteorological data to verify technical feasibility – if a proposed site is not already verified, three years must be added to the lead time.

The electric system transition can be visualized as planning, permitting and building the equivalent of 12 major wind facilities (40 per cent larger than Blackspring Ridge) plus 10 Shepard Energy Centres over the next 14 years.

Although more carbon-intensive than new gas plants, repurposing some existing coal plants to gas plants could simplify the construction challenges – but such conversations are still major projects. Re-using the plant infrastructure and transmission infrastructure at existing sites is a major advantage.

To develop a first-cut sense of these construction logistics, a Gantt chart was developed to lay out milestones for an orderly transition to 2030. See Attachment 4A for commentary and Chart 4A-1, Gantt Notional Critical Path. To achieve the target 5,000 MW renewable generation capacity, notionally 12 large renewable energy facilities must be brought onstream, one per year from 2019 to 2030; construction of the first facility would need to start in 2018 (assuming permitting is in place for projects already in the Alberta Electric System Operator (AESO) queue). Additionally, 10 notional high-efficiency gas plants must be brought onstream, one per year from 2021 to 2030; construction of the first plant would need to start in 2017 or 2018. The Notional Critical Path assumption of “one per year” is simplistic - it is possible to “stack” multiple projects into later years to accommodate the initial planning and permitting delays. However, it must be recognized that stacking brings risk of shortages of skilled trades, engineering design capacity and project management capacity – reminiscent of the overheated market in the heyday of oil sands construction.

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The main points of the simple Notional Critical Path are:

- The construction challenges are substantial.
- The 2030 endpoint is not as far in the future as it might at first seem.
- The critical path must be identified and addressed immediately if an orderly transition is to be achieved.

The intersection of the critical path and the establishment of a stable policy and regulatory environment is evident as this white paper is being written. In a recent Q3 Results Release², Capital Power, and its partner ENMAX Corporation, announced that the Genesee 4 and 5 project decision to proceed has been deferred to the first quarter of 2017.

The simple Notional Critical Path also reveals the potential for a transitional shortfall of effective capacity below required effective capacity in the 2019 to 2023 period, as illustrated in Figure 4-1, Peak System Demand and Available Capacity. Coal generation capacity is being subtracted faster in those years (following the AESO assumption re: coal retirement schedule) than renewable and gas generation effective capacity is being added (on the simplified one-per-year schedule). Given the number of potential wind projects in the AESO queue, it may be possible to bring them online faster than one-per-year. However, stacking the renewable and gas projects further into the future may exacerbate such transient shortfalls. The simplified Notional Critical Path illustrates that transient shortfalls can occur; more rigorous modelling of the critical path and perhaps adjustment of the coal retirement schedule are needed to mitigate the risks, together with disciplined delivery of new generation capacity to meet the critical path. The AESO Market Transition Recommendation³ has presented a more detailed analysis and noted that special measures may be needed at certain periods during the transition.

Another risk to the critical path, and the adjusted coal retirement schedule, is the increased potential for unplanned outages or even unplanned retirements of aging plants. It is not unusual for sustaining capital investments and major maintenance expenditures to be minimized in the final years before retirement. If high reliability of the remaining coal plants is critical to reliable supply and stable pricing of the Alberta electric system, special arrangements may have to be made with the operators of the plants to assure the required reliability.

An opportunity exists to streamline regulatory processes on the critical path. Over the next 14 years, about 20 electric power projects will be built. Investing at the front end in fair, clear, procedurally sound and transparent consultation and approval processes will pay dividends on each project. The Alberta Utilities Commission has a track record of effective and efficient processes for generating and transmission projects and they should be engaged early in the transition planning.

² Capital Power – 2016 Third Quarter Results (www.bit.ly/2guKppS)

³ Alberta's Wholesale Electricity Market Transition Recommendation, October 3, 2016 (www.bit.ly/2fQ70jS)

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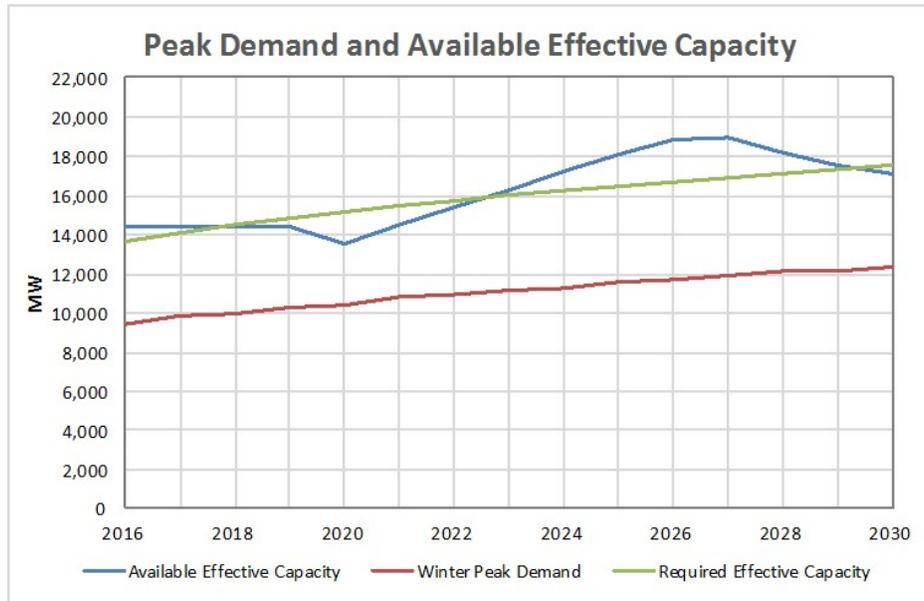


Figure 4-1 Peak System Demand and Available Capability
(Courtesy of BECL & Associates Ltd.)

In summary, the transition of the Alberta electric system is an ambitious one, with considerable construction challenges compounded by the interrelationship between ramping up renewable and gas generation and ramping down coal generation. It is important that all stakeholders be engaged and effective working relationships be developed to inform the planning process. Consideration should also be given to forming a Critical Path Planning Advisory Group, comprising AESO senior staff, key stakeholders, and regulators – with the mandate to assess logistics, evaluate options and expeditiously place before decision-makers the critical items required to meet critical path deadlines. The orderly transition will require a master plan, incorporating individual plans for various replacement energy sources. As noted in the initial section of this white paper, effective collaboration will be required from all stakeholders to maintain a reliable and price-stable electric system.

Stable Supply and Price of Electricity

The supply and cost of electricity has far-reaching effects on all areas of Alberta, from quality of life for families and communities to an input to production and driver of GDP. The transition from coal to renewables is based on a fundamental societal shift, with increased value being placed on environmental sustainability, as reflected by the political leadership provincially and federally. Consumers and companies seem to have stoically accepted that improving our Alberta environmental performance and reputation will come at a price.

Other jurisdictions have embarked on similar ambitious transitions, some successful and some problematic. While remaining optimistic about the ability of Alberta regulators and companies to successfully manage the transition, all stakeholders must remain aware of the tangible risk of increased electricity prices and must commit accordingly to “get it right”. The stakes are high: uncompetitive prices will impair current consumers, discourage new companies and diversification initiatives and generally reduce jurisdictional competitiveness and investment attractiveness.

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The evolution of Alberta's electric system is ambitious and capital intensive, requiring investors to provide the estimated \$25 to \$30 billion needed for the transition. Potential incremental components of the price include the magnitude of the risk premium associated with investor uncertainty about policy and regulatory risks, as well as effectiveness of the planning and efficiency of delivery of projects. The latter components are largely within the control of the Government of Alberta and the AESO – establishing an appropriate policy and regulatory environment, and leading and communicating an effective planning process.

Many stakeholders feel that 2016 was not an auspicious beginning to effective stakeholder communication, nor to the concepts of clarity and transparency. The announcements of November 2016 have turned a new page. As the Government of Alberta and the AESO are prepared to provide leadership toward engagement, clarity and effective transition planning, the members of the Alberta Chamber of Resources (ACR) are prepared to engage collectively to contribute perspectives and experience to the pre-competitive planning, plus risk identification and mitigation. ACR members, which account for virtually all the traditional power generation, about 80 per cent of the current renewable power generation and a substantial proportion of the industrial load in Alberta, bring this balance of perspectives to consultation discussions.

The Path to 2030

The plan to transition Alberta to a more responsible and sustainable generation is ambitious on many levels. There will no doubt be challenges and unanticipated consequences; ACR has confidence that these will be dealt with through the good policy, good contracts and good will of the AESO and industry stakeholders.

As noted above, electricity prices will almost certainly increase, eroding to some degree a longstanding Alberta advantage: reliable and competitively priced electricity to enable economic growth. Albertans, while recognizing the price of progress, are trusting the Government of Alberta to monitor jurisdictional competitiveness and to make appropriate policy adjustments if the transition disadvantages Alberta companies in the global marketplace.

In particular, the issue of “emissions leakage” bears close monitoring (i.e. when an emitting company closes shop in a restrictive jurisdiction and opens shop in a relaxed jurisdiction, continuing to emit unabated). It is a broad threat both to an orderly transition and to the Climate Leadership Plan, in that responsible jurisdictions lose economic activity, while irresponsible jurisdictions gain, with no global benefit of reduced climate impact. The Climate Leadership Panel noted that, *“Large emitters do not all have the same potential to reduce emissions, nor do they face the same level of international competition. The proposed CCR [Carbon Competitiveness Regulation] architecture would allow the government to periodically review allocations, on a sector basis, to ensure that the appropriate balance between creating a material incentive to address emissions and maintaining competitiveness/preventing emissions leakage, has been maintained.”* This is a reasonable approach, if “frequently reviewed” can be substituted for “periodically reviewed”: international competition is dynamic and reviews must be timely and expeditiously assess issues of competitiveness. Again, effective engagement with stakeholders will be vital to understanding the dynamics of jurisdictional competitiveness.

A hybrid approach might be explored to allow companies to opt into the CCR and pay the Alberta carbon levy on some operations, or opt to participate in a “cap & trade” system for other operations. Flexibility is key to remaining competitive in a global environment, and such optionality would allow firms to continue to operate in Alberta, per their individual circumstances.

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Key Points – for Further Dialogue

- The prize for a successful transition is that Alberta citizens and companies will enjoy a modernized and reliable electric system with an affordable price tag. Alberta will earn a brand as a responsible jurisdiction, which is competitive in attracting investment to generate growth and diversification.
- The transition of the Alberta electric system, from predominantly coal-fired generation to a substantial portion of renewable generation, is an ambitious change agenda with technological, logistical, investment and market dimensions. Robust planning is essential and must start with engagement and dialogue between all the players in the Alberta electric system, including the Government of Alberta, regulators, investors, operators and consumers. Planning an orderly transition that delivers supply and price stability for Alberta's electric system, requires forethought for the province's requirements well beyond 2030.
- Creating a policy and regulatory environment of stability, fairness, transparency, directional clarity, due process, procedural propriety, contractual integrity, and action in good faith, must be a top priority for Alberta's regulators and government.
- The transition can be visualized as planning, permitting and building about 20 large energy projects over the next 14 years. The construction challenges are substantial and the critical path must start immediately if an orderly transition is to be achieved.
- The construction challenges are compounded by the interrelationship between ramping up renewable and gas generation and ramping down coal generation. Rigorous modelling and planning of the critical path are needed to mitigate the risks, together with disciplined delivery of new generation capacity, to meet the critical path.
- As the Government of Alberta and the AESO are prepared to provide leadership toward engagement, clarity and effective transition planning, ACR members are also prepared to engage collectively to contribute perspectives and experience to the pre-competitive planning, plus risk identification and mitigation.
- Two major components of future electricity price increases are largely within the control of the AESO and the Government of Alberta – establishing an appropriate policy and regulatory environment (minimizing the investment risk premium) and leading and communicating an effective planning process (minimizing potential for suboptimal project delivery).

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Attachment 4A

Notional Critical Path

To develop a first-cut sense of the construction logistics, a Gantt chart was developed to lay out milestones for an orderly transition to 2030: see Chart 4A-1, Gantt Notional Critical Path. In the analysis, several assumptions were adopted from the AESO 2016 Long-term Outlook Reference Case (May 4, 2016), notably the coal retirement schedule, the peak demand and load growth forecasts, and the wind generation capacity factor of 33 per cent. To simplify the Gantt chart, assume the retiring 6,300 MW of coal generation and adding 5,000 MW of renewable (wind) generation maximum capability (i.e. 1,650 MW available capability at 33 per cent availability factor) means that about 9,000 MW of gas generation will be required by 2030, including reserve requirements. Hydro generation is also an option to backstop renewables, however, this option would fall beyond the 2030 timeline because of the long lead times to conceptualize, develop and permit such projects (plus, associated major additions to the transmission infrastructure).

As noted in this white paper, project development cycles (planning, permitting and constructing) for mid to large size generation projects are typically two-plus to five-plus years, respectively, for renewable generation or gas generation. Construction scheduling can be significantly affected by long lead times for major equipment. The Gantt chart has conservatively assumed 24 months for planning and permitting, plus 36 months for construction and commissioning for all projects. Lead time for large greenfield renewables projects extend as pushback and community consultations increase in proportion to the size of the projects – a trend which has been observed in other jurisdictions. (The Blackspring Ridge project spans 48,000 acres and involves about 100 individual and corporate landowners within an 800 metre radius of the project.) Approvals for refits or brownfield construction, on existing generating sites, are more likely to be straightforward.

It is likely that some existing coal plants will be converted to gas generation. While simpler than permitting, and constructing new gas plants, refits are still complex major projects. Re-use of the balance of plant and transmission infrastructure is a major cost and schedule advantage of this approach. For reasons of simplicity, substituting plant conversions for new plan construction has not been included in the Gantt chart.

To achieve the target 5,000 MW renewable generation capacity, 12 notional large renewable energy facilities must be brought onstream, one per year from 2019 to 2030; construction of the first facility would need to start in 2018. Additionally, notionally 10 high efficiency gas plants would have to be brought onstream, one per year from 2021 to 2030; construction of the first plant would need to start in 2017 or 2018. The Notional Critical Path assumption of “one per year” is simplistic, it is theoretically possible to “stack” multiple projects into later years to accommodate the initial planning and permitting delays. However, it must be recognized that stacking brings the risk of shortages of skilled trades, engineering design capacity and project management capacity – reminiscent of the overheated market in the heyday of oil sands construction.

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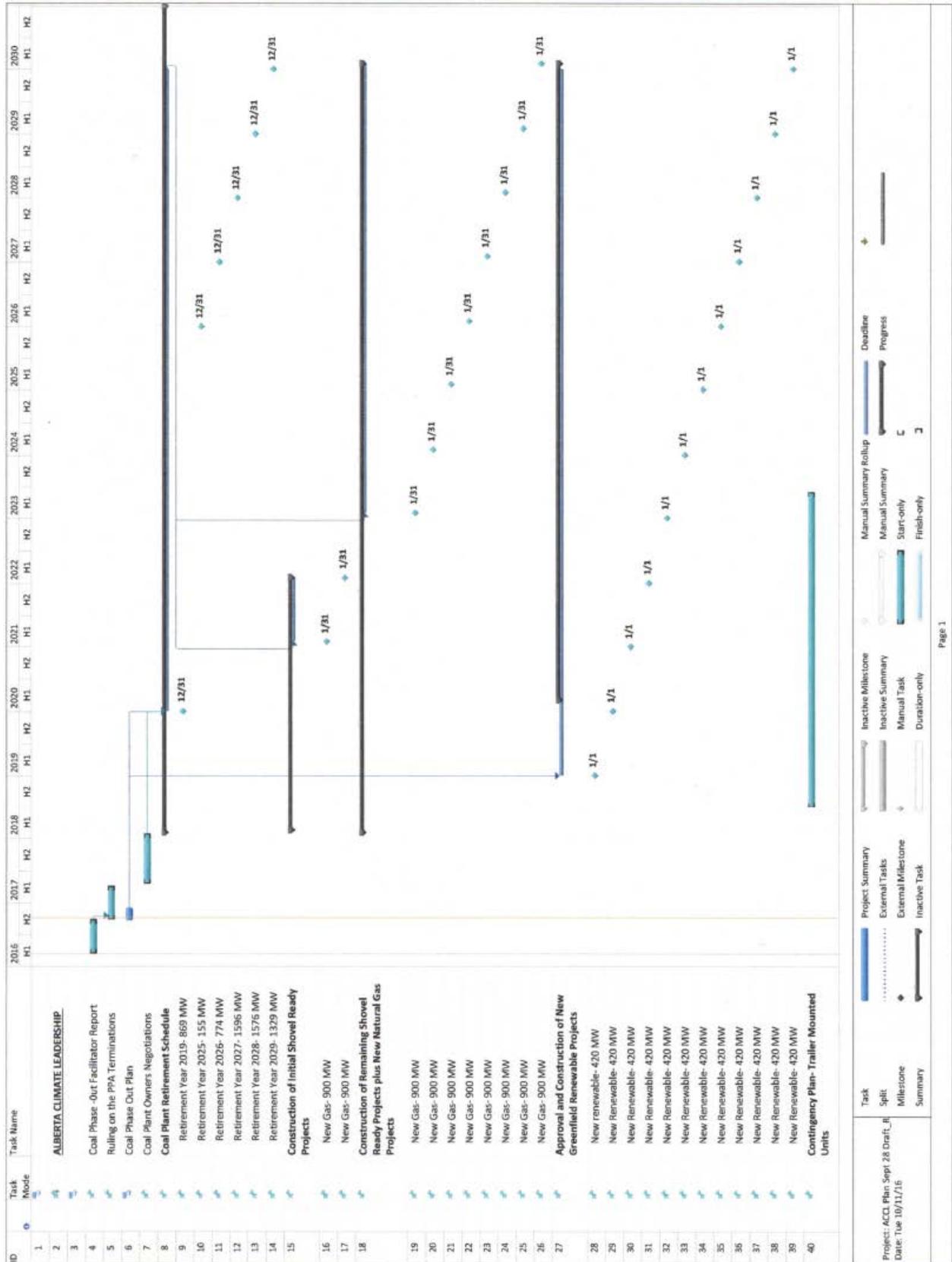


Chart 4A-1: Gantt Chart - Notional Critical Path
(Courtesy of Grindstone Creek Energy Services)