

Investment in Canada's Clean Technology Sector



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EXECUTIVE SUMMARY

This Policy Brief provides an in-depth assessment of the climate for investment in clean energy technology industries in Canada based on data from an extensive survey of senior energy sector executives conducted by the Ivey Energy Policy and Management Centre at Ivey Business School.

The overall picture that emerges is that firms in the energy sector are planning to increase investment in clean energy technologies over the next three years, especially in energy storage, hydrogen and fuel cells. Some of this investment will come from smaller companies that are primarily focused on specific clean technologies. Investment in cleantech will also be driven by larger, traditional energy firms in the electricity, oil, gas, and pipeline industries, which have complementary technologies, capabilities, and resources. The survey indicates that, on average, energy companies in the hydrocarbon sector – oil, gas and pipelines – are especially bullish about increasing their investment in cleantech.

Investment conditions for cleantech are perceived mainly as being favourable, notably for nuclear power generation and hydrogen, but less so for energy storage and renewable power. Energy companies active in cleantech as well as in oil, gas, pipelines, and electricity tend to regard investment conditions for cleantech more positively than companies involved only in cleantech. Executives are less sanguine about the policy and regulatory environment, which is rated as having a neutral impact overall on investment in cleantech. Exceptions included federal energy policy and intellectual property rights protection, which were evaluated as having a somewhat favourable impact on investment decisions. Economic conditions were also viewed as largely neutral, apart from market prices for cleantech products and services, which were

seen as somewhat unfavourable, and supply chain conditions, which were evaluated positively.

Improved government funding for cleantech research and development, and tax credits and other financial incentives, were commonly mentioned by executives at pure cleantech firms as preferred policy priorities for improving investment conditions in the sector. Improving the stability of federal and provincial regulatory conditions, which would foster greater investment certainty, was a priority for firms across cleantech sectors.

A majority of executives reported that their companies are likely to reduce carbon emissions in the near future. Companies involved in both cleantech and traditional energy sectors are predicted to decrease emissions by the greatest amount as compared to pure cleantech or pure traditional energy companies, indicating an environmental benefit of cross-investment in related energy technologies and processes.

THE CLEAN ENERGY TECHNOLOGY SECTOR IN CANADA

Clean energy technologies are expected to play an important role in reducing national greenhouse gas emissions and in the transition to a low-emission economy in many countries but especially in Canada, which is one of the world's leading energy producers and exporters.¹ Clean energy technologies, broadly defined, are energy sector processes, products and services that reduce environmental impacts relative to industry standards, and include emissions and energy management technologies and services, energy storage, smart grid technologies, renewable and nuclear power generation technologies, and alternative fuels such as hydrogen and fuel cells.²

The cleantech sector in Canada has been growing in economic importance over the last decade. According to Statistics Canada, the combined environmental and clean technology sector contributed \$70.5 billion (3%) to Canada's GDP in 2019, and accounted for approximately 341,000 jobs, an increase of 4.6% from 2018. Most of the cleantech sector's GDP and employment contributions came from the provinces of Ontario, Quebec, and British Columbia. Clean technology product exports totaled \$13.5 billion in 2019, representing 2% of total Canadian exports.³

The sector's growth has been driven both by new, pure cleantech companies and by traditional oil, gas, and electricity companies who are investing heavily in

technology development.⁴ For instance, Alberta's oil companies have collectively pooled \$1.4 billion to fund research and development of environmental technologies through the cooperative Canada's Oil Sands Innovation Alliance.⁵

Federal and provincial governments are promoting continued growth in clean technology investment. The federal government is providing financial support to the sector through Sustainable Development Technology Canada, the Strategic Innovation Fund, and the Clean Resource Innovation Network (CRIN), to stimulate the development and adoption of cleantech and emission-lowering solutions. The development of small modular reactor (SMR) technology is expected to offer reliable, carbon-free energy, with four provinces actively exploring SMRs to produce clean energy with lower upfront capital costs and enhanced safety features.⁶

However, despite the recent growth of the cleantech industry within Canada, concern has been voiced about the continued ability of the sector to compete against other countries that are also investing in cleantech firms and attracting globally mobile capital. A report issued by the federal government, based on consultation with industry executives, found that, in general, Canadian cleantech companies have grown less quickly and raised less capital than competitors in the U.S. and other

¹ See, for example, the Canada Energy Regulator report, "Canada's Energy Future 2020" and the report by Navius Consulting, "Achieving Net Zero Emissions by 2050 in Canada," January 2021.

² Statistics Canada defines environmental and clean technology as any process, product or services that reduces environmental impacts through any of the following three strategies: environmental protection activities that prevent, reduce or eliminate pollution or any other degradation of the environment; resource management activities that result in the more efficient use of natural resources, thus safeguarding against their depletion; or the use of goods that have been adapted to be significantly less energy or resource intensive than the industry standard. See Statistics Canada, "Clean technologies and the Survey of Environmental Goods and Services: A technical reference guide," Catalogue no. 16-511-XISSN 2561-3723, released September 1, 2020.

³ "Environmental and clean technology products sector grew at twice the pace as the total economy in 2019," The Daily, Statistics Canada, released December 18, 2020, accessed January 6, 2021, <https://www150.statcan.gc.ca/n1/daily-quotidien/201218/dq201218d-eng.htm>.

⁴ "From Chaos to Transformation: The Companies and Themes Delivering Sustainable Innovation," Cleantech Group, released January 2021, accessed March 23, 2021 and Joe Greenwood and Farooq Qaiser, "Innovation in Cleantech: How Canada can become a global leader," MaRS Discovery District, released March 2017, accessed March 23, 2021, <https://www.marsdd.com/wp-content/uploads/2017/03/Innovation-in-Cleantech-MaRS-Report-2017-1.pdf>.

⁵ Geoffrey Morgan, "Innovation Energy: Oilsands step up to take on clean tech challenge," Financial Post, released July 9, 2019, accessed April 16, 2021, <https://financialpost.com/feature/innovation-energy-oilsands-step-up-to-take-on-clean-tech-challenge>.

⁶ See report titled "Feasibility of Small Modular Reactor Development and Deployment in Canada," by SaskPower, Énergie NB Power, Bruce Power, and Ontario Power Generation, released March 2021, and "Four provinces opposing federal carbon tax to explore viability of small modular nuclear reactors," National Post, April 14, 2021, <https://nationalpost.com/news/politics/four-provinces-to-sign-memorandum-of-understanding-to-explore-small-nuclear-reactors>.

countries, partly because of a risk-averse domestic market and limited capital access.⁷ Clean energy technologies can be more capital intensive than digital technologies, and the payout on investment is often more than ten years. Some have argued that a lack of 'patient' capital in Canada has made it difficult for clean energy companies to secure financing at the commercialization and scale-up phases of technology development, and that more government and private sector co-investment partnerships are needed. Understanding how economic and policy factors are impacting investment in Canada's cleantech sector, and in specific technologies, can thus provide new insights for firms and policymakers alike.⁸

This Policy Brief provides an in-depth assessment of the climate for investment in clean energy technology industries in Canada based on data from an extensive survey of senior energy sector executives conducted by

the Ivey Energy Policy and Management Centre at Ivey Business School. Analysis of survey responses provides insights into three core issues: first, how is the level of private investment in clean energy technologies likely to change in the near future, and what types of firms are investing? Second, what aspects of the investment environment, including economic and policy factors, are perceived as facilitating or hindering investment? And third, how are firms' investments in clean technologies affecting their environmental impacts?

⁷ "Report from Canada's Economic Strategy Tables: Clean Technology," Government of Canada, released 2018, accessed March 23, 2021, [https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_CleanTechnologies.pdf/\\$file/ISED_CleanTechnologies.pdf](https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_CleanTechnologies.pdf/$file/ISED_CleanTechnologies.pdf).

⁸ "Climate Change Innovation and Technology Framework 2017, Advancing Alberta's environmental performance and diversification through investments in innovation and technology", 2017, accessed on June 15, 2021, <https://open.alberta.ca/dataset/59ff9a2e-da93-4f8e-8c91-e8610ad4c1d2/resource/222449d1-60d9-49d6-a47c-4086c350ea25/download/climate-change-innovation-and-technology-framework-2017.pdf>.

SURVEY METHODOLOGY

The survey was sent by email to more than 4,000 senior executives in cleantech as well as traditional energy companies in the fall of 2020 (see Appendix A for the survey instrument), and was fully completed by 388 respondents from 249 different firms. An important initial finding from the survey is that a broad array of different types of energy companies are involved in the cleantech sector. 119 respondents (31%) were employed at companies involved only in the cleantech sector, but a larger number—162 respondents (42%)—were executives at companies involved in traditional oil, gas, pipeline, and electricity sectors as well as in cleantech (see Table 1). Throughout the report, we refer to these as ‘mixed energy’ companies. A minority of respondents (27%) were employed at traditional-only energy companies. Among all the companies identified as being active in cleantech (162 in total), 46% were involved in traditional energy sectors as well.

Table 1: Survey Respondents by Company Type

Company Type	Number of Respondents	Number of Companies
Cleantech Only	119	87
Cleantech and Oil, Gas, Electricity, and/or Pipelines	162	75
Oil, Gas, Electricity, and/or Pipelines Only	107	87
Total	388	249

Note: The definition of the ‘Electricity’ category includes distribution, transmission, and hydrocarbon generation, and excludes renewable and nuclear generation, which are included in the ‘Cleantech’ category.

Among the firms that respondents identified as being active in electricity (excluding renewable and nuclear power generation), 69% were also active in cleantech (see Table 2). Similarly, 67% of respondent companies identified as being active in pipelines were active in cleantech. The equivalent percentages for companies active in oil and gas were 33% and 47%, respectively. Overall, these figures indicate that a significant share of ‘traditional’ energy companies—those active in electricity, gas, oil, and pipelines—are actively engaged in cleantech, which may reflect the complementary nature of the businesses and markets.

Table 2: Cross-Sector Involvement of Cleantech and Traditional Energy Companies

Company Type	Respondents	Company Also Active in Cleantech	
		(Number)	(Percentage)
Active in Electricity (excl. nuclear and renewables)	132	91	69%
Active in Oil Sector	113	37	33%
Active in Gas Sector	129	61	47%
Active in Pipelines Sector	61	41	67%

Respondents identified up to three ‘businesses’ (defined by an industry sector and province) that were the most important to their firms. The 388 respondents identified 770 respondent businesses in total, including 339 (44%) in the cleantech industry, 136 (18%) in oil, 122 (16%) in electricity (transmission, distribution, and hydrocarbon generation), 120 (16%) in gas, and 53 (7%) in pipelines (Table 2). Respondent businesses were most frequently located in the provinces of Alberta, British Columbia, and Ontario.

Table 3: Respondent Company Businesses by Industry and Province/Territories

Province/Territories	Cleantech	Electricity	Gas	Oil	Pipelines
Alberta (276)	69	21	56	91	39
British Columbia (118)	54	12	33	11	8
Manitoba (9)	5	2	2	0	0
New Brunswick (19)	17	0	2	0	0
Newfoundland and Labrador (16)	4	4	0	8	0
Nova Scotia (19)	14	3	2	0	0
Ontario (217)	128	65	17	5	2
Prince Edward Island (1)	1	0	0	0	0
Quebec (34)	23	2	5	4	0
Saskatchewan (47)	17	6	3	17	4
Territories (14)	7	7	0	0	0
Total (770)	339	122	120	136	53

Within the cleantech sector, respondents identified which of eight different types of technology their firms were active in, as well as the geographic location (see Table 4). The most frequently noted clean technology was Renewable Power Generation (39%), followed by Hydrogen/Fuel Cells (12%), Energy Storage (11%), Energy Consumption and Management (10%), Nuclear Power Generation (8%), Emissions Management (7%),

Smart Grid (5%), and Other (8%).⁹ The majority (74%) of these cleantech businesses operated in three provinces (Ontario, Alberta, and British Columbia). Cleantech-only companies accounted for almost two-thirds of the cleantech businesses, with mixed cleantech and traditional energy companies accounting for the other third (see Table 5).

Table 4: Cleantech Businesses by Technology Type and Province/Territories

Clean Technology	AB	BC	MB	NB	NL	NS	ON	PE	QC	SK	Territories
Emissions management (24)	11	3	0	0	0	2	4	0	3	1	0
Energy consumption management (34)	7	2	0	2	1	0	21	0	1	0	0
Energy storage (38)	3	4	1	3	0	6	20	0	1	0	0
Hydrogen and/or fuel cells (42)	9	18	0	1	0	1	8	0	4	1	0
Other Cleantech (26)	12	5	0	1	0	1	3	0	4	0	0
Power Generation (nuclear) (27)	0	0	0	8	0	0	16	0	0	3	0
Power Generation (renewable) (132)	26	22	4	2	3	4	44	1	9	10	7
Smart grid technologies (16)	1	0	0	0	0	0	12	0	1	2	0
Total (339)	69	54	5	17	4	14	128	1	23	17	7

Table 5: Cleantech Businesses by Company Type

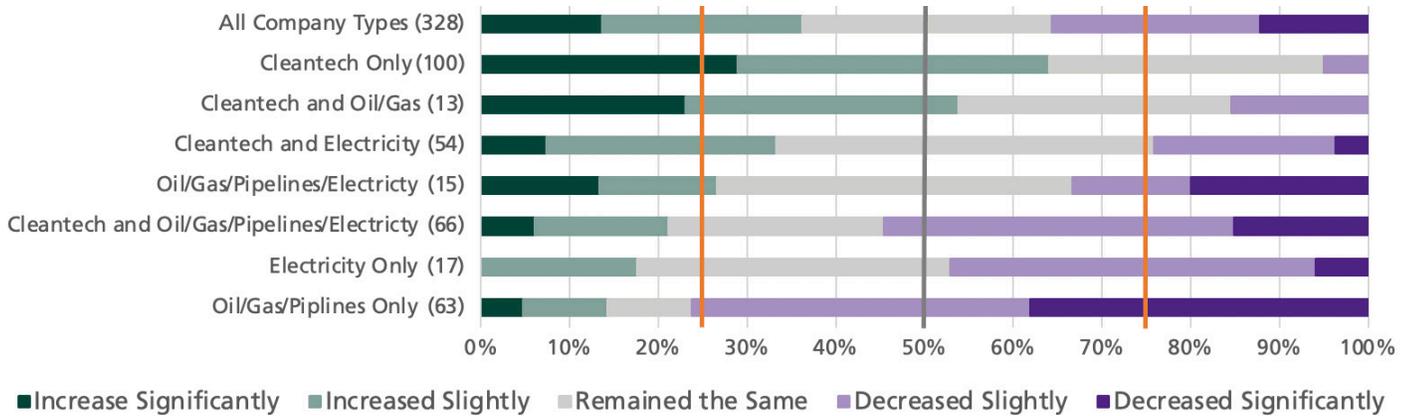
Clean Technology	Cleantech and Electricity	Cleantech and Oil/Gas	Cleantech and Oil/Gas/Pipelines/Electricity	Cleantech Only
Emissions management (24)	0	5	5	14
Energy consumption management (34)	9	4	7	14
Energy storage (38)	7	0	0	31
Hydrogen and/or fuel cells (42)	3	0	4	35
Other Cleantech (26)	0	5	2	19
Power Generation (nuclear) (27)	4	0	4	19
Power Generation (renewable) (132)	34	5	17	76
Smart grid technologies (16)	9	0	1	6
Total (339)	66	19	40	214

⁹ The Other category includes clean technologies related to energy sector waste management and remediation services, alternative renewable fuel products (renewable natural gas, renewable diesel, jet fuel, fusion energy), and clean energy product manufacturing (solar panels).

The typical (median) respondent cleantech-only company had 10-49 employees and was 6-10 years old. In comparison, the median respondent hydrocarbon company (oil, gas, pipelines) had 50-249 employees and was 11-20 years old. Cleantech-only companies were more likely to have increased employment over the

previous year compared to other company types (see Figure 1), and mixed energy companies were more likely to have expanded employment than pure traditional energy companies (i.e., electricity-only or oil/gas/pipeline-only companies).

Figure 1: Recent Change in Employment by Company Type



THE INVESTMENT ENVIRONMENT FOR THE CLEANTECH SECTOR

The survey assessed senior executives' perceptions of the state of the investment environment in Canada's cleantech sector, asking questions about (i) future investment intentions, (ii) the overall attractiveness of the investment environment and how it has changed, and (iii) the impact of economic and policy factors on investment decisions.

i. Future Investment Plans

According to survey respondents, the overall investment outlook for the cleantech sector is positive, especially when compared to the outlook for the gas, oil, and pipeline sectors. More than 75% of cleantech business respondents reported that investment by their companies would increase significantly or slightly over the next three years. In contrast, more than 50% of oil industry respondents expected that investment levels would decrease in the oil sector. Approximately two-thirds of electricity sector respondents expected that investment in the electricity business would increase in the next three years (Figure 2A).

Within the cleantech sector, respondents were most optimistic about investment in energy storage, hydrogen/fuel cells, and emissions management technologies, and least optimistic, but still net positive, about future investment in renewable power generation (Figure 2B). The expected change in investment in renewable generation varied across provinces, with investment levels more likely to increase in Alberta and Saskatchewan and and less likely to increase in Ontario and British Columbia.

All types of companies active in cleantech anticipated higher levels of investment in their clean technology businesses (Figure 2C). Companies that were active in traditional hydrocarbon industries — oil, gas, and

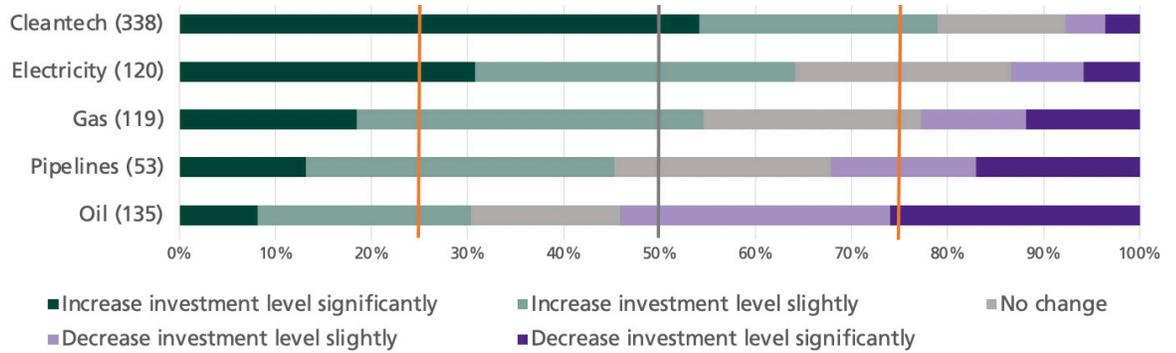
pipelines — as well as in cleantech were most optimistic about future investment, with 95% of respondent businesses from these companies predicting investment would increase significantly or slightly. The equivalent percentage for respondents from cleantech-only companies was just over 80%.

Cleantech-only companies anticipated increasing investment in all clean technologies, but particularly in nuclear generation, energy storage, emissions management, and hydrogen/fuel cells, where more than 90% of respondent businesses expected to increase investment slightly or significantly (Figure 2D). Companies active in both the electricity industry and cleantech industry anticipated increasing investment slightly or significantly in energy storage, smart grid technologies, energy management, and renewable generation. Companies involved in the traditional hydrocarbon and cleantech industries expected to increase investment in energy management and renewables.

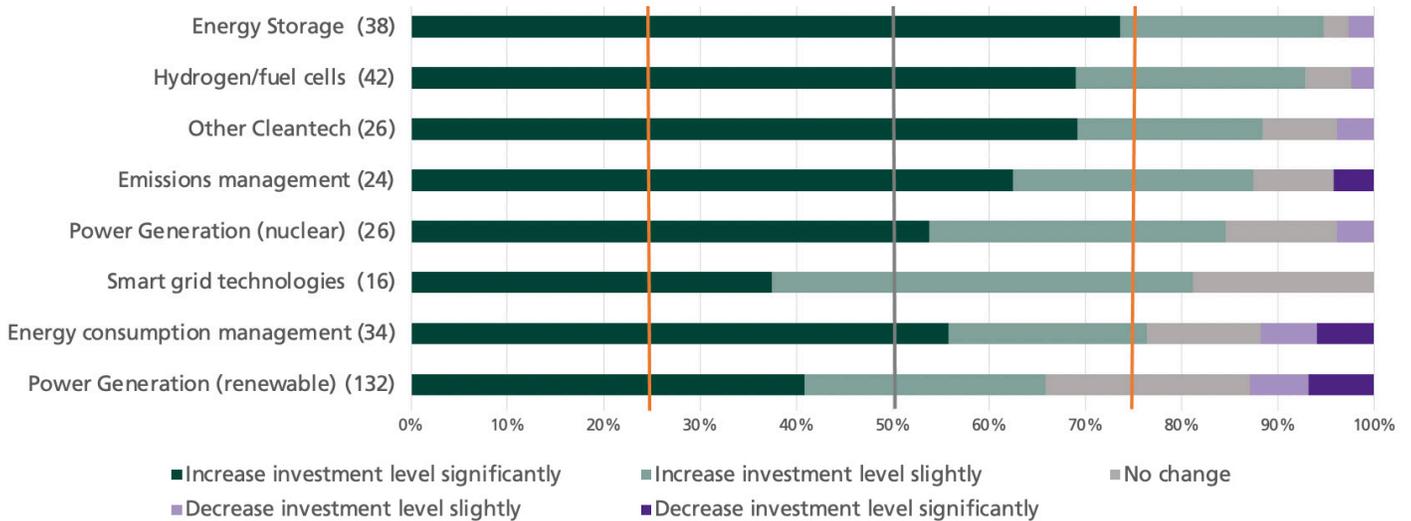
Figure 2: Expected Investment in Cleantech

Q: How is the level of investment by your company likely to change over the next three years in the industries/jurisdictions that are the most important to your company?

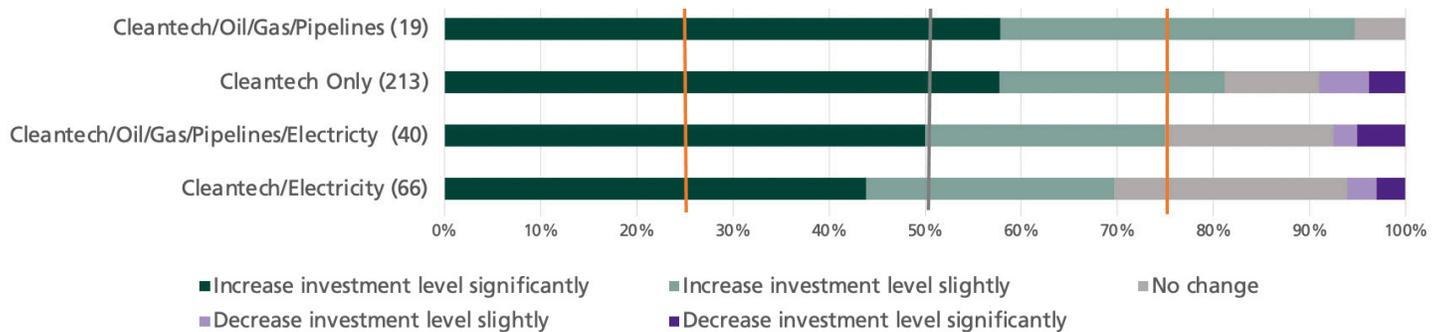
A. Industry



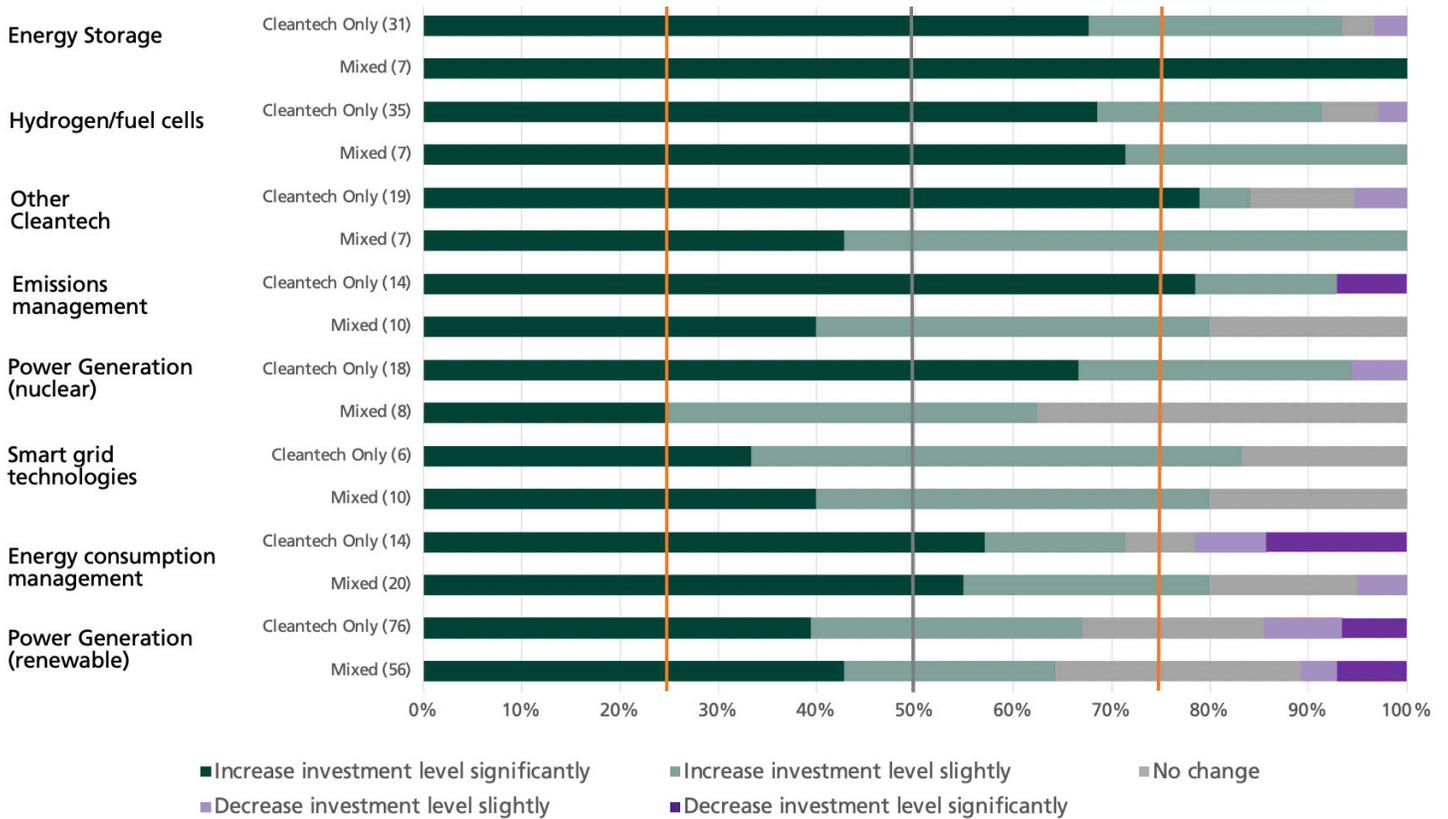
B. Clean Technology



C. Cleantech Business by Company Type



D. Clean Technology



ii. The Overall Investment Environment for Cleantech

Consistent with expressed investment intentions, most respondent businesses (60%) evaluated the overall investment environment for cleantech as very or mildly attractive (versus just 13% for oil, 27% for pipelines, and 37% for gas – see Figure 3A).

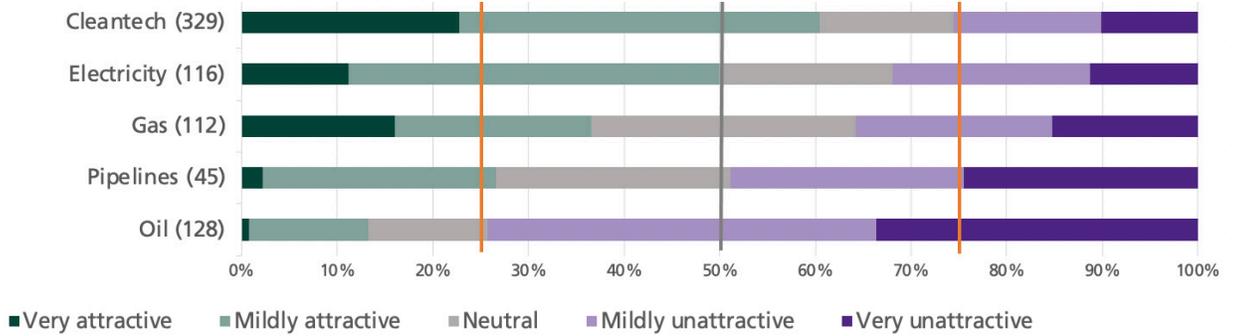
Within the cleantech sector, investment conditions were viewed as most favourable for nuclear power generation (85%) and hydrogen/fuel cells (76%), and least favourable but still net positive for energy storage (53%) and renewable power generation (49%) (Figure 3B). Investment conditions in renewable power generation in Alberta and Saskatchewan were viewed as more attractive than in Ontario and British Columbia, with roughly 50% of the respondents with renewable energy businesses in these provinces indicating that conditions were mildly or very unattractive.

Mixed energy companies — those active in cleantech as well as in oil, gas, pipelines and electricity — regarded investment conditions for cleantech more positively than companies involved only in cleantech. Almost 90% of respondents from mixed cleantech and hydrocarbon companies viewed conditions for cleantech as very or mildly attractive versus 54% of respondents from cleantech-only companies (Figure 3C). Additionally, mixed energy companies were notably more likely than cleantech-only companies to consider the investment conditions in emissions management technologies, energy storage, and renewable energy to be positive (Figure 3D).

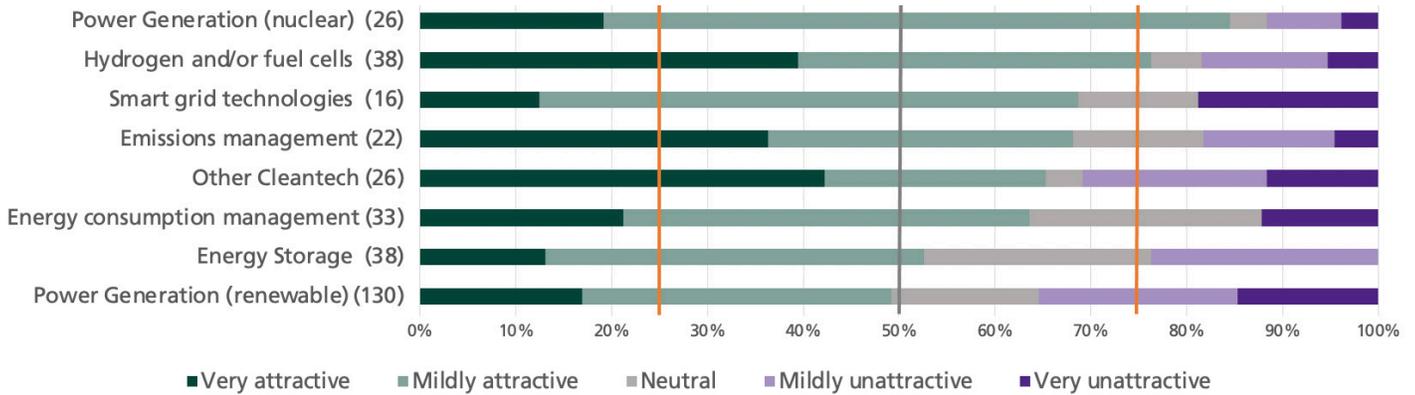
Figure 3: Investment Conditions for Cleantech

Q: How attractive are the current investment conditions in the industries/jurisdictions that are the most important to your company?

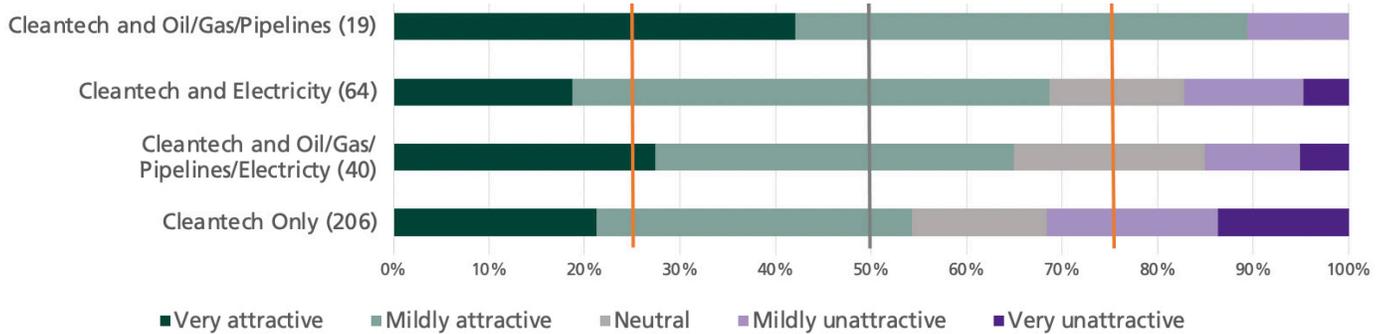
A. Industry



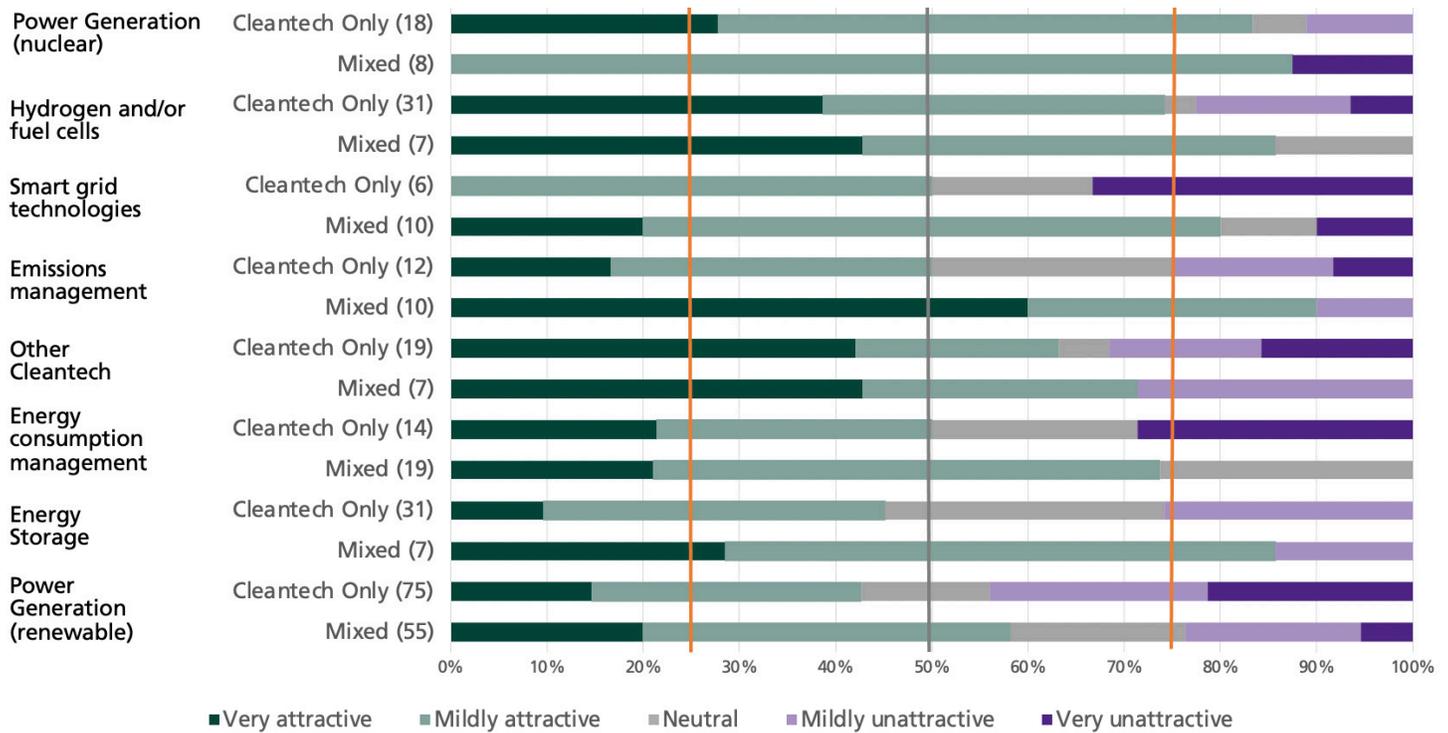
B. Clean Technology



C. Cleantech Businesses by Company Type



D. Clean Technology



Respondents' views on how investment conditions had recently changed differed considerably across industries. Approximately three-quarters of cleantech respondents viewed conditions as having improved or remain the same over the last three years. A similar percentage (71%) applied to electricity sector respondents. In stark contrast, 95% of oil sector respondents believed conditions had deteriorated in their sector, as did 77% of pipeline sector respondents.

Within the cleantech sector, respondents for most technologies viewed investment conditions as having improved recently, with the exception of renewable power generation where the net view was deterioration.

Again, views on renewable energy generation varied by jurisdiction; conditions were viewed as having improved in Alberta and Saskatchewan but as having deteriorated or remained the same in Ontario and British Columbia. The median respondent for smart grid technologies and energy consumption management regarded conditions as having remained the same.

Respondents from mixed energy companies – cleantech and oil and gas – were somewhat more positive than respondents from cleantech only companies about recent improvements in investment conditions. 89% of respondents from the former reported an improvement or no change versus 74% from the latter.

iii. Economic and Policy Factors Affecting Investment in Cleantech

The survey asked executives to assess the impact of seventeen economic, policy, and social factors on investment decisions by their companies. For the cleantech sector overall, virtually all factors were rated as neutral, with a few close to somewhat favourable. Market prices/regulated rates were ranked as the least favourable factor, although demand conditions were generally seen

as being more favourable. Several factors were regarded as having a more positive impact: federal energy policy, intellectual property rights, innovation and R&D support, supplier and material costs, and public opinion. Two of these strengths — federal energy policy and public opinion — were rated as negative by respondents for the oil, gas, and pipeline sectors (Table 6a).¹⁰

¹⁰ Not reported in Table 6 are the respondents' views on the impact of COVID-19 on investment decisions, which was consistently seen by respondents to have had a somewhat unfavourable impact on investment.

Within the cleantech sector, policy and regulatory factors, including at the provincial level, were seen as more supportive for nuclear power generation and emissions management technologies. Economic factors were broadly positive with the exception of access to financial capital, where there was some variation among technologies: financial capital availability was rated as somewhat positive for renewable power and energy storage, but marginally negative for energy consumption management technologies and very negative for the oil and pipeline sectors.

Table 6: Impact of Policy and Economic Factors on Investment Decisions (by Industry)

(a) Policy Factors

	Industry/Technology	Prov. Govt. energy policy	Fed Govt. energy policy	Prov. Reg. frameworks & approval processes	Fed Reg. frameworks & approval processes	Prov. Env. Standards & assessments	Fed. Env. Standards & assessments	Corporate tax & royalty regime	Innovation/ R&D Support	Intellectual property rights protection	Average Policy Factors Rating	
Industry	Cleantech (339)	3.1	3.5	2.9	3.0	3.1	3.2	3.1	3.4	3.5	3.2	
	Electricity (122)	2.9	2.7	2.5	2.6	2.8	2.6	2.8	3.0	3.1	2.8	
	Gas (120)	3.5	1.8	3.2	1.8	3.1	1.8	3.0	3.2	3.3	2.7	
	Oil (136)	3.4	1.4	3.0	1.3	2.9	1.6	3.0	2.9	3.2	2.5	
	Pipelines (53)	3.2	1.3	2.8	1.2	2.8	1.5	2.9	2.9	3.0	2.4	
	All Industries (770)	3.2	2.6	2.9	2.3	3.0	2.4	3.0	3.2	3.3	2.9	
Technology	Emissions management (24)	3.6	3.5	3.4	3.2	3.6	3.3	3.0	3.9	4.1	3.5	
	Energy consumption management (34)	2.6	3.1	2.7	2.8	2.9	3.0	3.0	3.6	3.5	3.0	
	Energy Storage (38)	3.1	3.8	2.7	3.3	3.2	3.3	3.0	3.7	3.3	3.2	
	Hydrogen and/or fuel cells (42)	3.6	3.5	3.0	3.1	3.2	3.0	3.1	3.5	3.8	3.3	
	Other Cleantech (26)	3.2	3.7	3.2	3.4	3.4	3.6	3.4	3.7	3.9	3.5	
	Power Generation (nuclear) (27)	4.7	3.7	3.6	2.8	3.4	2.6	3.1	3.6	3.6	3.4	
	Power Generation (renewable) (132)	2.7	3.5	2.6	3.0	2.9	3.2	3.2	3.0	3.2	3.0	
	Smart grid technologies (16)	2.7	3.4	2.6	2.9	2.9	3.0	2.8	3.0	3.3	3.0	
		All Technologies (339)	3.1	3.5	2.9	3.0	3.1	3.2	3.1	3.4	3.5	3.2

Assigned values: Unfavourable=1, Somewhat unfavourable=2, Neutral=3, Somewhat favourable=4, Favourable=5. Cells coloured in purple reflect unfavorable impacts, white or grey neutral, and green favourable.

(b) Economic and Social Factors

	Industry/Technology	Market price/regulated rate of energy product/service	Demand conditions for energy product/service	Natural resource availability	Cost & availability of financial capital (debt & equity)	Supplier, equipment and material costs and availability	Labour costs, availability and skill sets	Average Economic Factors Rating	Public opinion	Overall Rating	
Industry	Cleantech (339)	2.8	3.3	3.8	3.2	3.5	3.4	3.3	3.6	3.3	
	Electricity (122)	2.7	3.0	3.6	3.9	3.2	3.2	3.3	2.8	3.0	
	Gas (120)	2.8	3.0	4.2	2.7	3.6	3.6	3.3	2.3	2.9	
	Oil (136)	2.1	2.3	4.2	1.8	3.5	3.5	2.9	1.8	2.6	
	Pipelines (53)	2.5	2.6	3.9	2.4	3.4	3.5	3.0	1.7	2.6	
	All Industries (770)	2.6	3.0	3.9	2.9	3.5	3.4	3.2	2.8	3.0	
Technology	Emissions management (24)	2.8	3.3	4.4	3.3	3.5	3.6	3.5	3.8	3.5	
	Energy consumption management (34)	3.0	3.6	3.4	2.4	3.5	3.2	3.2	3.6	3.1	
	Energy Storage (38)	2.7	4.0	3.1	3.5	3.7	3.5	3.4	4.1	3.4	
	Hydrogen and/or fuel cells (42)	2.8	3.2	4.2	3.1	3.5	3.5	3.4	3.9	3.4	
	Other Cleantech (26)	2.6	3.8	3.8	2.7	3.6	3.7	3.4	4.1	3.5	
	Power Generation (nuclear) (27)	3.4	3.8	3.6	2.8	3.3	2.7	3.3	3.3	3.4	
	Power Generation (renewable) (132)	2.7	3.0	3.9	3.6	3.5	3.4	3.3	3.4	3.2	
	Smart grid technologies (16)	2.8	3.3	3.3	3.3	3.5	3.3	3.2	3.1	3.1	
		All Technologies (339)	2.8	3.3	3.8	3.2	3.5	3.4	3.3	3.6	3.4

Assigned values: Unfavourable=1, Somewhat unfavourable=2, Neutral=3, Somewhat favourable=4, Favourable=5. Cells coloured in purple reflect unfavorable impacts, white or grey neutral, and green favourable.

There is some evidence that executives at mixed energy and cleantech companies viewed economic and policy factors for certain technologies more favourably than executives from pure cleantech companies (see Table 7). This pattern is apparent for two technology categories with larger numbers of survey responses, renewable power generation and energy consumption

management. In each case, executives at cleantech-only companies rated provincial policies and regulatory frameworks, and market prices, as having a negative impact on investment, while executives at mixed energy companies rated these factors as neutral. This difference may reflect greater business resilience and adaptability of more diversified firms.

Table 7: Impact of Policy and Economic Factors on Investment Decisions (by Company Type)

(a) Policy Factors

	Industry/Company Type	Prov. Govt. energy policy	Fed Govt. energy policy	Prov. Reg. frameworks & approval processes	Fed Reg. frameworks & approval processes	Prov. Env. Standards & assessments	Fed. Env. Standards & assessments	Corporate tax & royalty regime	Innovation/ R&D Support	Intellectual property rights protection	Average Policy Factors Rating
Cleantech Only Companies	Emissions management (14)	3.5	3.5	3.4	3.3	3.6	3.4	3.1	3.9	4.2	3.5
	Energy consumption management (14)	2.2	2.7	2.4	2.2	2.4	2.7	3.1	3.9	3.6	2.8
	Energy Storage (31)	3.3	4.0	2.7	3.4	3.2	3.2	3.0	3.9	3.4	3.3
	Hydrogen and/or fuel cells (35)	3.5	3.3	3.0	3.0	3.1	2.9	3.0	3.3	3.9	3.2
	Other Cleantech (19)	3.2	3.6	3.2	3.2	3.4	3.4	3.2	3.6	3.8	3.4
	Power Generation (nuclear) (19)	4.8	3.8	3.7	2.8	3.3	2.7	3.1	3.5	3.8	3.5
	Power Generation (renewable) (76)	2.3	3.3	2.4	3.0	2.7	3.3	3.1	3.0	3.1	2.9
	Smart grid technologies (6)	3.2	4.0	3.7	3.3	3.2	3.5	3.0	3.5	3.7	3.5
	Average	3.0	3.5	2.8	3.0	3.0	3.1	3.1	3.4	3.6	3.2
	Mixed Cleantech Companies	Emissions management (10)	3.9	3.5	3.4	3.0	3.5	3.1	2.9	3.8	4.0
Energy consumption management (20)		3.0	3.6	3.0	3.4	3.6	3.6	2.9	3.3	3.4	3.3
Energy Storage (7)		2.2	2.6	2.3	2.3	3.5	3.5	3.2	2.8	3.0	2.8
Hydrogen and/or fuel cells (7)		4.1	4.1	3.3	3.4	3.4	3.4	3.2	4.4	3.3	3.7
Other Cleantech (7)		3.3	4.0	3.2	4.0	3.4	4.0	3.9	4.1	4.1	3.8
Power Generation (nuclear) (8)		4.3	3.3	3.3	2.7	3.5	2.5	3.0	3.8	3.2	3.3
Power Generation (renewable) (56)		3.3	3.7	3.0	3.1	3.2	3.1	3.2	3.0	3.3	3.2
Smart grid technologies (10)		2.4	3.0	1.9	2.7	2.7	2.7	2.7	2.7	3.1	2.6
Average		3.3	3.6	2.9	3.1	3.3	3.2	3.1	3.3	3.4	3.2

Assigned values: Unfavourable=1, Somewhat unfavourable=2, Neutral=3, Somewhat favourable=4, Favourable=5. Cells coloured in purple reflect unfavorable impacts, white or grey neutral, and green favourable.

(b) Economic and Social Factors

	Industry/Company Type	Market price/regulated rate of energy product/service	Demand conditions for energy product/service	Natural resource availability	Cost & availability of financial capital (debt & equity)	Supplier, equipment & material costs & availability	Labour costs, availability & skill sets	Average Economic Factors Rating	Public opinion	Overall Rating
Cleantech Only Companies	Emissions management (14)	3.0	3.3	4.3	3.5	3.6	3.8	3.6	3.8	3.6
	Energy consumption management (14)	2.7	3.4	3.3	2.4	3.8	3.3	3.1	3.8	3.0
	Energy Storage (31)	2.6	3.9	3.0	3.4	3.8	3.6	3.4	4.1	3.4
	Hydrogen and/or fuel cells (35)	2.9	3.3	4.0	3.0	3.3	3.3	3.3	3.8	3.3
	Other Cleantech (19)	2.3	3.7	3.7	2.7	3.5	3.6	3.3	4.1	3.4
	Power Generation (nuclear) (19)	3.5	3.8	3.5	2.3	3.4	2.6	3.2	3.5	3.4
	Power Generation (renewable) (76)	2.4	2.7	3.9	3.5	3.6	3.5	3.3	3.4	3.1
	Smart grid technologies (6)	3.7	3.7	3.5	2.5	3.3	3.3	3.3	3.2	3.3
Average	2.7	3.3	3.7	3.1	3.6	3.4	3.3	3.7	3.4	
Mixed Cleantech Companies	Emissions management (10)	2.4	3.1	4.4	2.9	3.4	3.4	3.3	3.9	3.4
	Energy consumption management (20)	3.3	3.7	3.5	2.5	3.3	3.1	3.2	3.3	3.3
	Energy Storage (7)	3.3	4.3	3.8	4.0	3.3	3.3	3.7	4.0	3.2
	Hydrogen and/or fuel cells (7)	2.4	2.9	4.7	3.7	4.4	4.4	3.8	4.3	3.7
	Other Cleantech (7)	3.4	4.0	4.0	2.9	3.9	4.0	3.7	4.3	3.8
	Power Generation (nuclear) (8)	3.3	3.8	3.7	3.8	3.2	2.8	3.4	2.8	3.3
	Power Generation (renewable) (56)	3.0	3.3	4.0	3.7	3.3	3.2	3.4	3.3	3.3
	Smart grid technologies (10)	2.2	3.1	3.1	3.9	3.6	3.2	3.2	3.1	2.9
Average	3.0	3.4	3.9	3.5	3.5	3.3	3.4	3.1	3.4	

Assigned values: Unfavourable=1, Somewhat unfavourable=2, Neutral=3, Somewhat favourable=4, Favourable=5. Cells coloured in purple reflect unfavorable impacts, white or grey neutral, and green favourable.

iv. Survey Respondent Policy Priorities

The survey also asked respondents to identify reform priorities for government policy and regulatory frameworks (provincial or federal) that would have the greatest impact on improving the investment climate for their sector. The most frequently mentioned priority by executives at cleantech-only companies was increased funding and policy support, specifically from the federal government, for emerging technologies and for R&D. Tax credits and financial incentives to support investment were the second-most mentioned policies. Compared to traditional energy companies, pure cleantech companies considered government funding and sources of finance to be more important. Improving the stability of federal and provincial regulatory conditions, which would foster greater investment certainty, was a priority for respondents across cleantech sectors. Implementing stronger carbon reduction or low-carbon targets and policies across Canada was also a common suggestion,

particularly among respondents from hydrogen/fuel cell and renewable power companies. Respondents from companies in the various cleantech sectors also frequently recommended more favourable sector-specific policy; this was particularly true in renewable power generation and hydrogen/fuel cells, as well as in nuclear. Respondents from companies in renewable power generation and emissions management recommended stronger carbon pricing and taxation, whether by increasing the level of pricing/taxation or expanding it in scope.

CARBON EMISSIONS AND CLEAN TECHNOLOGY EXPENDITURES

Executives at all types of energy companies expected that their companies will increase expenditures on products and services that reduce company-specific environmental impacts (see Table 8). Perhaps not surprisingly, on average, mixed energy companies — those involved in cleantech and traditional energy — were more likely to indicate their company will increase expenditures on various technologies as compared to traditional energy

companies (those not involved in cleantech). However, respondents at electricity-only companies expected greater expenditures on smart grid technologies than did respondents at any other type of company, and oil/gas/pipeline-only companies were expected to increase expenditures on emissions management technologies in particular, in line with other company types.

Table 8: Expenditure on Clean Technologies

Q: In your opinion, how is your company's expenditure likely to change over the next three years on the following activities that can reduce your company's environmental impacts (where applicable)?

Company Type	Energy consumption management	Renewable Power Generation	Smart grid technologies	Energy storage	Hydrogen and/or fuel cells	Emissions management	All Clean Technologies
Cleantech Only (92)	3.7	4.1	3.9	4.2	4.1	4.1	4.0
Oil/Gas/Pipelines/Electricity (15)	3.8	3.9	3.9	3.7	3.6	3.9	3.8
Cleantech and Oil/Gas/Pipelines/Electricity (65)	3.8	3.8	3.6	3.5	3.8	4.1	3.8
Cleantech and Oil/Gas (13)	3.8	3.7	3.3	4.0	3.9	3.7	3.7
Cleantech and Electricity (53)	3.7	3.9	3.8	4.0	3.3	3.2	3.7
Electricity Only (17)	3.3	3.4	4.2	4.0	3.2	3.0	3.6
Oil/Gas/Pipelines Only (62)	3.5	3.3	3.3	3.0	3.1	3.8	3.4
All Company Types (317)	3.7	3.8	3.7	3.7	3.6	3.8	3.7

Assigned values: Decrease significantly=1, Decrease slightly=2, No Change=3, Increase slightly=4, Increase significantly=5. Cells coloured in purple reflect decreases in expenditure, white or grey no change, and green increase expenditure.

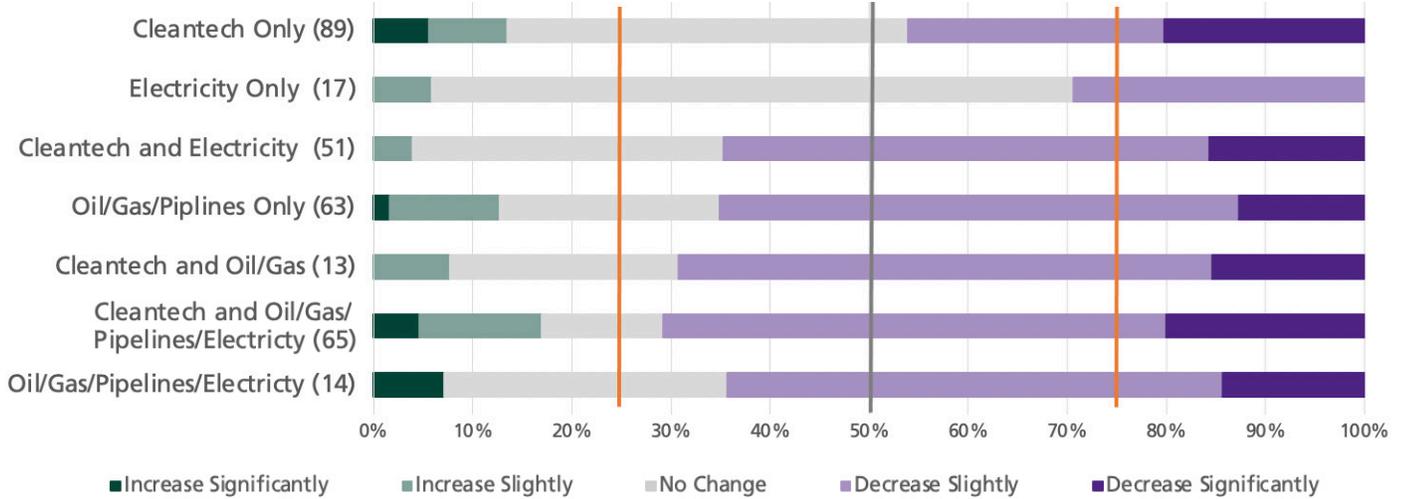
A clear majority of respondents (59%) reported that their companies are likely to reduce carbon emissions in the near future (see Figure 4). However, respondents at mixed energy companies predicted that their companies' carbon emissions will decrease by the greatest amount compared to pure cleantech or pure traditional energy companies. For instance, 65% of respondents from mixed cleantech and electricity companies expected emissions will decrease significantly or slightly, while the equivalent percentages for cleantech-only and electricity-only

companies were significantly lower, at 47% and 29%, respectively. Similarly, 71% of respondents from mixed cleantech and oil/gas/pipeline/electricity companies expected emissions will decrease significantly or slightly, while the equivalent percentage at oil/gas/pipeline-only companies was 65%. Executives at older and larger companies also anticipated greater carbon emission reductions than those at newer or smaller companies.

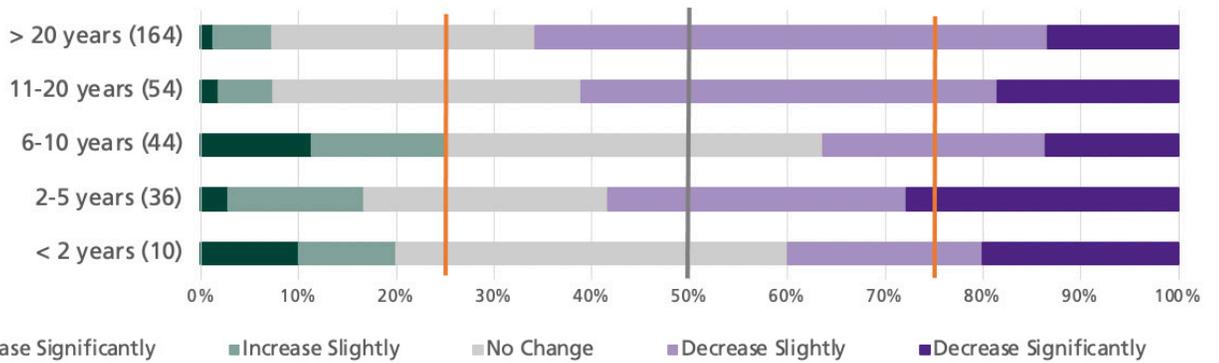
Figure 4: Expected Change in Company Carbon Emissions

Q: In your opinion, how is your company's overall carbon emissions in Canada likely to change in the next three years?

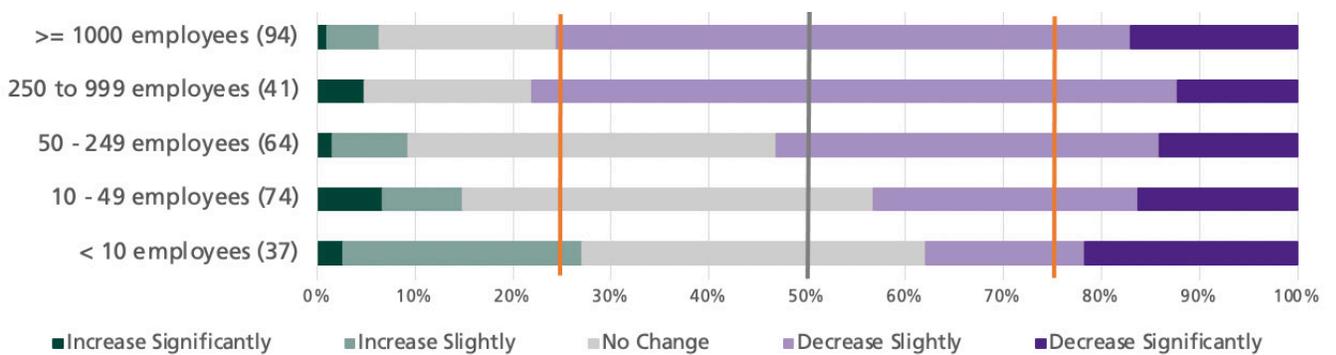
A. Company Type



B. Company Age



C. Employment Size



CONCLUSIONS

Canada's cleantech sector has been growing in economic importance over the last decade, and further investment in clean energy technologies is required for Canada to reduce its greenhouse gas emissions and to transition to a low-emission economy.

A number of core insights about the investment conditions for Canada's cleantech sector emerge from the survey responses. First, Canadian energy firms are poised to increase investment in clean technologies over the next three years. These investments will be made by both pure cleantech companies and traditional energy companies in the electricity, oil, gas, and pipeline industries. Clean technologies that are predicted to see the greatest increase in investment over the near term are energy storage, hydrogen/fuel cells, and emissions management technologies, though all clean technologies are expected to see net increases in investment.

Second, uncertainty and instability in the policy and regulatory environment are viewed as hindering greater improvement in the cleantech investment environment. Given the importance of both the cleantech and traditional energy sectors to Canada's economy and future climate change goals, coordination between provincial and federal governments toward a Canada-wide approach to energy and environmental regulation and policy is recommended. This would reduce the potential for regulatory overlap, policy seams, and regulatory hurdles that exist across various levels of government.

Finally, Canadian energy firms are expected to increase expenditures on clean technologies to reduce the environmental impacts from their own operations in the next few years. Mixed cleantech and traditional energy companies appear to be the most aggressive in their expenditures and the most likely to see reduced carbon emissions over the near term. Federal support programs for traditional energy companies to adopt new environmental technologies would foster greater investment, as would stronger carbon pricing and taxation policies.

APPENDIX A: SURVEY INSTRUMENT

Q1. Please indicate the energy industries in which your company is active in Canada (Select all that apply):

Electricity: [Distribution and/or transmission / Power Generation (natural gas or coal) / Power Generation (nuclear) / Power Generation (renewable, e.g., wind, solar, hydro, biogas, biomass, geothermal) / Other (specify)]

Oil: [Oil exploration, extraction, and/or production / Oil refining and/or upgrading / Petrochemical processing / Other (specify)]

Gas: [Natural gas gathering, extraction, and/or processing / Natural gas transmission and/or distribution / Natural gas trading, wholesale and/or retail / LNG fractionation/processing / Other (specify)]

Pipelines: [Pipeline bulk transportation and storage of crude oil, natural gas, and/or refined petroleum products / Other (specify)]

Clean Technology: [Energy consumption management technologies and services / Emissions management technologies and services (e.g. CO₂ capture, methane reduction, scrubbers) / Energy storage (e.g. batteries, compressed air, flywheels) / Hydrogen and/or fuel cells / Smart grid technologies / Other (specify)]

Q2. Please indicate the provinces/territories in which your company is active for each of the following industries (Select all that apply): [Selected Industries in Q1 will appear here] and [Alberta / British Columbia / Manitoba / New Brunswick / Newfoundland and Labrador / Nova Scotia / Ontario / Prince Edward Island / Quebec / Saskatchewan / Territories]

Q3.0. Please indicate the industries and jurisdictions that are currently the most important for your company in Canada (Select up to three)

Q3.1. In your opinion, how is the level of investment by your company likely to change over the next three years in the industries and jurisdictions listed below? [Top 3] and (Select one of Decrease significantly, Decrease slightly, No change, Increase slightly, Increase significantly)

Q4. In your opinion, how attractive are the current overall investment conditions in the industries and jurisdictions listed below? [Top 3] and (Select one of Very unattractive, Mildly unattractive, Neutral, Mildly attractive, Very attractive)

Q5. In your opinion, how have the overall investment conditions changed over the last three years in the industries and jurisdictions listed below? [Top 3] and (Select one of Deteriorated, No Change, Improved)

Q6.1.2.3. In your opinion, what is the current impact of the factors listed below on investment decisions by your company in the following industry and jurisdiction: [Pairs 1.2.3] and (Select one of Unfavorable, Somewhat unfavorable, Neutral, Somewhat favorable, Favorable)

[List of Factors: Government energy policy (Provincial/State) / Government energy policy (Federal) / Regulatory frameworks and approval processes (Provincial/State) / Regulatory frameworks and approval processes (Federal) / Environmental standards and assessment processes (Provincial/State) / Environmental standards and assessment processes (Federal) / Corporate tax and royalty regime / Innovation/R&D support / Intellectual property rights protection / Market price/regulated rate of energy product/service / Demand conditions for energy product/service

/ Natural resource availability / Cost & availability of financial capital (debt & equity) / Supplier, equipment and material costs and availability / Labour costs, availability, and skill sets / Public opinion / COVID-19 / Other (specify)]

Q7. In your opinion, how is your company's overall carbon emissions in Canada likely to change in the next three years? (Select one of Decrease significantly, Decrease slightly, Remain the same, Increase slightly, Increase significantly)

Q8. In your opinion, how is your company's expenditure on the following environmental technologies and services likely to change over the next three years (where applicable)? (Select one of Decrease significantly, Decrease slightly, Remain the same, Increase slightly, Increase significantly)

[List of technologies and services: Energy consumption management technologies and services / Renewable power generation / Smart grid technologies / Energy storage (e.g. batteries, compressed air, flywheels) / Hydrogen and/or fuel cells / Emissions management technologies and services (e.g. CO₂ capture, methane reduction, scrubbers) / Other (specify)]

Q9. In your opinion, how important are the following financing sources for your company's future expenditures: [Equity / Debt / Retained earnings / Venture founders' personal capital / Government funds (e.g. grants, subsidies, loans) / Other (specify)] and (Select one of Not important, Somewhat important, Very important)

Q10. Please indicate the age of your company: (< 2 years / 2-5 years / 6-10 years / 11-19 years / > 20 years)

Q11. Please indicate the size of your company in terms of employment: (< 10 employees / 11 - 49 employees / 50 - 249 employees / 250 to 999 employees / >= 1000 employees)

Q12. Over the past 12 months, has employment at your company approximately increased, decreased or remained the same? (Select one of Decrease significantly, Decrease slightly, Remain the same, Increase slightly, Increase significantly)

Q13. Please indicate the primary scope of responsibilities that you have in your company: [Board Director / C-level / Senior Management / Middle Management / Founder / Other (specify)]

Q14. Please indicate the number of years of employment experience you have in the energy sector: [< 5 years / 6-10 years / 11 - 20 years / 21 - 30 years / > 30 years]

Q15. In your opinion, what 1-2 changes in government policy/regulatory frameworks (provincial or federal) would have the greatest impact on improving the investment climate for companies like yours in Canada?

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