Energy-related research and development expenditures

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World events and the impacts of climate change continue to put a focus on how and where energy is produced and used. This is because energy production and technologies affect all aspects of our lives and the economy, with benefits ranging from keeping the lights on to transportation of food and goods to health benefits from reduced air pollution.

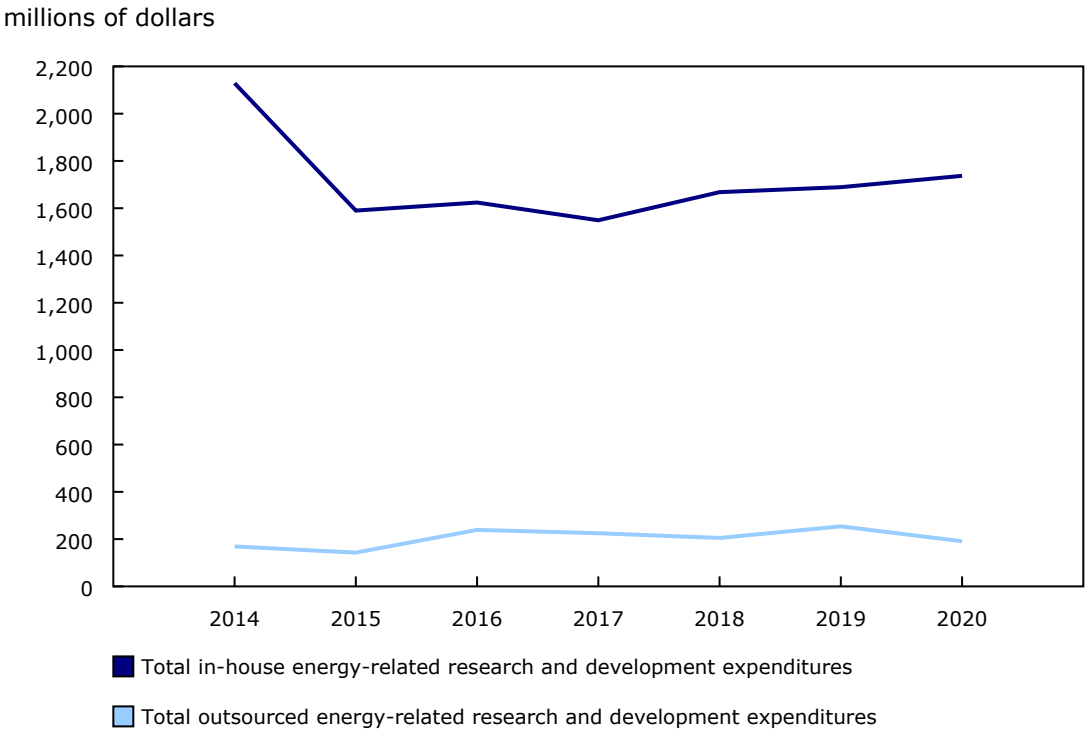
Investments in energy-related research and development (R&D) allow businesses to transform energy products through the development and improvement of technologies in relation to energy sourcing, extraction, production, storage, transportation, distribution, and its efficient use. While there is no guarantee that energy-based R&D projects will be successful, investments in technologies can have profound economic impacts and can offer the promise of better realizing global energy policy goals.

In-house spending on energy-related research and development rises, while outsourced spending falls

Of the $22.6 billion spent on overall in-house R&D in Canada in 2020, an increase of 3.3% from 2019, businesses spent $1.7 billion on in-house energy-related R&D. This marked an increase of 2.8% from 2019. Proportionally, in-house energy-related R&D represented 7.7% of all in-house R&D in Canada in 2020 (this percentage has been calculated with the numbers from tables 27-10-0333-01 and 27-10-0347-01, which are rounded to millions of dollars).

Outsourcing of energy-related R&D decreased by 24.8% to $191 million, primarily driven by a drop in outsourcing of fossil fuels. In total, energy-related outsourcing of R&D represented 4.1% of the $4.6 billion companies expended on the outsourcing of R&D in Canada (this percentage has been calculated with the numbers from tables 27-10-0346-01 and 27-10-0347-01, which are rounded to millions of dollars). For over a decade, energy-related R&D has consistently represented a smaller proportion of outsourced R&D than in-house R&D in Canada.

Chart 1
Total in-house and outsourced energy-related research and development expenditures, 2014 to 2020



Source(s): Table 27-10-0347-01.

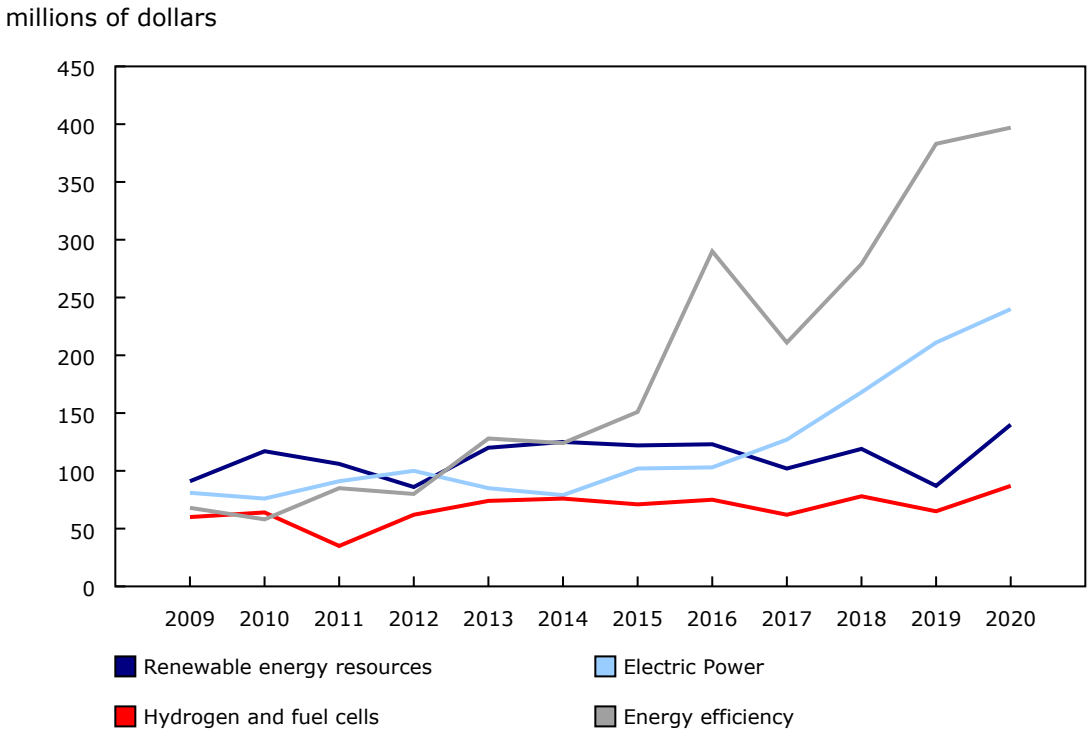
In-house and outsourced energy-related R&D encompass all energy-related technologies and are classified by international standards developed by the International Energy Agency. Expenditures are divided into several technology groups, such as fossil fuels, renewable energy resources, nuclear fission and fusion, electric power, hydrogen and fuel cells, energy efficiency, and other energy-related technologies.

Businesses increase their investments in many areas of energy research and development

Businesses in Canada showed a strong commitment to investing in energy-related R&D in 2020, with in-house expenditures rising to $1.7 billion. Although fossil fuels-related in-house R&D still claim a large portion of expenditures (32.1%), the growth between 2019 and 2020 was driven by R&D expenditures on renewable energy resources technologies, which rose $53 million to $140 million. This was a noticeable reversal from a decrease in 2019. Electric power spending also played a significant role, increasing by $29 million to $240 million, while hydrogen and fuel cells increased $22 million to $87 million, and energy efficiency increased $14 million to $397 million.

In 2020, in-house R&D expenditures on renewables, electric power, hydrogen and fuel cells, and energy efficiency all reached their highest levels in over a decade. Despite these increases, the percentage of total in-house energy-related R&D represented by renewables and hydrogen and fuel cells has remained relatively stable since 2014. By contrast, from 2014 to 2020, energy efficiency and electric power have increased from representing 5.8% to 22.9%, and 3.7% to 13.8% of total in-house energy-related R&D, respectively.

Chart 2
In-house energy-related research and development expenditures, on selected clean technologies, 2009 to 2020



Source(s): Tables 27-10-0347-01 (2014 to 2019) and 27-10-0103-01 (2009 to 2013).

Energy-related research and development concentrated in a handful of industries

Of the 57 unique industry breakouts in which in-house energy R&D spending is measured, the majority of the spending (66.4%) in 2020 was concentrated in five groups. Oil and gas extraction, contract drilling and related services alone accounted for over a quarter (25.4%) of spending, followed by electric power generation, transmission and distribution (19.6%); electrical equipment, appliance and component manufacturing (7.7%); architectural, engineering and related services (7.3%); and R&D in the physical, engineering and life sciences (6.4%).

Outsourcing of R&D spending was even more concentrated, with four groups accounting for 73.8% of all outsourced energy-related R&D expenditure. By far the largest contributor was petroleum and coal product manufacturing, at 46.1%, followed by oil and gas extraction, contract drilling and related services (15.7%); computer systems design and related services (6.3%); and R&D in the physical, engineering and life sciences (5.8%).

Despite the oil and gas extraction, contract drilling and related services subsector representing over a quarter of all in-house energy-related R&D in Canada, the amount is actually down from 2014 when this subsector represented more than half (51.3%). By contrast, the manufacturing sector increased over this period, accounting for 8.9% in 2014 to 26.1% in 2020.

Record-high government funding for businesses

Government funding provided to businesses for in-house energy-related R&D increased by 9.5% to $138 million in 2020, its highest level since 2014, and represented 7.9% of all in-house energy-related R&D expenditures. The recipients of this funding were largely concentrated in the professional, scientific and technical services sector, which received 66.7% of all government funding. Specifically, these included R&D in the physical, engineering and life sciences ($40 million; 29.0% of government funding), computer systems design and related services ($28 million; 20.3% of government funding), and architectural, engineering and related services ($13 million; 9.4% of government funding).

Government funding of R&D was spread across all energy-related areas of technology, with the largest percentage going to energy efficiency which received 42.8% of all government funds, followed by fossil fuels (15.9%), nuclear fission and fusion (11.6%), other energy-related R&D (10.9%), renewable energy resources (10.1%), electric power (5.8%), and hydrogen and fuel cells (2.2%).

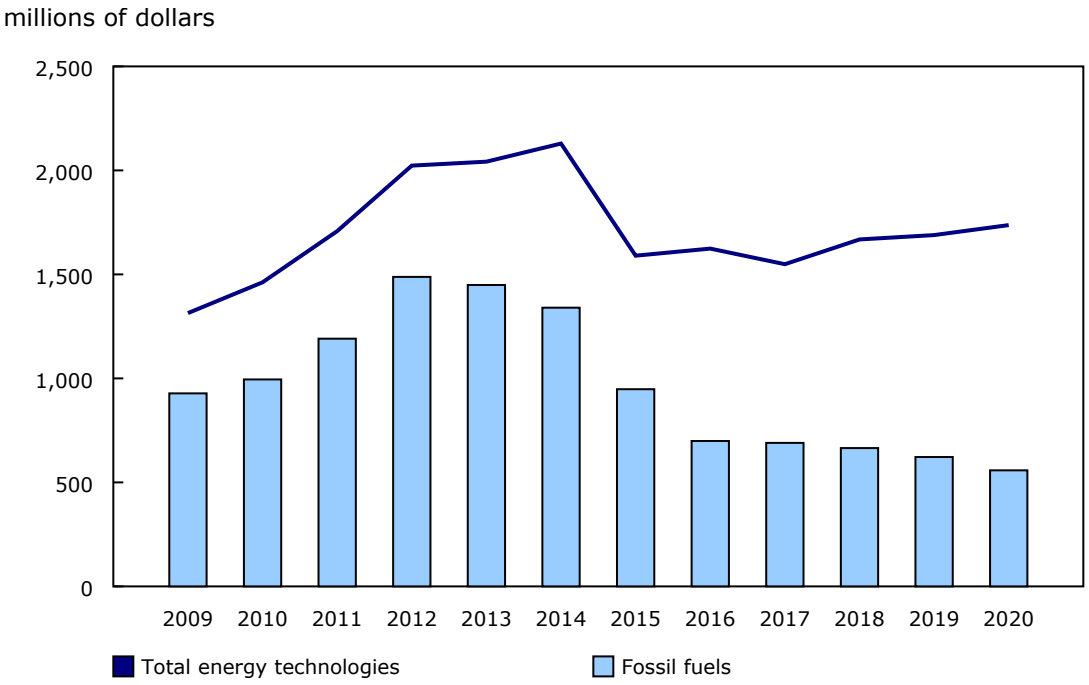
Foreign funding represented 6.7% or $117 million of all in-house energy-related R&D funded in Canada. It was largely concentrated in three technology areas with electric power receiving 34.2% (or $40 million), energy efficiency receiving 28.2% (or $33 million), and hydrogen and fuel cells R&D receiving 25.6% (or $30 million). Together those three areas of technology represented 88.0% of all foreign funding of in-house energy-related R&D.

Fossil fuels research and development expenditures decline

Fossil fuels-related in-house R&D decreased by 10.3% to $558 million in 2020, its eighth consecutive year of decrease. This is still relatively stable compared with the large declines seen from 2014 to 2016, but puts it at nearly one-third (32.1%) of total in-house energy-related R&D expenditures, down from a high of nearly three-quarters (73.6%) in 2012. Outsourcing of fossil fuels R&D also decreased by 38.9% to $110 million in 2020, which still represented 57.6% of the overall amount of outsourced energy-related R&D.

The change in in-house expenditure over the years highlights the changing energy R&D landscape. Prior to the large declines from 2014 to 2016, fossil fuels-related R&D was the driving force behind energy-related R&D in Canada. Since then, the general trend has been towards investments in sustainable energy and more efficient technologies.

Chart 3
Total in-house energy-related research and development expenditures, with fossil fuels technologies breakout, 2009 to 2020



Source(s): Tables 27-10-0347-01 (2014 to 2019) and 27-10-0103-01 (2009 to 2013)

The decreases seen in both in-house and outsourced fossil fuels R&D expenditures occurred in the context of significant volatility and uncertainty for the oil and gas sector. This was particularly evident during the first two quarters of 2020 when oil prices and demand experienced significant economic shocks due to a convergence of several external factors. Among these were legal challenges faced by pipeline projects across Canada, and a decrease in the demand for fuel as a result of lockdowns and travel restrictions related to the COVID-19 pandemic which, in turn, created an oversupply of oil due to insufficient storage capacities.

Sustainable Development Goals

On January 1, 2016, the world officially began implementing the 2030 Agenda for Sustainable Development—the United Nation's transformative plan of action that addresses urgent global challenges over the next 15 years. The plan is based on 17 specific sustainable development goals.

Data on energy-related research and development expenditures by area of technology are an example of how Statistics Canada supports the reporting on the Global Goals for Sustainable Development. This release will be used in helping to measure the following goals:

Note to readers

Energy-related technologies

Energy-related technologies include fossil fuels, renewable energy resources, nuclear fission and fusion, electric power, hydrogen and fuel cells, energy efficiency, and other energy-related technologies.

Data collection

The Energy Research and Development Expenditures by Area of Technology survey data are collected as part of the Annual Survey of Research and Development in Canadian Industry.

Random Tabular Adjustment

The Annual Survey of Research and Development in Canadian Industry and the associated Energy Research and Development Expenditures by Area of Technology survey, 2018, are the first annual surveys at Statistics Canada to use the Random Tabular Adjustment (RTA) technique, which aims to increase the amount of data made available to users while protecting the confidentiality of respondents.

Statistics Canada typically uses suppression techniques to protect sensitive statistical information. These techniques involve suppressing data points that can directly or indirectly reveal information about a respondent. This can often lead to the suppression of a large number of data points and significantly reduce the amount of available data.

Using RTA, Statistics Canada can identify sensitive estimates and randomly adjust their value rather than suppress them. The size of the adjustment is calculated to protect respondent confidentiality. After adjusting the value, the agency assigns a quality measure (A, B, C, D, or E) to the estimate to indicate the degree of confidence that users can have in its accuracy. Quality measures account for uncertainty related to sampling, non-response and RTA, when applied.

For more information on RTA, please refer to the blog article "Random Tabular Adjustment is here!" available as part of the StatCan Blog.

Available tables: table 27-10-0347-01.

Definitions, data sources and methods: survey number 4205.

The interactive dashboard, "Characteristics of research and development in Canadian industry" (**71-607-X**), is now available.

For more information, or to enquire about the concepts, methods or data quality of this release, contact us (toll-free 1-800-263-1136; 514-283-8300; **infostats@statcan.gc.ca**) or Media Relations (**statcan.mediahotline-ligneinfomedias.statcan@statcan.gc.ca**).