ENERGY RESEARCH AND DEVELOPMENT FUNDING IN THE ENERGY SECTOR

A PUBLIC DISCUSSION PAPER

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PREFACE

In November 1995, the Government of Yukon released its three year plan for the development and management of the energy sector from 1996 through 1998. The Energy Plan was created to ensure that the Yukon's energy potential is developed and managed in an economically, socially and environmentally responsible manner. Two of the Energy Plan strategies are to:

> *"Promote the development of Yukon's energy resources to reduce our dependence on imported fossil fuels."*
>
> *"Encourage the development of a sufficient supply of competitively priced energy for industry and communities."*

A number of the specific actions related to each of these strategies pertain to electricity supply planning including a direction to the Yukon Development Corporation (YDC), owner of the Yukon Energy Corporation (YEC), to prepare a capital plan with stakeholders for review by the Yukon Utilities Board (YUB).

The capital planning process will integrate electricity supply options, such as new generation and transmission facilities, with energy management options, such as conservation and efficiency improvements, to determine the most viable alternatives for meeting future increases in electricity load. Stakeholders will have an opportunity to participate in the process through consultations sponsored by the Yukon Energy Corporation and through a Yukon Utilities Board hearing.

From a public perspective, electricity supply planning and regulation can appear complicated and at times difficult to understand. The outcomes of the process however, can directly affect matters of public concern such as the cost of electricity, the availability of power for economic development and the impact of electricity development on the environment. In order to increase public understanding of electricity planning issues, the Yukon Government's Energy Resources Branch has prepared a series of public discussion papers on anticipated points of debate related to electricity supply planning.

The series has been created to provide information for stakeholders and interested members of the community. It is important to note that the Yukon Utilities Board's review of the Yukon Energy Corporation's capital plan is an independent regulatory process. As a result, the discussion papers do not include recommendations on policy or energy resource options considered during the capital planning process. Topics addressed by the series include:

Electricity System Investment Issues for Yukon Government
The Use of Non-utility Generation as an Electricity Supply Option
Trends in the Role of Energy Management in Electricity Supply Planning
Trends in Electricity Market Reform
Research and Development Funding in the Energy Sector
Future Opportunities for Electricity Grid Expansion in Yukon

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EXECUTIVE SUMMARY

Energy research and development (R&D) is a component of the general R&D which is increasingly being used as a tool for economic development in many jurisdictions outside of the Yukon. The Yukon may also benefit from using R&D as a tool for economic development; however, it is currently difficult to finance R&D within the Yukon.

The governments of many jurisdictions across Canada and in Alaska are supporting R&D through both direct funding and through infrastructure building activities. Their experience leads to a number of options for the Yukon Government to consider as it works toward establishing funding support for energy R&D.

These options include:

- building awareness of the link between energy R&D and economic growth;
- taking a sectoral approach to funding R&D, starting with the energy sector;
- updating the Yukon Science Policy and the Yukon Science and Technology Strategy;
- strengthening the links between the commercial and knowledge sectors;
- enacting energy R&D tax credits;
- becoming an information centre on Yukon energy R&D activity; and
- making a commitment to long-term support of Yukon energy R&D.

To further public discussion of energy R&D, the Energy Resources Branch could host a meeting for representatives of the energy sector, science community, commercial sector, and government. The meeting would provide an opportunity for stakeholders to come to a better understanding of what the demand is for energy R&D and what the government's role should be in this area.

INTRODUCTION

Section 5.5 of the Department of Economic Development's Energy Action Plan, states that the Department will:

> *"pursue the establishment of funding support with partners by 1997 for research and development to promote the use of local energy resources to displace imported fossil fuels."*

The purpose of this paper is to generate discussion within the energy sector, science community, commercial sector and government about energy R&D: what it is, its role in the economy and options for funding it. Although this paper is focused on energy R&D, much of what is discussed here will have a broader application to general R&D.

The first section of the paper will present some definitions of energy R&D, to give the reader a better understanding of the topic. The second section will show the link that has been made between R&D, the knowledge sector and economic prosperity. The third section will examine various funding agencies' approaches to funding energy R&D within the Yukon. In the fourth section there will be a discussion of how jurisdictions outside of the Yukon are managing energy R&D. The final sections will present options and propose next steps for the Yukon Government to consider in its approach to energy R&D.

WHAT IS ENERGY RESEARCH AND DEVELOPMENT?

Before discussing how to fund energy R&D, it is important to have an understanding of what it actually is. Definitions of R&D are abundant, from the National Advisory Board on Science and Technology's general description of R&D as "industrial innovation", to the very specific definition created for tax purposes by Revenue Canada:

> a) *"basic research, namely work undertaken to advance scientific knowledge without a specific practical application in view;*
> b) *applied research, namely, work undertaken to advance scientific knowledge with a specific practical application in view;*
> c) *experimental development, namely, work undertaken to achieve technological advances for the purpose of creating new, or improving existing, materials, devices, products, or processes, including incremental improvements thereto...."*

Most, if not all of the energy R&D done in the Yukon to date has been applied R&D; that is research that tries to improve existing processes or equipment; and, development that takes the form of building prototypes or testing pilot projects. This type of R&D has often seen customization of existing equipment to operate efficiently under the local geography and climate. Examples of these projects include:

- Boreal Energy Centre and the Yukon Energy Corporation's research done on modifying wind turbines, to mitigate the rime ice build up on turbine blades and to cope with the effects of cold temperature;
- the wind/solar power monitoring study done by the Northern Research Institute at Yukon College with the Yukon Energy Corporation and more recently, Boreal Energy Centre, to demonstrate solar and wind systems and technologies; and

- the construction and testing of a prototype solar-charged, battery powered car by Avtec Services Yukon Ltd. This project incorporates new battery charging technologies and other modifications to develop an electric car that will operate in the Yukon's cold climate for long distances.

There have also been a number of studies and pilot projects that have not sought to modify existing technologies, so much as to prove their workability in the Yukon. Examples of these projects include:

- five site suitability studies for using micro-hydro generators at Community and Transportation Services Highways Camps. This included the study which lead to the installation of the micro-hydro generator at Fraser, B.C.;
- several site suitability studies for using wind, micro-hydro, and wood chip boiler technologies, done for the Yukon Energy Alternatives Program (YEAP). This included studies which lead to the installation of a wood chip heating system by the Champagne and Aishihik First Nations at Haines Junction and another wood chip heating system by the Selkirk First Nation in the Pelly Crossing school; and
- wind monitoring studies done in three Yukon communities by the Yukon Energy Corporation.

These past projects have all had the potential benefit to Yukoners of reducing the territory's reliance on imported fossil fuels. Future energy R&D proposed to displace imported resources include:

- researching and developing methods and adapting technologies to most efficiently use local oil, gas and coal;
- further researching and developing the best ways to make use of local wood for space heating, district heating and industrial process heating; and
- pilot projects to show the increased potential for wind/battery and wind/diesel hybrid systems using new battery technologies and new energy charging techniques.

All of the R&D described above, has been applied R&D, which may be the type of R&D most suited to the energy sector in the Yukon. As stated in the 1987 report on *A Science and Technology Strategy for the Yukon:*

> *"The Yukon is a significant land mass with some world scale resources, but its population and thus its domestic market is very small. For diversification to occur, Yukoners must begin to "think small." Thinking small certainly does not mean operating a second-rate business or using second-rate technology. Some businesses may grow to become very large through export marketing but will nonetheless continue to be based on small-scale technologies.*
>
> *An additional benefit from such appropriate-scale thinking is that the capital requirements for developing or adopting small-scale technologies are also smaller, which means a greater chance to stimulate a local venture capital community, thereby bringing more development under Yukon control. Also, the cost of job creation in small business is typically far less than in megaprojects, which means that many more jobs can be created for a given financial outlay.*
>
> *The key is in realizing that the Yukon is not merely an extension of southern Canada northwards but is a discrete, small society, for which technologies whose scale makes them inappropriate in other parts of Canada may be most effective."*

Another view, is that the accepted paradigm of the Yukon being too remote for pure research, is now outdated. (Pure research is research that is undertaken to advance scientific knowledge without a

specific practical application in view.) The Yukon is now sufficiently connected to the rest of the world, via electronic and transportation links, to make pure energy R&D practical. Computer modeling facilitates many kinds of R&D, that would not have been possible in the Yukon in the past. Much of the costs are avoided by designing and testing early prototypes using computer software, rather than actual models.

WHY DO ENERGY RESEARCH AND DEVELOPMENT?

"Science and technology were once the condiments of our civilization... More recently they have been regarded as vitamins, tiny quantities of which could prevent stunted growth and enable us to absorb our industrial nourishment. Now they must be reckoned as the very meat and potatoes of our economy." Derek J. deSolla Price - Science Council of Canada

"There can be no doubt that our economy is undergoing a major transformation, unlike any since the Industrial Revolution. Knowledge and information - their applications and technologies - are at the root of it." Industry Canada - Science and Technology for the New Century

"Constant industrial innovation is the foundation of future competitiveness within the world economy." National Advisory Board on Science and Technology

"Innovation has become the engine of economic development...." Alberta Research and Science Authority

As the quotes at the start of this section suggest, R&D can be viewed as a central element to a strong economy. The key element of this idea is competitiveness. The Alberta Government goes so far as to predict, a "lower standard of living consistent with that of other countries that are operating from a base of natural resource exploitation", if it does not "attempt to compete in the area of innovation" and make the "shift to a knowledge based economy". This idea may have particular relevance in the Yukon given that the Yukon's economy is also based on natural resource use.

Along with the element of competitiveness, there is also one of natural limits to growth. If an economy is based solely on extracting raw materials locally and selling them to external markets, then it cannot continue to grow. It is limited by the stocks of resources available. This idea may not seem as relevant in the Yukon as in other areas, such as British Columbia, where the timber resource is being rapidly depleted. The relevance of this idea depends on how forward looking Yukoners want to be and on any changes in the economy that could cause a rapid acceleration in the territory's rate of natural resource extraction.

What does this have to do with energy in the Yukon?

For each energy resource available within the Yukon, ways could be researched to capture it that are the most efficient under local conditions. Based on that research, technologies could be developed that are appropriate for local needs. Then those technologies could be applied locally and sold to markets with needs similar to the Yukon's. New and more efficient ways of transferring local, or imported energy resources, into power, heat, or transportation fuel could also be researched, developed and applied locally. In addition, the most efficient ways to use our local energy resources, as well as imported

energy, could be researched, developed and applied locally. The increased activity in the Yukon's energy sector would result in an expansion of the territory's economic base, resulting in more jobs for Yukoners.

- Yukoners could develop products, processes or a combination of both, using Yukon resources. This could make local energy resources more viable, for example local crude oil, or coal water slurry could be produced for use in converted diesel electric generators.

- Yukon industries could become more effective and more competitive by using processes that are appropriate locally. For example, in the oil and gas industry, southern technology could be adapted to address challenges that arise due to the permafrost and accessibility conditions encountered in the far north; or solutions could be developed for the icing problems on wind turbines.

- The Yukon's economic base could be expanded by creating a new manufacturing and assembling industry. For example, hybrid power plants that utilize batteries in conjunction with small diesel generators could be assembled for small communities.

- Yukon businesses could sell Yukon-manufactured products, or new processes, to areas with a similar climate or geography to the Yukon.

- The Yukon could join the leading economies of the world, by creating a new knowledge sector specializing in unique energy knowledge. Yukoners could export their knowledge and be less reliant on consultants from outside the territory for expertise in the energy sector.

What is the "Knowledge Sector"?

Just as the Energy Sector is the sector that produces and sells energy, the Knowledge Sector is the sector that produces and sells knowledge. It is made up of businesses, universities and colleges, government laboratories, individual entrepreneurs and cooperative combinations of any of these, that conduct R&D to produce new products or processes.

The knowledge sector employs consultants - people who sell their knowledge. Some of these people come into the territory in the energy sector, specifically in the oil and gas industry. The knowledge sector also employs researchers, who may later become consultants, technical experts, and manufacturers.

A fully developed knowledge sector fuels existing industries with new innovations that allow them to be more competitive and less vulnerable to outside influences. It also spawns new industries as research reveals opportunities (often a need that isn't being filled by existing technology) and R&D finds ways to take advantage of those opportunities. The long term effect of new and more competitive industries is a stronger economy.

According to Industry Canada's recently released *Science and Technology for the New Century: Summary Document*:

> *"...knowledge-based activities have given Canadians the tools to build a strong economy and a caring social system, sustain our rich natural environment, and enjoy peace at home and a respected place among nations. They have provided Canadians with a standard of living second to none, a status recognized by the United Nations."*

Another Industry Canada document gives specific examples of how the knowledge sector affects the economy:

> *"From 1984 to 1994, there was a net gain of more than 800 000 new jobs in Canada for those with advanced post-secondary education, while there was a net loss of almost 1.4 million jobs for Canadians with high school training or less. Although high-knowledge industries account for only about a third of total employment, they have contributed more to recent job growth in Canada than all other industries combined."*

Doesn't it take a long time to see results from R&D?

The experience of other jurisdictions such as Alaska and British Columbia, shows that governments can see a significant return on their R&D investments within one year, both in terms of net profits generated and in terms of new jobs created (and in some cases old jobs saved). In addition, the capability to continue generating profits and creating jobs increases exponentially as a jurisdiction is able to build on its previous R&D, increase the confidence of both old and new investors and accelerate its competitiveness. The speed with which results are seen depends on the quality and size of the initial *and continued* investment the jurisdiction makes in R&D.

Who would do energy R&D in the Yukon?

One of the reasons the Territorial Government has given other issues, such as electrical rates, a higher priority than funding energy R&D, may be that there has not been a strong lobby for energy R&D within the territory. This could be due to there only being a few researchers and developers in the energy sector within the Yukon.

People within the Yukon's science community feel that there are sufficient people interested in doing energy R&D, to merit government support of it. They feel that there would be more energy R&D occurring now, if there was more financial support for it. They see the issue as a "chicken and egg" question: What needs to come first, the funding or the R&D?

Members of the Yukon Science Institute, the Northern Research Institute and other members of the scientific community agree, that if the Yukon Government made a commitment to support R&D, then there would be a significant amount of R&D done in the territory. They note that since the *Energy Action Plan* was published, even the Department of Economic Development's hint of support to come, in 1997, has been enough to generate some discussion of possible new energy R&D projects.

Another reason funding for energy R&D has not received a great deal of territorial attention could be that this money has traditionally come from the Federal Government. However, the Federal Government has been reducing the amount of money it channels into R&D and plans to continue to do so. More information on Federal Government funding is presented in the next section.

WHO FUNDS ENERGY RESEARCH AND DEVELOPMENT?

The previous sections were intended to give the reader a better understanding of what R&D is and why it is done, within the Yukon. This section will now turn to focus on how R&D is financed within the Yukon.

New business ventures are generally funded from three sources: about one third are funded by the retained earnings of existing companies; another third comes from bank loans; and, the remaining third comes from a variety of other sources, most notably, venture capitalists and governments. However, Statistics Canada states that approximately 58 percent of R&D funding in Canada comes from industry, foreign, or private non-profit institutions, with the remainder being funded by provincial and federal governments. Statistics Canada does not show banks as funding R&D at all. A study of the Yukon situation shows both similarities and differences to the national situation. A summary is provided below.

Banks

An in-house study of Yukon banks shows that they find the risk associated with funding R&D too high to be worth the potential benefits. They explain that there is little security for a bank if the only collateral a scientist has is the potential profits of an unproved, or perhaps even undeveloped product. Once an entrepreneur is past the R&D stage and has proven that there is a market for the new process or product, then the banks become more interested and have a number of financing options available.

This situation is not unique to the Yukon. The National Advisory Board on Science and Technology confirms that banks across Canada are unwilling to fund innovation because of the perceived risk involved. The Board states that this is not the case in countries such as Germany and Japan. There, banks and their customers in the non-commercial sectors are more closely linked, resulting in there being greater understanding between them. This increases the banks' awareness of the potential of R&D to produce a profit and so greater risk is tolerated.

Retained Earnings

Yukon companies are typically small companies, or small subsidiaries of larger companies, with their head office located outside of the territory. In the case of locally based, small companies, their R&D budgets will be limited by their size. Further research may reveal just how much of their profits Yukon companies are turning over into R&D, but at this point no surveys have been done. For the larger companies, with their bases elsewhere, the R&D tends to be done elsewhere as well. This is particularly relevant in the energy sector, where the Yukon's private electric utility's head offices are located in Alberta.

Venture Capitalists

Venture Capitalists are individuals or groups that invest in the work of entrepreneurs. They accept a higher level of risk than conventional investors and in return expect more control over their investments. This control may come in the form of actually helping to manage the ventures in which they invest. This could be a long term control, as venture capitalists commonly must invest for between five and ten years

in order to see a return. Research by the Strategic Planning Branch of Economic Development, has not uncovered any significant investments in R&D, in the Yukon, by venture capitalists.

Match makers

While match makers do not provide funding themselves, they do provide a valuable service to those looking for money. They bring together investors and entrepreneurs. Typically their service consists of compiling lists of potential funders, such as venture capitalists, and government grant and loan programs. The lists are then published, or entered into a computer service where investors with a particular interest are introduced to prospective investees who are undertaking work in the investor's area of interest.

In the Yukon there are some match making services available, but only one has a Yukon focus; that is the Yukon Chamber of Commerce Alaska/Yukon Matchmaking Service, which is very informal and is focused on trade opportunities. Other services are briefly described in the list below:

- the Toronto Dominion Bank's TD/CANLOC service, which is a computer match making service, available for a fee of approximately $140;
- the national Canadian Opportunity Investment Network (COIN) administered by the Yukon Chamber of Commerce for a fee of from $200 to $300 for entrepreneurs and from $300 to $400 for the investor; and
- the Canadian Sources of Funds Index LTD's yearly list of funds available in Canada which includes venture capitalists, federal and provincial government funding programs.

Neither the Toronto Dominion Bank, nor the Yukon Chamber of Commerce have evaluated the success of their services within the Yukon. In the TD's case, their program is so new that at the time of research no one within the Yukon had used their service.

Government Loans and Grants

Since 1986, the Government of Yukon has offered financial assistance to Yukon businesses through a variety of programs involving direct loans, guarantees, and contributions. Although these programs did not focus specifically on R&D, some energy R&D projects did receive funding. The Economic Development Agreement (EDA) was one such program that funded research on wind generation. However, the EDA expired in March of 1996 and the Governments of Canada and Yukon have not negotiated for any renewal. The Yukon Government's Business Development Fund (BDF) was another such program. This program was also terminated in March of 1996.

The Yukon Government is now considering a venture loan guarantee program. The intent of this program is to increase local lending institutions' willingness to lend to new business start-ups, or expanding smaller businesses by reducing their risk. Like the BDF, this program will not focus on energy R&D, but energy R&D projects could be within the program's eligibility guidelines. The cabinet submission for the approval of the program's criteria states that "Eligible activities include the development and distribution of new products or services, the export of goods or services, import substitution, high technology and information services. Upgrades to tourism attractions are also eligible."

The Federal Government provides some funding for Yukon research through its Industrial Research Assistance Program. This program is limited to applied research undertaken by industrial clients already established in small and medium sized businesses. Researchers involved in pure research, or those who

do not yet have businesses, or are not in the industrial sector, do not meet the program's criteria. Therefore, limited funding has been available for energy R&D through this program in the Yukon.

There are a number of other Federal Government funding programs which could be accessed by researchers and developers in the Yukon's energy sector, if they met program criteria. A listing of all Federal Government Funding Programs is available through *The Canadian Reference Directory on Business Planning and Funding*, published by The Canadian Sources of Funds Index Ltd.

In addition to specific funding programs, the Federal Government recently made a renewed commitment to partner with the provinces and territories on Science and Technology initiatives. In its publication, *Science and Technology for the New Century*, the Federal Government makes a commitment to have

> *"federal science-based departments and agencies ...develop explicit strategies for working with their provincial and territorial counterparts on S&T activities of mutual interest."*

As in past Federal-Territorial partnering initiatives, it will be necessary for the Yukon to have a territorial agency to be actively involved in managing Yukon Science and Technology (on a broader scale then just energy R&D) in order for the Yukon to benefit from this federal initiative.

It should be noted that Federal Government funding of R&D is decreasing, as are transfer payments in general. Therefore, any existing funding programs are open to review and cancellation.

Tax Incentives

The idea behind using tax incentives to increase R&D is that they avoid the government granting process, which has been perceived by some as time consuming and arbitrary. The reasoning is that if investors are willing to support a company's R&D activities then the investors, rather than the government, are deciding whether those activities are economically viable. Thus, they are worth the public's support through the tax system.

The Yukon Government does not award tax credits to people investing in R&D in the Yukon. Yukoners are, however, eligible to apply for the Federal R&D Tax Credit. Across Canada; Nova Scotia, New Brunswick, Manitoba, Ontario and Quebec have provincial R&D tax credits. These tax credits vary from a 10% refund in New Brunswick, to the Federal Government's 100% refund of investments in R&D.

Gaps

Traditionally, researchers and developers in the Yukon have been composed of small businesses, non-profit organizations, and individuals at the pre-startup phase of business. The previous pages show that there are few funders in the Yukon who find the perceived risk-reward ratio attractive enough to invest in these groups. The National Advisory Board on Science and Technology, indicates that this is due to gaps in awareness on the part of banks, governments and other potential investors. Across Canada, the link between R&D and revenue generation has not been fully appreciated. As stated in the 1987 Science and Technology Strategy paper for the Yukon:

> *"While most of the strategic development initiatives have been designed to generate self-sustaining profitable businesses which in turn will generate tax revenues for the government, most of them require initial seed funding and all require infrastructural support which must be funded by government."*

Other gaps, which are more Yukon specific are summarized in the following list:

- few Yukon businesses are big enough to feel that they have the size of profits necessary to put meaningful amounts of money into R&D;
- investors outside of the Yukon may not be aware of the R&D potential within the Yukon;
- Yukon researchers may not be aware of the various match makers available to connect them with funders; and
- there are no Yukon tax incentives to encourage Yukoners to invest in Yukon R&D.

This section has explored the funding situation for Yukon R&D and identified some gaps in funding. The next section will describe how R&D funding is being approached by jurisdictions across Canada and in other countries.

WHAT ARE OTHER JURISDICTIONS DOING?

The gaps discussed in the previous section are not unique to the Yukon. Other jurisdictions, with similar gaps in funding R&D, are trying to bridge these voids. For example, Germany, Japan and France have managed to bridge the gap between banks and entrepreneurs involved in R&D. As the Committee on the Financing of Industrial Innovations states in its 1991 report:

> *"Regulation of financial institutions in Canada limits opportunities for growth in the base of innovative industrial performers. While still protecting depositors, closer commercial links between the financial and commercial/industrial sectors could create a climate in which greater innovative risk is not only accepted, but encouraged... in France, Germany and Japan ...links encourage greater understanding between financiers and industrialists, with the effect of increasing tolerance and reducing risk. The result is often improved access to capital, at a lower cost. Federal policies in Canada and the United States discourage, if not prohibit, such links, citing concerns about the safety of depositors' funds and the risk of corporate concentration. The Committee notes that failures of financial institutions are more common in countries that discourage commercial links than in those where they are permitted."*

The governments of the Canadian jurisdictions studied, and Alaska, are involved in R&D in three key ways: recognition; commitment; and, cash. Recognition means perceiving the development of a knowledge sector as a means to ensuring economic survival. Commitment means creating policies that state what the government will do to support R&D. Cash means making money available for researchers and developers.

Recognition

The first step in furthering R&D in the Canadian jurisdictions studied, and Alaska, appears to be a learning step. In this step, research papers and discussion papers are produced at an increasing frequency and with an increasing focus, until in many areas, there is now a clear recognition of the key importance of the knowledge sector, what it is, and the important role government can play in stimulating it.

Commitment

The second step, that jurisdictions with the most commitment to R&D are taking, is to put their commitment in writing in the form of science and technology policies. In forming these policies they have consulted with their science and technology communities to assess their strengths, weaknesses and opportunities. They have taken that consultation and incorporated it into coordinated and comprehensive strategies. The strategies then serve as a guide as the governments of the jurisdictions start actively supporting R&D.

An additional advantage is that the strategies help the jurisdictions attract firms interested in the type of manufacturing that depends on high levels of R&D to ensure profitability. Also, by having science and technology strategies, and the resulting infrastructure, the jurisdictions often become eligible for additional federal money.

Cash

The third step is for the governments of the jurisdictions to prove their commitment by acting on their written words. The main actions that have been funded by the jurisdictions surveyed are as follows:

- university-industry partnerships with government support in the form of indirect funding through foundations;
- tax incentives to investors, or businesses linked to R&D;
- direct funding to researchers and developers in the form of grants, loans and loan guarantees; and
- money channeled into building knowledge infrastructure by such activities as creating close relationships between the scientific community and investors, ensuring technology transfer, and establishing communication links.

All but a few of the jurisdictions studied are involved in some form of support for R&D. The reason given for this involvement is their governments believe that R&D are fundamental tools for maintaining a healthy economy.

WHAT CAN THE YUKON DO?

If the Yukon were to join the majority of jurisdictions across Canada in pursuing a policy to support local R&D, then the following options could be considered. Any one option done in isolation may not accomplish much, but combined, their synergistic effect could result in a strengthened Yukon economy.

Build Awareness

As a starting point, one option is to build on the current R&D knowledge. Discussion papers like this one, surveys showing actual dollars and jobs created by R&D in other jurisdictions, debates about appropriate R&D for the Yukon, and other such activities would all serve to raise awareness. Discussions on energy R&D may just be a start. By building awareness of R&D, other options will become more apparent, and the most appropriate options for the Yukon can emerge from the discussions.

Take a sector approach

The government could take a sector approach to funding R&D, beginning with the energy sector. Another option would be for the government to take a comprehensive approach at the planning stage, but apply its plans on a sector by sector basis, beginning with the energy sector. This would avoid spreading limited funds over too broad a spectrum of projects, make monitoring the results easier and would foster meaningful R&D in at least one sector that government has already made a commitment to supporting in its Energy Action Plan.

Update the Science Policy and the Science and Technology Strategy

The Yukon Government wrote a Science Policy in 1986 and, in 1987 began work on a Science and Technology Strategy. The policy and strategy could be updated by the Department of Economic Development, which is currently responsible for Science and Technology. Ideally, the science community, government departments, private organizations and companies would be involved in the update, through consultations. It may be useful to pattern the consultations on those done by the British Columbia Ministry of Employment and Investment when it developed British Columbia's Science and Technology Strategic Plan. This would give government the comfort of knowing that it had a well formed, comprehensive guide to follow that had the acceptance of a broad base of Yukoners, as it begins actions to support R&D.

Strengthen links between the commercial and knowledge sectors

The Yukon Government could take actions that lead to stronger links between the commercial sector (banks and other financing institutions and venture capitalists), and researchers and developers. As discussed earlier in the section on activities in other jurisdictions, such links could encourage greater innovative risk. As the commercial sector gains a better understanding of how to evaluate intellectual assets and the true risk/reward ratio involved in investing in R&D, it may be more willing to finance R&D. Building such links might not be an easy thing to undertake in the Yukon, given that Yukon banks' headquarters are located outside of the territory. The Yukon Government role, could be to collaborate with the governments of other jurisdictions across Canada, to encourage the appropriate federal agencies to work with the commercial sector on a national basis.

Enact R&D tax credits

The Yukon Government could consider enacting tax incentives to encourage R&D, as is done in Nova Scotia, New Brunswick, Manitoba, Ontario and Quebec, and is being considered in Alberta. The Alberta Government seems to be particularly interested in this option because it is "consistent with Alberta's economic strategy which emphasizes a facilitative role and creation of investment advantage".

Become an Information Centre

Another option is for the Department of Economic Development to become an information centre on general R&D activity, or for the Energy Resources Branch to become an information centre for energy R&D activity. Surveys could be conducted to find out how much R&D is going on in the Yukon and to determine its economic potential. The results of the surveys could be advertised to outside investors. Potential Yukon researchers and developers could be provided with a list of match making services, or the department could set up its own match making service. The goal of such an information centre would be to increase investment in Yukon energy R&D, by providing a comprehensive picture to potential investors, without duplicating any of the services already provided by commercial and non-profit private sector organizations.

Commitment

Whichever options the government chooses, it is important to remember the experience of other jurisdictions across Canada. Significant benefits to the economy, from funding R&D, were only realized when the governments made long term commitments to R&D. It was only with such commitments in place, that options dealing with government funding of R&D through partnerships, foundations, councils, grants, or loans could be realistically attempted. This is because researchers and developers need long-term investments in order to do meaningful work. One time only, or short term funds will not make most projects show rewards because they will run out of money before they have had enough time to start supporting themselves.

NEXT STEPS

If the Yukon government chooses to use energy R&D as a tool to promote economic development, further research would be useful. Perhaps a meeting, where stakeholders such as representatives of the science community, commercial sector, energy sector and government could gather and discuss a course of action, would be the most appropriate next step. Direction from the meeting could be used to form an action plan for the government to follow as it works toward meeting its objective to support energy R&D.

Key questions to be asked at the meeting would be

- What do Yukoners consider to be energy R&D in the Yukon?
- Who would be involved in doing energy R&D, if they had funding support?
    - What projects would they undertake?
- What is the demand for energy R&D funding?
    - How much money is required?
- Does the Yukon Government have a role to play in funding energy R&D?
    - If so, what is that role?

It is hoped that this paper can be used as a starting point for stakeholders as they work toward answering the questions listed above. By bringing a common understanding to stakeholders, it is hoped that the level of discussion between them will be raised and useful direction will be forthcoming.