

## Progressive Environmental Stewardship: Climate Change Management

We believe in open and transparent reporting on material impacts relating to climate change. Our climate change reporting is structured as per guidance from the Financial Stability Board's TCFD recommendations. The following highlights our management, performance and leadership of impacts related to climate change.

### TransAlta Climate Change Action - Highlights

- The GSSC includes in its mandate that it will review guidelines and practices relating to environmental protection and the Corporation's plans with respect to environmental impact;
- Our strategy involves moving away from GHG-intensive coal and achieving a 100 per cent mix of renewables and natural gas by the end of 2025;
- Our business is showing resilience to mitigation of global warming by reducing GHG emissions – we have a target to reduce annual emissions by 19.7 million tonnes of CO<sub>2</sub>e by 2030 over 2015 levels and a new goal to be carbon neutral by 2050. Since 2015, we have reduced our annual emissions by 15.8 million tonnes of CO<sub>2</sub>e or approximately 80 per cent of required GHG reductions to meet this target;
- We have reduced our annual emissions by approximately 25 million tonnes of CO<sub>2</sub>e since 2005, which is a 61 per cent reduction over the time period and highlights our decarbonization track record - this is the equivalent annual GHG emissions of a small country;
- As a leader in North American renewable energy, and on-site generation development and production, we are well positioned to build renewable energy facilities and lower-carbon gas facilities to support customer sustainability goals to decarbonize; and
- In 2020, CDP (the global disclosure system for environmental impacts known formerly as Carbon Disclosure Project) recognized TransAlta with an A- score, ranking the Corporation among industry leaders on climate change management.

### Climate Change Governance

The highest level of oversight on business impacts related to climate change is at our Board level, specifically by the GSSC and the AFRC. Macro issues and opportunities such as coal GHG emissions and the phase-out of coal power generation, cost-competitiveness of renewable energy and customer preferences toward lower carbon energy have been at the forefront of strategic discussions with our executive and Board. These deliberations resulted in our actions to move away from coal, establish 2030 and 2050 GHG emissions reduction targets and grow our generation capacity with renewable energy and gas.

The GSSC has oversight of climate-related issues. Meeting on a quarterly basis, the GSSC's charter includes "monitoring and assessing climate change risks and compliance with associated legislation and public reporting." The charter also directs that the GSSC "at least annually, review guidelines and practices relating to environmental protection, including the mitigation of pollution and climate change; consider whether TransAlta's policies and practices relating to the environment are being effectively implemented, and discuss and advise regarding the development of policies and practices regarding climate change, greenhouse gas and other pollutants."

In addition to the GSSC, climate risks are reviewed through the AFRC. For example, climate policy considerations are factored into decision-making with respect to conversion of coal facilities to gas facilities. In addition, many of our new projects, including clean energy projects, are reviewed by other committees of the Board and climate risk and opportunity is factored into those committee deliberations. As a result, climate change related capital expenditures, acquisitions and budgets are also reviewed at the Board level on a case-by-case basis.

Notably, five of our Board members have identified Environment and Climate Change as being among their top four relevant competencies. We have noted this in our skills matrix section of our 2020 Management Proxy Circular on page 33.

The highest level of oversight on climate change at our executive level is with the President and CEO. Climate change related risks are monitored and actively managed through our TransAlta-wide risk management processes. Climate change risks and opportunities are identified and reviewed at the Board level and all levels of the Corporation. The business units and corporate functions work closely together and flow risks and opportunities upwards to the executive and the Board. Risks and opportunities are reviewed by our CEO and executive team quarterly and are reported to the GSSC and the AFRC.

A significant component of executive compensation is tied to achieving our strategic goals, which include growing renewable energy, reducing GHG emissions through our conversion to gas transition and supporting our customer sustainability goals to decarbonize through on-site low carbon generation. Our corporate executive annual incentive plans (short-term incentive or annual bonus and long-term share incentives) are linked to TransAlta's performance (i.e.,

"pay for performance"). These incentives are linked to execution of strategic goals and our compensation philosophy is designed to drive the right actions to achieve our strategic goals. The long-term incentive plan for the period 2018 to 2020 included a strategic goal to Transition to Renewable Energy. This goal was measured against the performance of the Corporation, which included: advancing and executing our conversion to gas (which results in significant GHG reductions); deliver growth in our renewables fleet (zero or very low carbon assets); expand our presence in the US renewables market (zero or very low carbon assets); advance and grow our on-site generation and cogeneration business (decentralized and low carbon/high energy-efficiency assets); continue to improve our already strong financial position; and remain disciplined with our capital investment strategy. As such, our incentive program is tied to reducing GHG emissions and climate change management.

### Climate Change Strategy

TransAlta, and the electricity sector in general, are at the forefront of reducing GHG emissions, pursuing innovative lower-carbon and zero-carbon solutions (e.g., renewable energy, natural gas, distributed power generation, energy storage, etc.) and are showing a path to resiliency in a low-carbon world. Our investments and growth in renewable energy are highlighted by our diverse portfolio of renewable energy-generating assets. We currently operate approximately 2,500 MW of hydro, wind and solar power. In 2020, we completed construction and commercial operation of an additional 136 MW (net 67 MW) of wind generation in the US (2019 - 119 MW). Today, our diversified renewable fleet makes us one of the largest renewable producers in North America, one of the largest producers of wind power in Canada and the largest producer of hydro power in Alberta.

In addition to climate resiliency, TransAlta remains focused on reliability of electricity supply and affordability for customers. To support our own path to reduce our GHG footprint and ensure climate resiliency, we have a corporate goal to reduce our GHG emissions by 60 per cent by 2030 over 2015 levels, while growing renewable energy and natural gas. We believe natural gas plays a strong role in supporting grid reliability and supporting customer goals of affordability. In 2021, we have adopted a target to be carbon neutral by 2050. We believe carbon neutrality provides flexibility as we shape our strategy over the coming decades and we believe our clean electricity strategy has us well positioned to support us achieving this.

In 2021, we are conducting scenario analysis to further inform our understanding of risks, opportunities, technologies and pathways with respect to a number of future climate scenarios. This process will help inform us as we evaluate strategic GHG reduction pathways with respect to achieving our target of carbon neutrality by 2050. This target aligns us with efforts in the countries where we operate and broader global efforts under the Paris Agreement.

All our business units and operations consistently seek energy-efficiency improvements, opportunities to integrate clean combustion technologies and development of emissions offset portfolios to achieve emissions reductions at competitive costs. We seek investment in climate change related mitigation solutions, such as renewable energy development, where we can maximize value creation for our shareholders, local communities and the environment. Conversion of our large coal fleet to gas-fired generation highlights this approach, which will allow us to run our assets longer than the federally mandated coal retirement schedule. Our goals for undertaking such actions are to enhance value for our shareholders, ensure low-cost and reliable power, and reduce our GHG footprint.

With respect to our customers, we note that we are shifting our product offering from a GHG-intensive product to a low-carbon product to meet the need to decarbonize and mitigate associated societal risks, but also to meet the changing goals of our customers. We continue to build renewable projects for customers seeking to meet their own sustainability goals, such as carbon neutrality on Scope 2, RE100 goals or net zero. We continue to support customers with on-site power-generation goals, where collectively there is an opportunity to reduce GHG impacts through on-site cogeneration, where power and steam production replace existing higher GHG-intensive boilers. Our conversion of coal facilities to gas will significantly reduce the GHG intensity of the Alberta grid, supporting Scope 2 emission reductions for our customers and Alberta commercial and industrial loads.

Another way we can contribute to our customers' sustainability goals is through the use of environmental attributes. We have the ability to generate, trade, purchase and sell environmental attributes that include Alberta EPCs, Alberta carbon offsets, RECs and emission offsets. Production from renewable electricity in 2020 resulted in avoidance of approximately 2.9 million tonnes of CO<sub>2</sub>e for our customers, which is equivalent to removing over 630,000 vehicles from North American roads over the same year. As previously noted, we seek to commoditize carbon through trading and the generation and sale of environmental attributes from renewable energy. Annual revenue generation from the sale of environmental attributes (Alberta carbon offsets and RECs) in 2020 was \$25 million.

## Climate Change Risk Management

Climate change risks are monitored and actively managed through our TransAlta-wide risk management processes. Although we do not have a formal process to review specific climate change risk, climate change risks and opportunities are identified at the Board level, executive and management level, business unit level (coal, gas, wind, solar and hydro) and through our corporate function (e.g., government relations, regulatory, emissions trading, sustainability, commercial, customer relations and investor relations). The business units and corporate functions work closely together and provide information on risks and opportunities to management, the executive team and the Board. One area that is constantly monitored is climate policy, including the impacts on cost, growth and compliance.

Climate change risks at the asset or business unit level are identified through our EMS, asset management function and systems, our energy and trading business, active monitoring, active participation/communication with stakeholders, liaison with our corporate function, active participation in working groups and more. All identified material risks are added to our Enterprise Risk Management risk register. These risks are assessed and scored based on likelihood and impact (what could have "substantive financial impact," "strategic impact," "stakeholder or reputational impact" or "environment, health and safety impact"). Risks are not considered in isolation. Major risks are the focus of management response and mitigation plans.

Our climate change risks are divided into two major categories as per guidance from the TCFD, which include: (1) risks related to the transition to a lower-carbon economy and (2) risks related to the physical impacts of climate change.

### 1. Transition Risks to a Lower-Carbon Economy

We seek to understand the impact on our business as the world shifts to a lower-carbon society. We participate in ongoing decisions related to climate policy and regulation.

## Policy and Legal Risks

### Ongoing and Recently Passed Environmental Legislation

Changes in current environmental legislation do have, and will continue to have, an impact upon our operations and our business. For further details, please refer to the Governance and Risk Management section of this MD&A.

### Canadian Federal Government

#### *Federal Climate Plan*

On Dec. 11, 2020, the Government of Canada released its "A Healthy Environment and a Healthy Economy" climate plan that outlines how the federal government intends to use policies, regulations and funding to achieve Canada's Paris Agreement emission reduction target of 30 per cent reduction from 2005 greenhouse gas emission levels. The three major aspects of the plan include increased carbon prices and obligations, increased funding for clean technology and the implementation of the Clean Fuel Regulation ("CFR"). The government stated that it will consult with provinces and industry regarding many elements of the plan so significant uncertainty remains regarding the final form of the related regulations and other initiatives.

Key proposed elements of the federal plan:

- Carbon price for the carbon tax and the larger emitters program is to rise \$15 per tonne CO<sub>2</sub>e per year from 2023 until reaching \$170 per tonne by 2030;
- Carbon obligations to rise as performance standards (benchmarks) under large emitter regulations tighten;
- Over \$10 billion of funding will be made available for the energy transition, including support for electric vehicles and clean energy development to battery storage and improved grid technology; and
- Implementation of the CFR on liquid fuels, but no CFR obligations for gaseous and solid fuels.

TransAlta intends to continue to engage with governments to mitigate risks and identify opportunities within the new federal plan.

#### *Clean Fuel Regulation*

In 2016, the Canadian federal government announced plans to consult on the development of a CFR to reduce Canada's GHGs through the increased use of lower carbon fuels, energy sources and technologies. The objective of the regulation is to achieve 30 million metric tonnes of annual reductions in GHG emissions by 2030.

On Dec. 19, 2020, the Canadian federal government published its draft version of the CFR with the accompanying supporting documents. As a result of gaseous fuels no longer being regulated by the CFR, the CFR will have a limited impact on the electricity sector. Consultation on the regulation will conclude on March 4, 2021. The CFR is scheduled to be finalized in December 2021 and come into force on Dec. 1, 2022.

#### *Federal Carbon Pricing on GHGs*

On June 21, 2018, the Canadian federal *Greenhouse Gas Pollution Pricing Act* ("GGPPA") came into force. Under the GGPPA, the federal government implemented a national price on GHG emissions. On Jan. 1, 2019, the GGPPA's backstop mechanisms came into force in provinces and territories that did not have an independent carbon pricing program or where the existing program was not deemed equivalent to the federal system. The backstop mechanism has two components: a carbon levy for small emitters ("Carbon Tax") and regulation for large emitters called the Output-Based Pricing Standard ("OBPS"). The Carbon Tax sets a carbon price per tonne of GHG emissions related to transportation fuels, heating fuels and other small emission sources.

As noted above, in the *"Healthy Environment and a Healthy Economy"* plan, the federal government proposed escalating the national price on carbon by \$15 per tonne each year from 2023 until it reaches \$170 per tonne in 2030.

The OBPS regulates large emitters' carbon intensity by setting a sectoral benchmark of GHG emissions per unit of production (e.g., tonnes CO<sub>2</sub>e/MWh) for electricity generators. Emitters exceeding the benchmark generate carbon obligations and those emitters that perform below the benchmark generate EPCs. Emitters can meet their obligations by reducing their emission intensity, buying carbon credits from others (offsets or EPCs) or making compliance payments to the government.

As discussed in the provincial sections below, the OBPS does not apply in Alberta and Ontario is in the process of transitioning out of the OBPS and into a provincial industrial carbon pricing system. As a result, TransAlta's Canadian thermal fleet will be regulated by provincial systems moving forward. However, the federal government compares provincial carbon pricing systems against the OBPS when deciding whether provinces have achieved equivalency with the federal government's carbon price under the GGPPA. On Feb. 12, 2021, the federal government began planning for a 2022 review of the OBPS and other aspects of the GGPPA. TransAlta will actively engage in this process as any changes to the OBPS will influence provincial carbon pricing systems in the future.

#### *Gas Regulation*

On Dec. 18, 2018, the federal government published the *Regulations Limiting Carbon Dioxide Emissions from Natural Gas-fired Generation of Electricity*. Under the regulations, new and significantly modified natural-gas-fired electricity facilities with a capacity greater than 150 MW must meet a standard of 420 tonnes CO<sub>2</sub>e/GWh to operate. For units with a capacity between 25 MW and 150 MW, their standard was set at 550 tonnes CO<sub>2</sub>e/GWh. Facilities with a capacity less than 25 MW have no standard.

Under the regulations, conversions to gas will also eventually have to meet a standard of 420 tonnes CO<sub>2</sub>e/GWh. If the first-year performance test after conversion meets certain emission standards it will not have to meet the 420 tonnes CO<sub>2</sub>e/GWh standard for several additional years past the end of its useful life.

As part of the *Healthy Environment and a Healthy Economy Plan*, the federal government signalled an interest in exploring a new emissions performance standard for the Canadian electricity sector. There are few details available regarding the potential new standard and TransAlta is engaging the federal government to understand the intent of the proposal.

#### *Coal Regulation*

On Dec. 18, 2018, amendments to the *Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations* came into force under the *Canadian Environmental Protection Act, 1999*. The amended regulations will require coal units to meet an emission level of 420 tonnes CO<sub>2</sub>e/GWh by the earlier of end-of-life under the 2012 regulations or Dec. 31, 2029.

## Alberta

### *Large Emitter Greenhouse Gas Regulations*

On Jan. 1, 2020, the Government of Alberta replaced the previous Carbon Competitiveness Incentive Regulation ("CCIR") with a new regulation called the *Technology Innovation and Emissions Reduction* ("TIER") Regulation. For the electricity sector, there were negligible changes between CCIR and TIER with renewable facilities continuing to receive crediting. The carbon price for TIER in 2021 will be \$40/tonnes CO<sub>2</sub>e aligned with the GGPPA requirements. The performance standard benchmark remained at 0.370 tonnes CO<sub>2</sub>e/MWh. A review of TIER is not expected until 2023.

Facilities with emissions above the set benchmark comply with TIER by: a) paying into the TIER Fund (a government-controlled fund that invests in emissions reduction in the province) at the current carbon price; b) making reductions at their facility; c) remitting EPCs from other facilities; or d) remitting emission offset credits.

As required by the GGPPA, the Alberta government files annual reports on TIER program details with the federal government. The federal government reviewed TIER and found it compliant with the GGPPA for 2021. The Corporation will continue to receive offsets and EPCs for its renewable facilities under TIER, ensuring expected revenues are realized.

## British Columbia

Beginning April 1, 2018, the British Columbia government increased its carbon tax price to \$35 per tonne CO<sub>2</sub>e and committed to raise the price \$5 per year until it reaches \$50 per tonne in 2021. Upon review, the government has determined that the carbon tax rate will remain at its current level of \$40 per tonne CO<sub>2</sub>e until April 2021, when it will increase from \$40 to \$45 per tonne CO<sub>2</sub>e. The carbon tax will increase to \$50 per tonne CO<sub>2</sub>e in April 2022. The tax has a negligible cost impact for the Corporation as the tax applies primarily to our transportation fuel use, which is negligible in BC.

## Ontario

### *Large Emitter Greenhouse Gas Regulations*

On July 4, 2019, the Government of Ontario released its final regulations for the provincial Greenhouse Gas Emissions Performance Standards ("EPS"). On Sept. 21, 2020, the federal government accepted the Ontario government's EPS as meeting the requirements of the GGPPA. In December 2020, the Ontario government published amendments to align the EPS with the GGPPA requirements. The Ontario government also announced its intention to transition from the OBPS to the EPS starting on Jan. 1, 2021. Therefore, Ontario's large emitters were covered by the OBPS for 2019 and 2020 compliance years and will subsequently be covered by the EPS.

This requires TransAlta's Ontario natural-gas-fired assets to track and make compliance filings annually and to meet the carbon emission obligations of the applicable government. There are minor differences between the EPS and OBPS. Compliance requirements will be met through payments and alternative compliance units under the OBPS and EPS. However, change-of-law provisions in the contracts with Sarnia, Windsor and Ottawa allow TransAlta to flow carbon-regulation-related costs to customers, resulting in negligible cost increases to the Corporation.

## Michigan

Michigan has air permit requirements related to the Clean Air Interstate Regulation with respect to NO<sub>x</sub> and SO<sub>2</sub> emissions. There are currently no GHG emission compliance requirements other than to report these emissions annually. The Ada cogeneration facility is in compliance with all environment requirements and there have been no recent changes to regulations that would increase costs at the facility.

## Washington

In 2010, the Washington Governor's office and State Department of Ecology negotiated agreements with TransAlta related to the operation of Centralia's two coal-fired electricity generating units. TransAlta agreed to retire its two Centralia coal units: one in 2020 and the other in 2025. This agreement is formally part of the state's climate change program. We currently believe that there will be no additional GHG emissions regulatory burden on Centralia given these commitments. The related TransAlta Energy Transition Bill was signed into law in 2011 and provides a framework to transition from coal to other forms of generation in the State of Washington.

### Massachusetts

The Solar Renewable Electricity Credit I ("SREC I") program carved out from Massachusetts' Renewable Portfolio Standard ("RPS") an initial quantity of 400 MW from small solar facilities of 10 MW or less. The initial SREC I program size was expanded and replaced by a lower-valued SREC II program. In 2018, the solar incentive program evolved into the current Solar Massachusetts Renewable Target Program that further reduced the incentive levels.

The initial SREC I program's volume target was achieved, and qualified projects under SREC I continue to generate SREC I credits for their first 10 years post-commercial operation date. SREC I facilities then generate Class 1 RECs under the Massachusetts RPS for the remainder of their operational life.

Under Massachusetts' net metering program, qualified facilities connect with the local utility and generate net metering credits. Net metering credits offset the delivery, supply and customer charges and can be sold to customers from remote or on-site qualifying facilities. In 2016, the net metering program was updated to reduce the value of the net metering credits by reducing the offset to only energy costs. New projects are impacted once the net metering program volume reaches 1,600 MW. Existing facilities were grandfathered and continue to receive the full, original cost offset treatment for a period of 25 years from initial commercial operation.

Le Nordais receives value from the sale of RECs into the New England RPS markets. Massachusetts has proposed a lower compliance cost ceiling on its RPS standard that would effectively cap the value of RECs. This could have a negative impact on Le Nordais' REC sales price. The change in regulation is still being considered and has not yet been put into force.

### Australia

On Dec. 13, 2014, the Australian government enacted legislation to implement the Emissions Reduction Fund (the "ERF"). The AU\$2.55-billion ERF is the centrepiece of the Australian government's policy and provides a policy framework to cut emissions by five per cent below 2000 levels by 2020 and 26 to 28 per cent below 2005 emissions by 2030. The ERF's safeguard mechanism, commencing from July 1, 2016, is designed to ensure emissions reductions purchased by the Australian government through the ERF are not displaced by significant increases in emissions elsewhere in the economy. The ERF and its safeguard mechanism provide incentives to reduce emissions across the Australian economy.

In addition, on June 23, 2015, the federal Australian government also reformed the Renewable Energy Target ("RET") scheme. The RET is designed to add at least 33,000 GWh/year of renewable sources by 2020. The Australian government has advised there are now sufficient projects approved to meet and exceed the 2020 target of 33,000 GWh/year of additional renewable electricity. The annual target will remain at 33,000 gigawatt hours until the scheme ends in 2030. This would result in approximately 23.5 per cent of Australia's electricity generation being sourced from renewable projects.

The ERF is not expected to have a material impact on our Australian assets. In Australia, electricity has a single sectoral baseline applied to all electricity generators' emissions for units connected to one of Australia's five main electricity grids. The electricity sector baseline has been set at 198 million tonnes CO<sub>2</sub>e per year. In the most recent high emission years of 2015-2016, total emissions were 179 million tonnes CO<sub>2</sub>e per year.

If the baseline is exceeded, then all large emitter generation facilities will need to comply with individual facility baselines. The electricity sector should never exceed the sectoral emission target as no new coal generation is to be built and older coal facilities are retiring. The Corporation's gas facilities will not be subject to carbon costs under current regulations unless changes are made.

### Technology Risks

Our conversion to gas strategy uses existing infrastructure and applicable technologies (natural gas turbines), which reduce the cost and GHG emissions related to new generation construction and material procurement.

Behind-the-fence generation and energy storage technology are emerging risks to the large-scale power-generation model. However, they are practical solutions for some customers, and TransAlta provides these technologies in addition to providing services to the grid.

We provide behind-the-fence generation or decentralized power to some of our industrial customers to supply on-site electricity generation. This generally can be in the form of a cogeneration system that provides steam for industrial processes in addition to power, or a renewable power system. These systems can either be tied to the grid or independent.

Battery storage has the ability to enable greater adoption of renewables and motivate a shift to a distributed power-generation model. We continue to evaluate battery storage for its financial viability, while monitoring the potential impact battery technology could have on natural gas power generation. TransAlta began commercial operations of Alberta's first utility-scale lithium-ion battery storage facility, called WindCharger, on Oct. 15, 2020. This project is unique as it uses TransAlta's existing Summerview II wind facility to charge the battery, allowing WindCharger to be a truly renewable battery energy storage system. The project uses Tesla technology and the potential exists for the expansion of this technology. We are investigating the viability of battery storage at our various wind facility locations and for use in developing customer-specific energy supply solutions.

We have demonstrated upside in growing renewables and gas-powered generation. From 2000 to 2020, we have grown renewables capacity from approximately 900 MW to over 2,500 MW.

### Market Risks

TransAlta has taken significant steps since 2005 to reduce its GHG impact and has announced a full transition off coal by the end of 2025. TransAlta continues to operate hydro facilities and invest in, develop and construct on-site natural gas facilities for customers and new renewable energy from wind, solar, and battery technology.

Changing customer behaviour, reduced consumption and associated use of electricity could impact the demand for electricity; however, we believe this risk is mitigated somewhat by the global trend toward electrification of the economy. Our low-carbon business model supports this type of future.

Increased costs for natural gas supply due to carbon pricing can impact our operating costs. Further discussion can be found in the Governance and Risk Management section of this MD&A. Use of renewable resources, such as the wind and sun, remove associated risk related to cost of supply.

Our Corporate function applies regionally specific carbon pricing, both current and anticipated, as a mechanism to manage future risks pertaining to uncertainty in the carbon market and as a safeguard to anticipate future impacts of regulatory changes on facilities. This information is directed to the business unit level for further integration. Identified climate change risks or opportunities and carbon pricing are recognized in the annual TransAlta long- and medium-range forecasting processes. We capture economic profit through generation of environmental attributes (such as carbon offsets and RECs) and through our emission trading function, which seeks to commoditize and profit from carbon trading.

### Reputation Risks

Consumer trends appear to be moving in favour of renewable and cleaner electricity. We are invested in a diversified mix of renewable generation as well as natural gas, as it provides vital support to the electricity system.

## 2. Physical Impact Risks of Climate Change

As we learn more about the physical risks associated with climate change and weather, we continue to consider both acute and chronic risk, which could materially impact value creation from our operations.

### Acute Risks

We are continuing to evaluate the potential impact of an acute climate change related impact to our business and/or an operational facility or facilities. Our facilities, construction projects and operations are exposed to potential interruption and damage or partial or full loss resulting from environmental disasters (e.g., floods, high winds, fires, ice storms, earthquakes and public health crises, such as pandemics and epidemics). Climate change can increase the frequency and severity of extreme weather events. Further impacts of extreme weather and climate change could result in social unrest, war or terrorism. There can be no assurance that in the event of an earthquake, hurricane, tornado, tsunami, typhoon, or other natural, man-made or technical catastrophe, all or some parts of our generation facilities and infrastructure systems will not be disrupted. The occurrence of a significant event disrupting the ability of our power generation assets to produce or sell power for an extended period, including events that preclude existing customers under PPAs from purchasing electricity, could have a material negative impact on our business.

We seek to mitigate future impact where relevant with climate adaptation solutions. The TransAlta South Hedland facility in Western Australia was built with climate adaptation in mind. The facility is designed to withstand a category 5 cyclone. Category 5 is the highest cyclone rating. Floods, which can occur in the area, have been mitigated by constructing the facility above the normal flood levels. In 2019, when a category 4 cyclone hit this facility, operations were not impacted and we were able to continue generating electricity through the storm, despite widespread flooding and the shutdown of the nearby port and associated business activities.

## Chronic Risks

We have not identified any chronic physical risks that could impact our operations. However, we continue to further our understanding and integration of climate modelling into our long-term planning.

## Climate Change: Metrics and Targets

In 2020, we estimate that 16.4 million tonnes of GHGs with an intensity of 0.67 tonnes per MWh (2019 - 20.6 million tonnes of GHGs with an intensity of 0.75 tonnes per MWh) were emitted as a result of normal operating activities. This reduction of approximately 20 per cent or 4.2 million tonnes CO<sub>2</sub>e is primarily the result of co-firing with gas and lower production volumes at our merchant Alberta coal facilities and lower production from our Centralia coal facility. In 2020, our renewable energy facilities also offset approximately 2.9 million tonnes of CO<sub>2</sub>e for our customers. Because we sell the environmental attributes (offsets and RECs) generated from our renewable energy facilities, we do not net this amount from our total GHGs, but it should be noted that this offset is occurring and our customers are reporting net GHG reductions from TransAlta's renewable energy operating activities.

Our 2020 GHG data is reported to a number of different regulatory bodies throughout the year for regional compliance and, as a result, may incur minor revisions as we review and report data. Any historical revisions will be captured and reported in future disclosure. As per the Kyoto Protocol, GHGs include carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, nitrogen trifluoride, hydrofluorocarbons and perfluorocarbons. Our exposure is limited to carbon dioxide, methane, nitrous oxide and a small amount of sulphur hexafluoride. The majority of our estimated GHG emissions result from carbon dioxide emissions from stationary combustion from coal and natural-gas-powered generation. Emissions data has been aligned with the "Setting Organizational Boundaries: Operational Control" methodology set out in The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard developed by the World Resources Institute and the World Business Council for Sustainable Development. As per the methodology, TransAlta reports emissions on an operation control basis, which means that we report 100 per cent of emissions at facilities in which we are the operator. Emissions intensity is calculated by dividing total operational emissions by 100 per cent of production (MWh) from operated facilities, regardless of financial ownership.

Global warming potentials can vary with respect to regional compliance guidance. We compile our corporate GHG inventory using our business segment GHG calculations. The Clean Energy Regulator in Australia amended global warming potentials in August of 2020 and the use of global warming potentials in our Australia Gas GHG calculations differ from the rest of our fleet as a result of these amendments. Applying harmonized global warming potentials across our fleet would result in a minor variance to our overall calculated GHG totals.

The GHG Protocol Corporate Accounting and Reporting Standard classifies a company's GHG emissions into three scopes. Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy. Scope 3 emissions are all indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions. Scope 1 emissions in 2020 were estimated to be 16.3 million tonnes CO<sub>2</sub>e and accounted for 99 per cent of emissions reported. All of our Scope 1 emissions (100 per cent) are reported to national regulatory bodies in the country in which we operate. This includes: Australia (National Greenhouse and Energy Reporting), Canada (Greenhouse Gas Reporting Program) and the US (EPA). Scope 2 emissions in 2020 were estimated to be 0.1 million tonnes CO<sub>2</sub>e. We estimate our Scope 3 emissions in 2020 to be in the range of six million tonnes, which is primarily attributed to our non-operating joint venture interests.

The following are our GHG emissions broken down by business segment, by Scope 1 and 2 and by country in million tonnes CO<sub>2</sub>e. In our business segment breakdown Hydro, Wind & Solar, Corporate and Energy Marketing are shown as 0.0 in million tonnes, but do have minor GHG emissions.

Year ended Dec. 31	2020	2019	2018
Hydro	0.0	0.0	0.0
Wind & Solar	0.0	0.0	0.0
North American Gas	1.5	1.5	1.4
Australia Gas	1.1	1.0	1.0
Alberta Thermal	7.9	10.1	12.3
Centralia	5.9	8.0	6.1
Corporate and Energy Marketing	0.0	0.0	0.0
<b>Total GHG emissions</b>	<b>16.4</b>	<b>20.6</b>	<b>20.8</b>

Year ended Dec. 31	2020	2019	2018
Scope 1	16.3	20.4	20.6
Scope 2	0.1	0.2	0.2
<b>Total GHG emissions</b>	<b>16.4</b>	<b>20.6</b>	<b>20.8</b>

Year ended Dec. 31	2020	2019	2018
Australia	1.1	1.0	1.0
Canada	9.4	11.6	13.7
United States	5.9	8.0	6.1
<b>Total GHG emissions</b>	<b>16.4</b>	<b>20.6</b>	<b>20.8</b>

All of our reported 2020 and historical GHG emissions are verified by Ernst & Young LLP to a level of limited assurance. An assurance statement can be found in the back of this Integrated Annual Report. In addition, GHG emissions are verified to a level of reasonable assurance in locations where we operate within a carbon regulatory framework. In Alberta, we verify GHG emissions through the TIER program and, as a result, 51 per cent of our total Scope 1 emissions are also verified to a level of reasonable assurance. Our GHG emissions are calculated using a number of different methodologies depending on the technologies available at our facilities.

We have a target to reduce 60 per cent or 19.7 million tonnes of our GHG emissions by 2030 over 2015 levels. In 2021, we set a new target to be carbon neutral by 2050. Our actions to reduce GHG emissions are aligned with the UN's SDGs, specifically "Goal 13: Climate Action." By 2030, we expect to have reduced close to 30 million tonnes over 2005 levels.

The following highlights our GHG emission reductions since 2005 and our targeted emissions in 2030 (in line with our GHG target). The actual GHG emissions for the Corporation in 2030 will vary from that presented below depending on, among other things, the growth of the Corporation, including its on-site generation business.

Year ended Dec. 31	2030 (forecast)	2020	2005
<b>Total GHG emissions (million tonnes CO<sub>2</sub>e)</b>	<b>12.5</b>	<b>16.4</b>	<b>41.9</b>

In 2020, TransAlta increased its scoring on the CDP Climate Change investor request. Our overall score was an A-, indicating that we are implementing current best practices. This ranks the Corporation among industry leaders on climate change management and places us as ahead of most companies in North America. The average CDP score for our peers was a B and the average score for reporting companies in North America was a D.