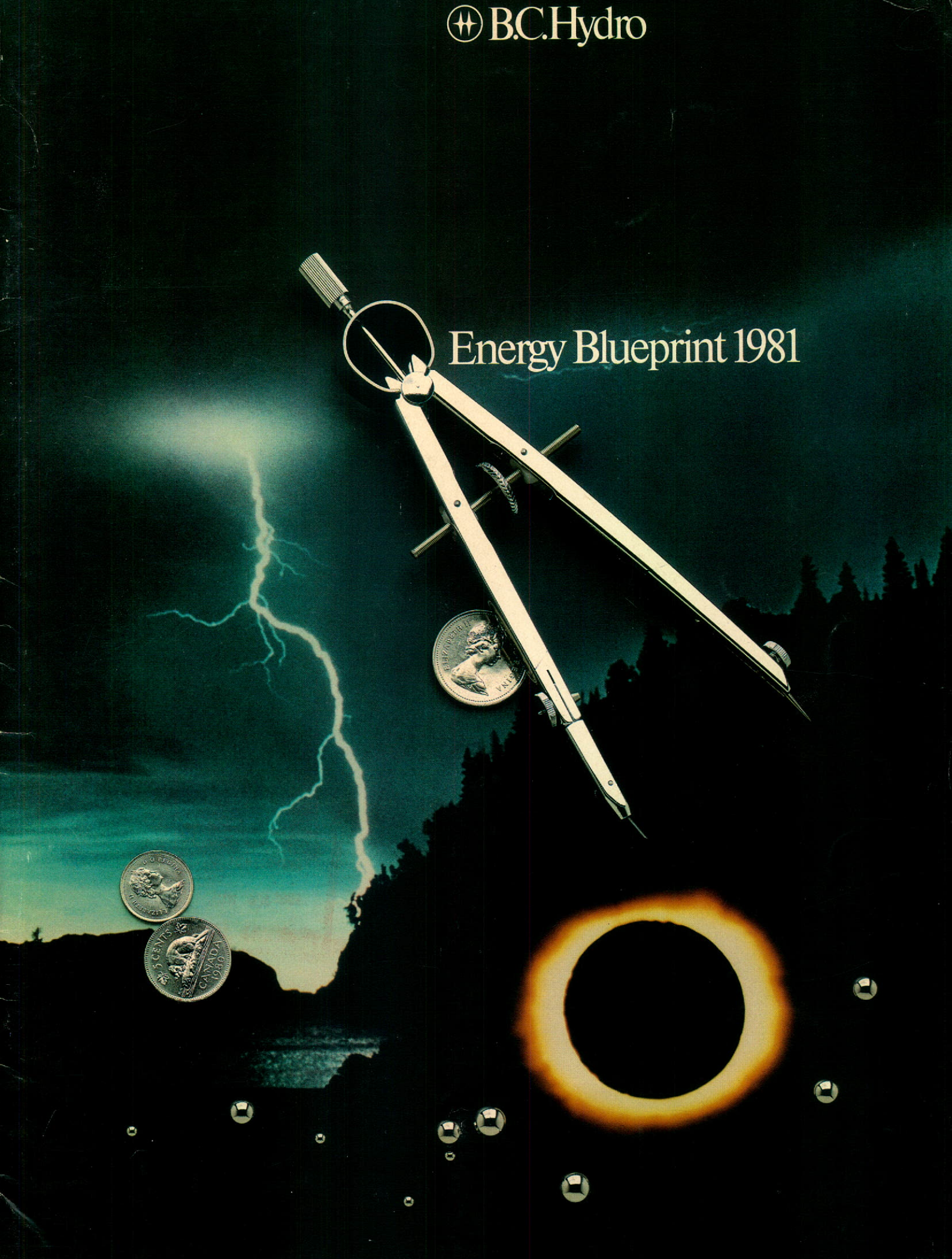
B.C. Hydro

# Energy Blueprint 1981



# Introduction.

B.C. Hydro has a responsibility to meet the demand for electricity of its customers in British Columbia.

Hydro now supplies about 93 per cent of the provincial population with electricity. Under the provincial government's new energy policy for B.C., Hydro will serve almost all the future electric load growth in British Columbia.

The growth rate of electric demand is forecast to increase by 6.1 per cent annually in the 11 years from April 1, 1980 to March 31, 1991. Hydro must keep pace with anticipated industrial development and the life-style expectations of the people of British Columbia. Projects now under construction are insufficient to meet expected demands beyond the mid-1980s.

It is vital to industry, to government and to the public that we plan today to meet customer requirements 10 or more years hence.

This booklet discusses electric supply and demand today and in the future and draws from that discussion Hydro's recommendations for action to ensure supply will be sufficient to meet demand.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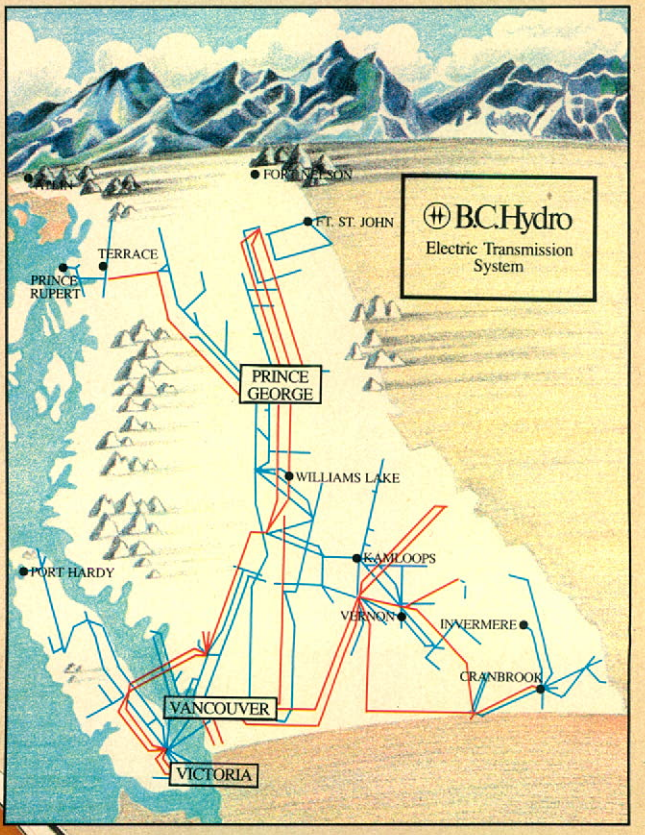
# What we have.

Most electricity consumed in British Columbia today is produced at Hydro's 32 hydroelectric plants across the province and reaches customers through an interconnected province-wide system of transmission lines.

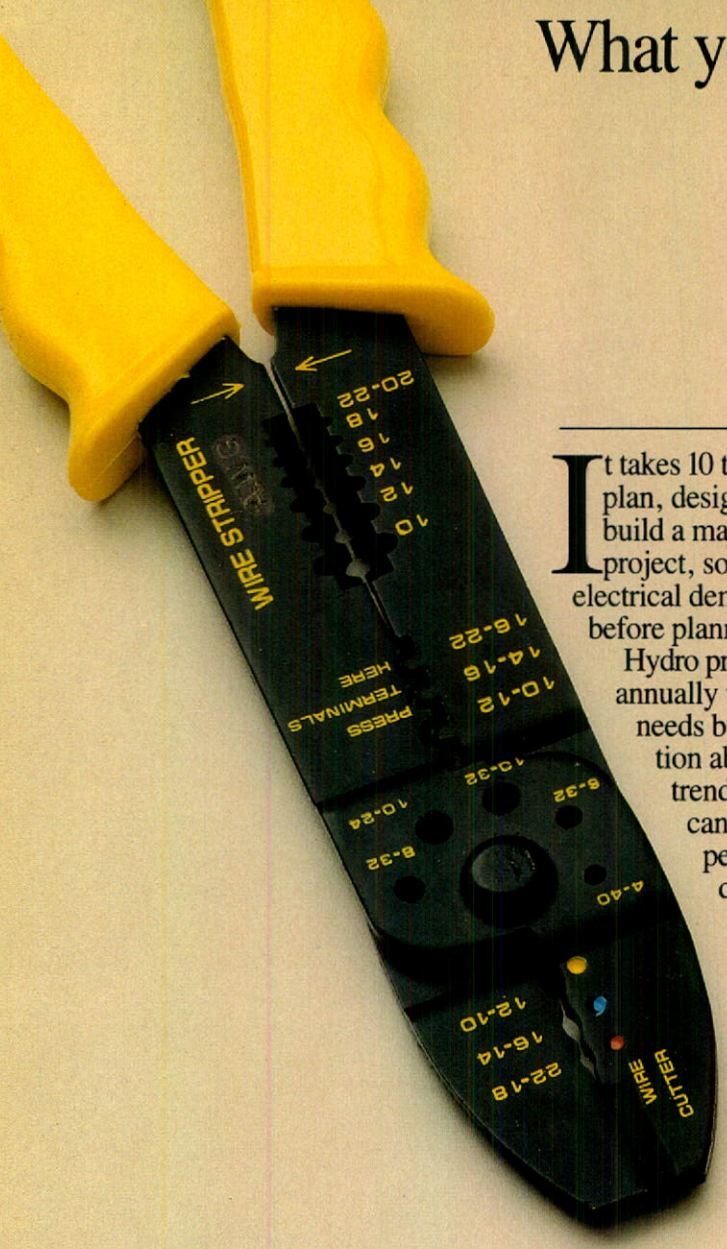
Because these hydroelectric plants are "fuelled" by water, the amount of electricity they can produce fluctuates with precipitation variations. To ensure adequate supply at all times, Hydro plans to meet B.C.'s electric needs under critical (driest) streamflow conditions. In years of excess water, therefore, we may have surplus electricity to sell in the export market. It makes sense to generate electricity from the surplus water rather than to spill it.

Hydro's existing system has a total nameplate capacity, or manufacturer's rating, of 8.8 million kilowatts (kW), as of March 31, 1981.

The Burrard thermal generating plant is used to supplement the hydroelectric system under emergency conditions. Because the plant is gas-fired, the electricity it produces costs more than that produced by hydroelectric plants.

# What you need.




It takes 10 to 15 years to plan, design, license and build a major hydroelectric project, so careful estimates of electrical demand must be made before planning can begin.

Hydro prepares a load forecast annually which estimates electric needs by combining information about past and current trends and projecting what can reasonably be expected to happen in the decade ahead.

District managers consult local governments, business and industry representatives. The data is compiled and analyzed. In addition, expansion plans of existing large industrial customers are analyzed. Inquiries related to possible new industrial development are evaluated. In the past two years the number of these inquiries has been substantial. Only about 10 per cent of this potential new load was allowed for in our last annual forecast.

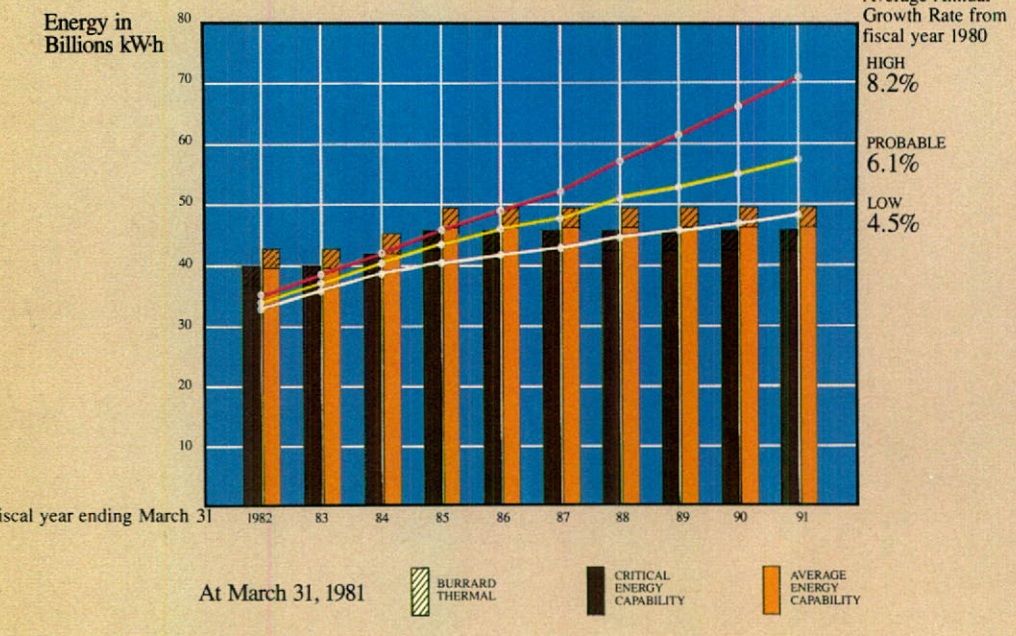
Government policy, changing lifestyles and the conservation ethic also are considered. Export of electricity is not included in the forecast.

Each year Hydro reviews and revises the forecast in light of current economic conditions and updated predictions. This annual revision is accompanied by a corresponding adjustment of system plans where necessary.

Hydro's current load forecast indicates that the need for electricity in the province will probably grow at an average annual rate of 6.1 per cent from April 1, 1980 to March 31, 1991. The forecast reflects Hydro's undertaking to provide electricity to West Kootenay Power and Light starting in 1981/82 when their customers' demands are expected to exceed that utility's generating capacity. Also included are significant amounts of electricity for Cominco starting in 1986/87 under the Kootenay Canal agreement. Excluding West Kootenay and Cominco requirements, the load forecast for B.C. Hydro alone is 5.6 per cent.

Hydro cannot be certain of meeting these requirements from its own resources from 1986 until proposed new electric generating projects at Site C and Hat Creek or their equivalents are in place.

Committed system capability compared to forecast

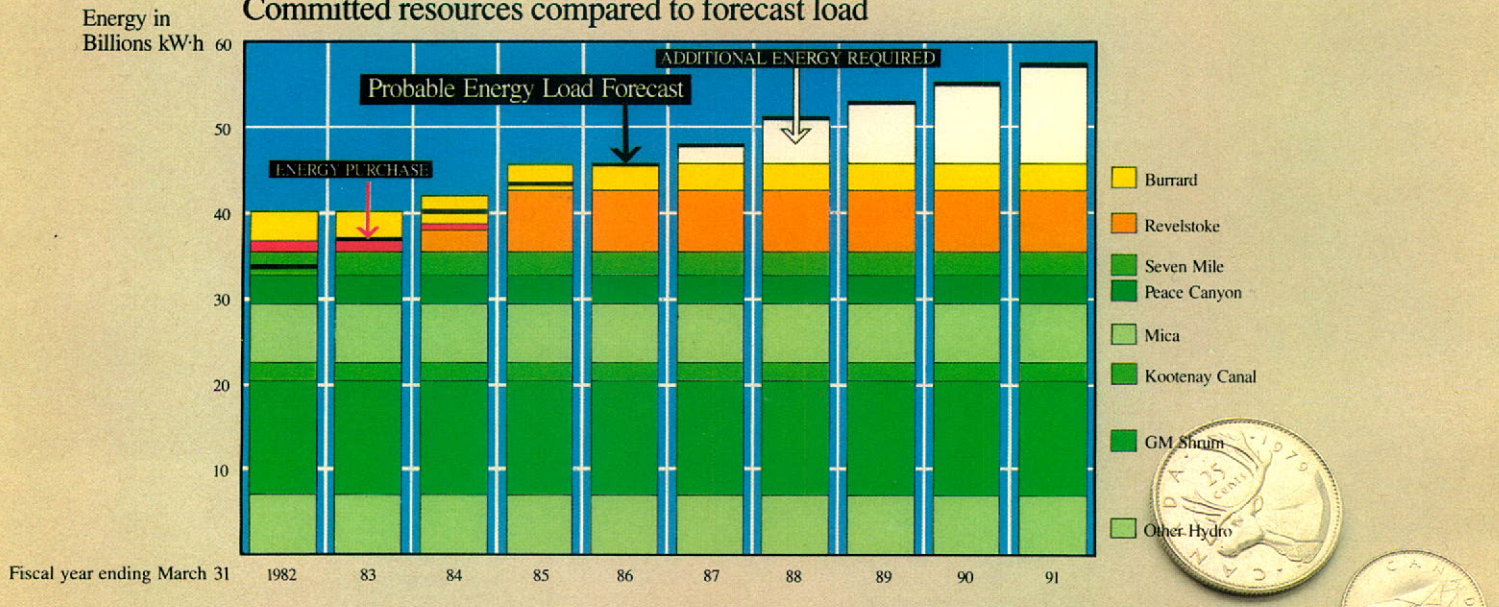


# What we need.

Even with Burrard thermal generating plant operating, Hydro's committed system cannot meet forecast loads under all streamflow conditions after 1985.

The demand for electricity is projected to reach 45 790 GW·h by 1985/86. Currently installed generation can assure only 38 820 GW·h per annum. The Revelstoke project is the only major generating project now under construction and will increase the power supply in B.C. to 45 700 GW·h by the time the four planned generating units are operating in 1984/85. As of March 31, 1981, Hydro had not received approval to construct another major project.

## Committed resources compared to forecast load




Note: All hydroelectric plant energy capability based on critical water conditions.

At March 31, 1981

# Where we will get it.

B.C. Hydro's generating alternatives are confined to those energy sources which meet four basic criteria. They must:

- be in British Columbia;
- have a well-developed technology;
- be cost competitive with other available energy sources;
- be acceptable to the provincial government and the public.

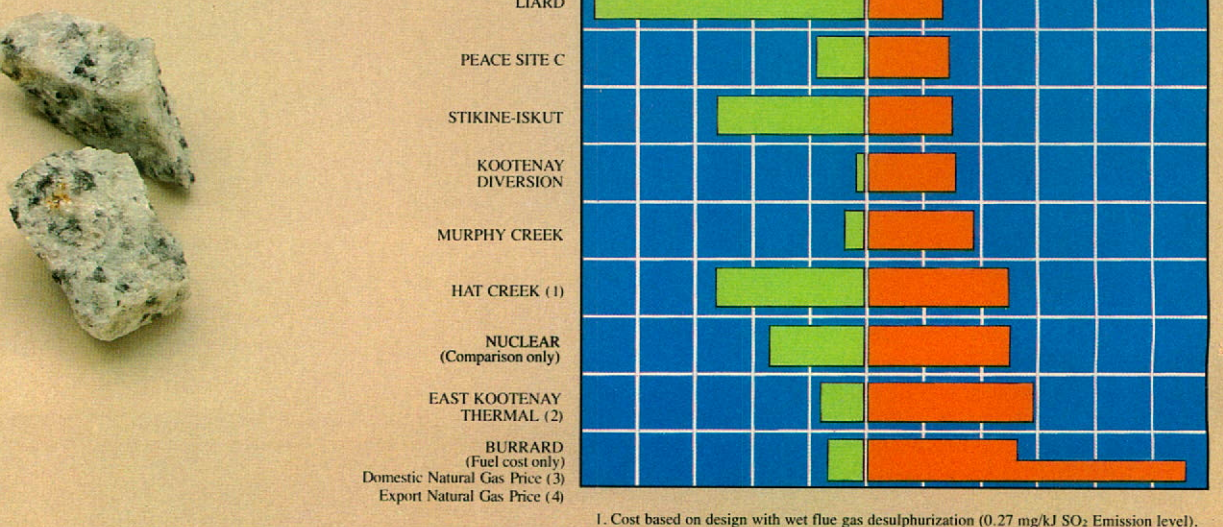
Although Hydro is studying sources such as solar, wind and tidal energy, they are not developed to the point where they can supply sufficient economic electricity to meet demand. Geothermal energy may prove to be an economic source of electricity. Exploratory drilling now under way in the Meager Creek area could demonstrate the feasibility of this resource.

In practical terms, the Site C hydroelectric development on the Peace River and Hat Creek coal-fired thermal plant appear to be Hydro's only available alternatives to bring new power on line in time to avoid extending the anticipated electricity shortage which could occur with low streamflows into the late 1980s.

# A view of the costs.

Hydro's general policy is to provide a secure, reliable supply of electricity at the lowest practical cost consistent with sound financial management.

The illustration shows the economic ranking of potential projects. The energy cost index provides a comparison of the expected unit energy costs of these projects with the cost of the Revelstoke plant now under construction. The existing Burrard thermal plant is included to indicate a cost comparison with potential hydroelectric and thermal plants.




1. Cost based on design with wet flue gas desulphurization (0.27 mg/kJ $SO_2$ Emission level).
2. Cost based on design with Meteorological Control System (MCS) without flue gas desulphurization.
3. Cost based on estimated (Nov. 1980) domestic price for natural gas.
4. Cost based on current export price for natural gas.

* **NOTE: All energy costs are compared with energy cost for the Revelstoke Project (4 units) on the Columbia River (i.e. Revelstoke has an energy cost index of 1.0).**

At March 31, 1981

# How we will get it.

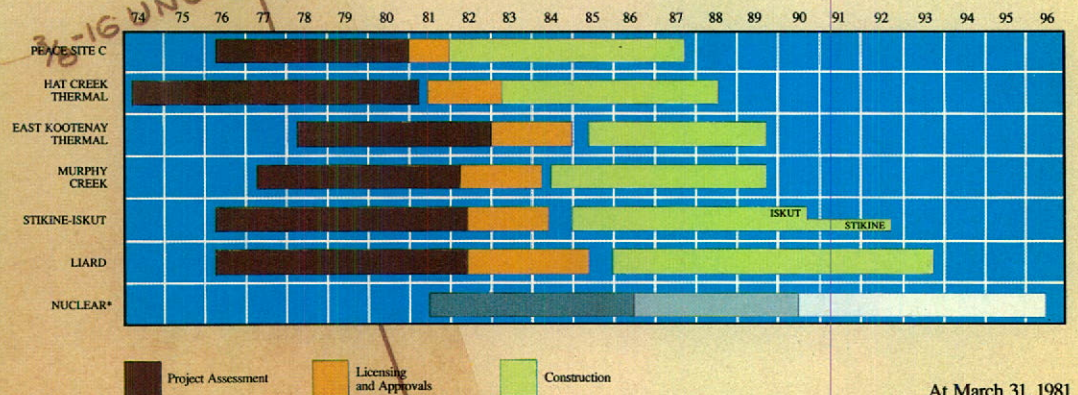
Hydro is studying several projects to meet forecast demands. The illustration shows the status of each project. Until feasibility and detailed engineering and environmental studies are completed, no decision is made on whether or not to seek approval for licensing. In addition to several permits and licences, Hydro must apply for an energy project certificate from the Ministry of Energy, Mines and Petroleum Resources. The government may refer the application to the B.C. Utilities Commission, and the Commission would then hold a public hearing. Although it would be desirable to bring Site C project into service by October 1986 in order to meet forecast demands, it now appears October 1987 would be the earliest in-service date. An application for an energy project certificate for Site C was submitted in September 1980 and a hearing is expected to begin about mid-1981.

## The alternatives.

The number of feasible projects for early development is limited. The earliest feasible in-service dates of major generation projects that Hydro is considering for future construction are shown below:

| | Project | Earliest In-Service Date | Nominal Generation Capacity (MW) | Average Energy (GW·h/a) | Firm Energy (GW·h/a) |
|---|---|---|---|---|---|
| Hydro: | Peace Site C | October 1987 | 900 | 4 610 | 4 660 |
| | Murphy Creek | October 1989 | 400 | 1 870 | 1 780 |
| | Iskut Sites | October 1990 | 935 | 4 320 | 4 050 |
| | Stikine Sites | October 1992 | 1 830 | 10 860 | 8 970 |
| | Liard Sites | October 1993 | 4 760 | 26 090 | 23 900 |
| Thermal: | Hat Creek | August 1988 | 2 000 | 11 400 | 13 140 |
| | East Kootenay | October 1989 | 600 | 3 420 | 3 940 |

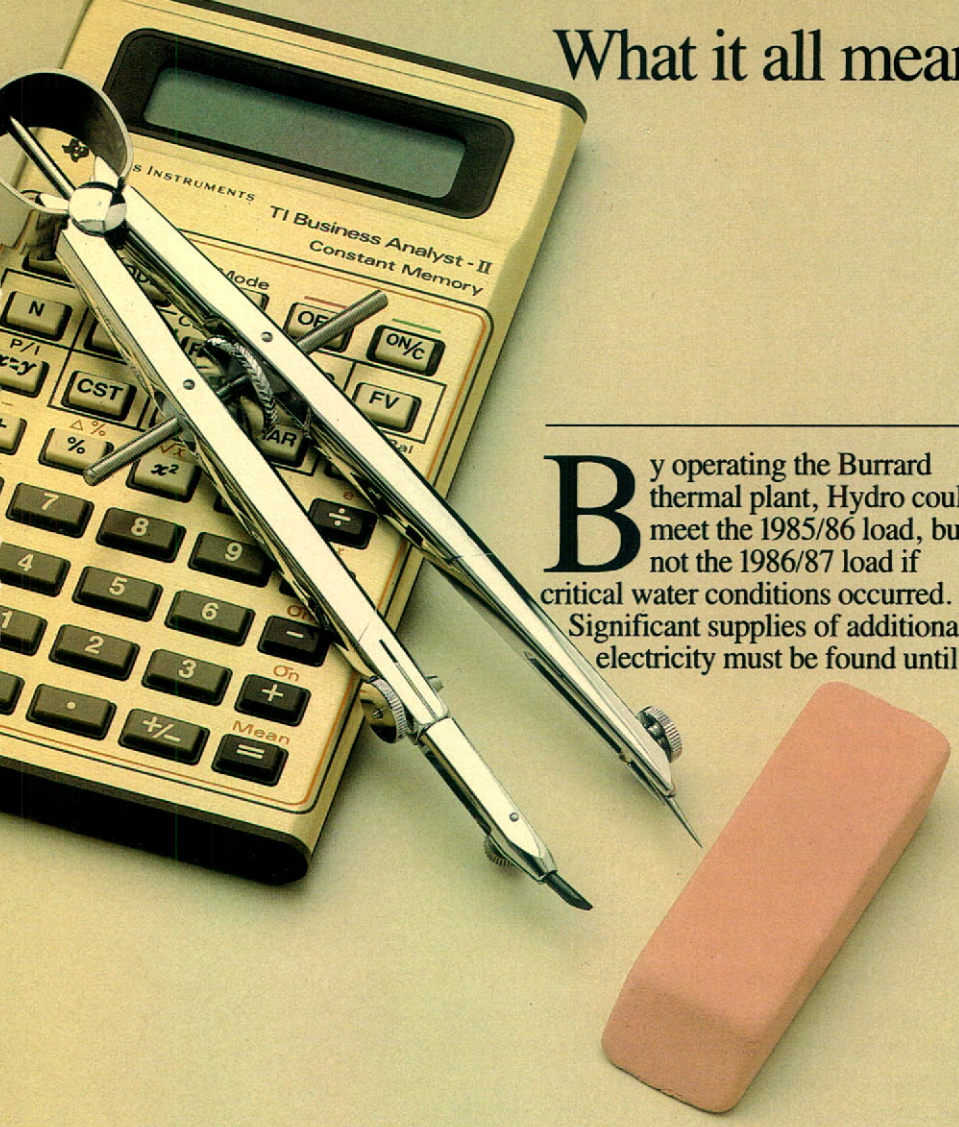
### Earliest feasible in-service dates




At March 31, 1981

*Nuclear planning schedule is shown for comparison only.

# What it all means.

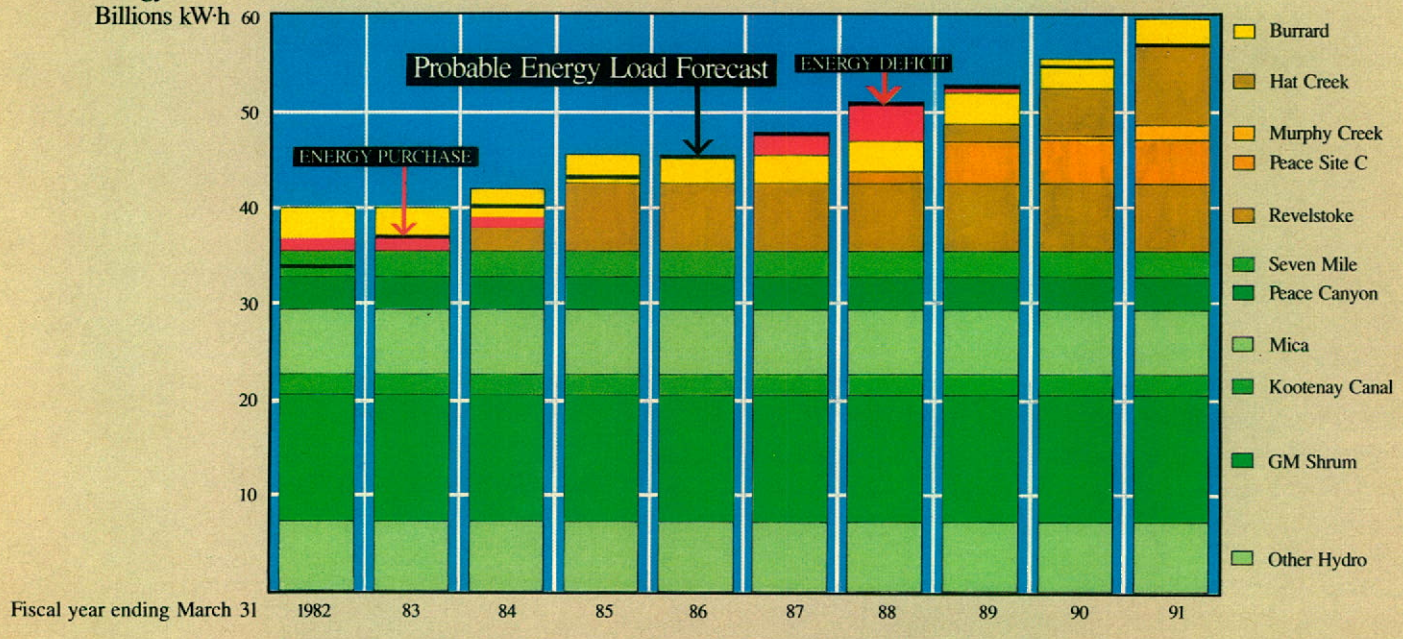



By operating the Burrard thermal plant, Hydro could meet the 1985/86 load, but not the 1986/87 load if critical water conditions occurred. Significant supplies of additional electricity must be found until the combined output of Site C and Hat Creek could be brought on stream.

If forecast demands are met or surpassed in a critical water year, Hydro would be unable to meet B.C.'s electric needs after 1985/86. This situation will be relieved somewhat, but not entirely, if Site C and Hat Creek are licensed and come on line by mid-1988.

Any delays in licensing of Site C and Hat Creek would aggravate the energy supply situation. While we have an agreement to purchase energy from Alcan extending until December 1983, at this time we have no assured source of firm energy from Alcan or other utilities beyond that date.

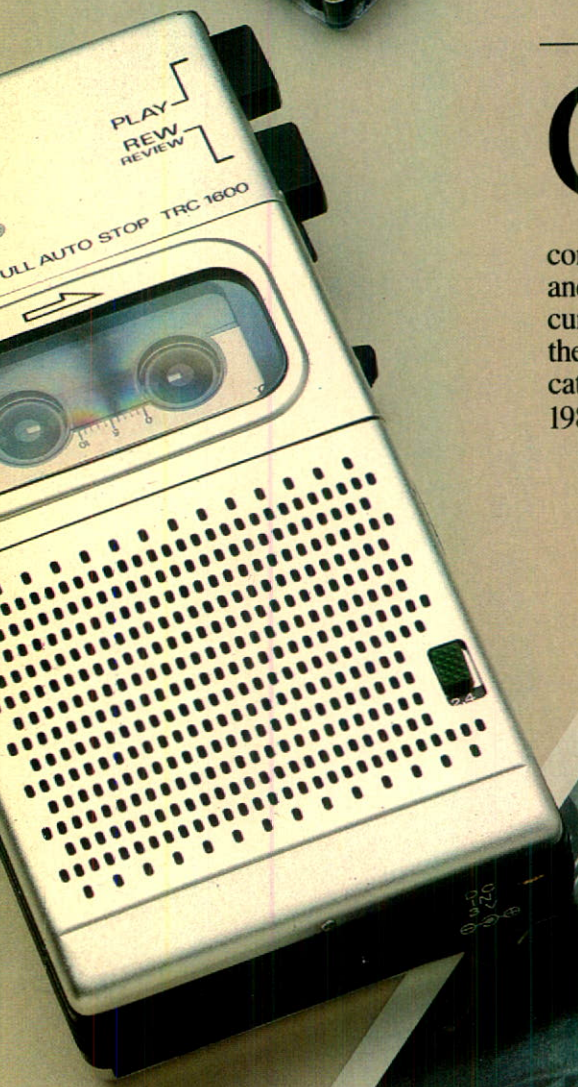
## Integrated system loads and resources




Note: All hydroelectric plant energy capability based on critical water conditions.

At March 31, 1981

# How you can help.




Conservation of electricity can help to reduce the pressure on the B.C. Hydro system in future.

For example, as a result of conservation efforts by commercial and small industrial customers, our current load forecast assumes that the growth of all new loads in that category coming on line after 1982/83 will be reduced by some 20 per cent below a "no conservation" growth rate. These reductions have resulted in considerably lower projections for this class of customer.

Hydro has representatives throughout its service area to advise residential, commercial and industrial customers on ways to economize through efficient use of electricity. Hydro also conducts industrial management seminars to provide practical advice on effective measures to use energy efficiently in plants and buildings.

# What it will cost.

The cost of building major new projects and other related fixed asset expenditures in the period from 1981-1991 is estimated to be $22.6 billion, including overhead, interest during construction and allowance for future inflation.

These expenditures offer both short-term and long-term benefits to British Columbia. Hydro's debt is backed by revenue-producing assets which have current and forecast values in excess of the debt.

Simply stated, the debt is like a mortgage and is paid off from revenues produced over the service life of the facilities.

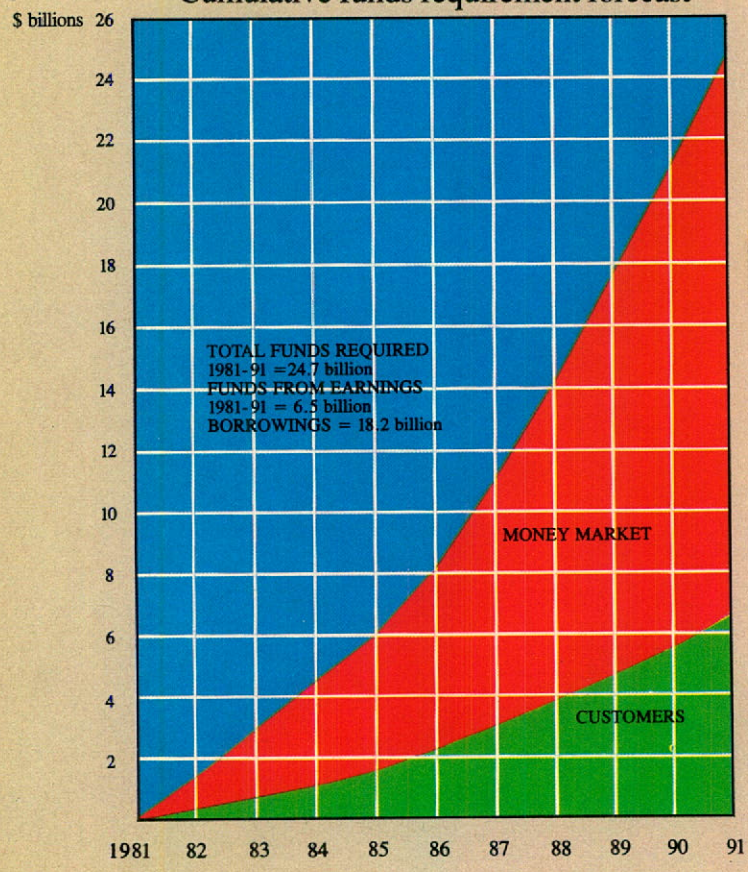
# How to pay for it.

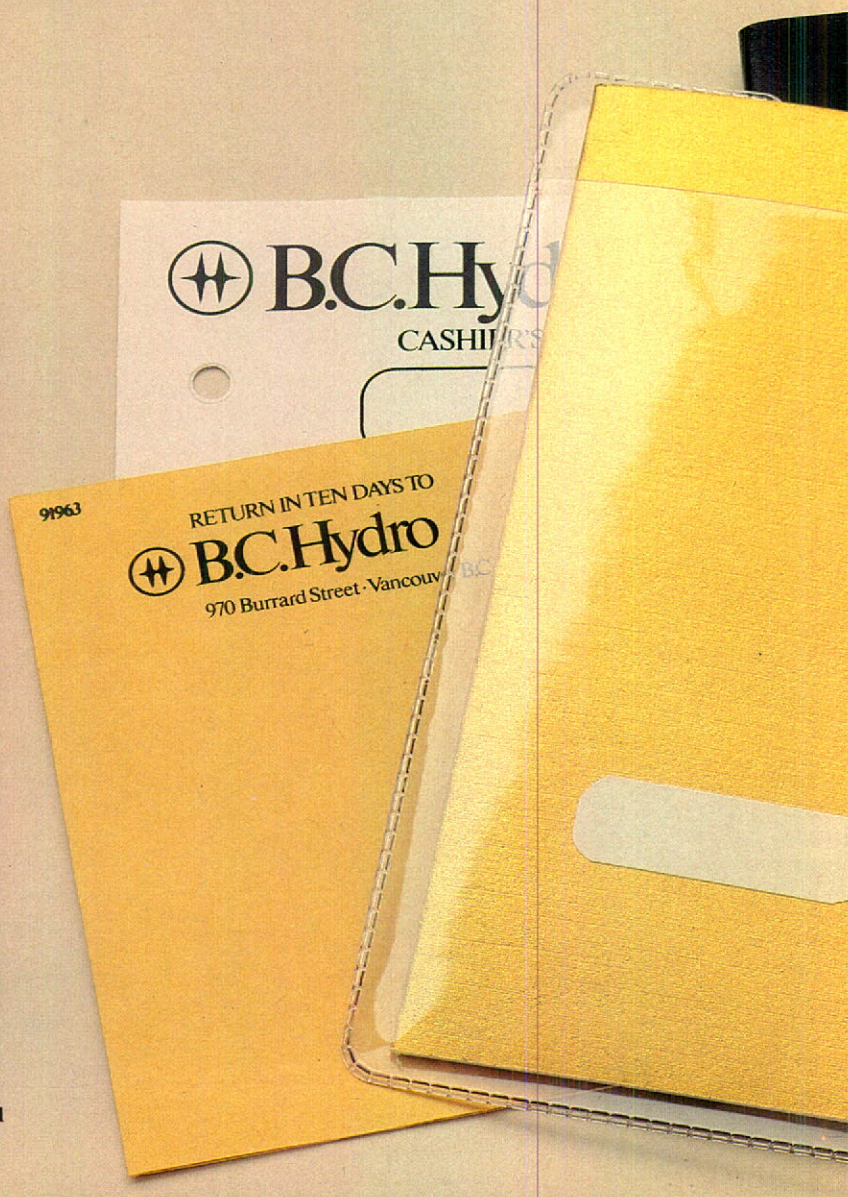
Funds are raised through borrowings and through rates paid by customers.

In the next 10 years we project that about $6.5 billion of the total funds required will be provided from operations. Of this amount $2.1 billion will be used to retire existing debt. The remainder will be re-invested in the business. With the cost of new fixed asset expenditures over the 10 years being estimated at $22.6 billion, this leaves $18.2 billion to be borrowed.

Rather than burden today's customers with tomorrow's costs, we amortize the debt over the long service life of the new facilities. Traditionally Hydro's rates are structured to cover the servicing of the debt along with other operating costs. Under the new provincial energy policy, B.C. Hydro's rates are regulated through the B.C. Utilities Commission.

Cumulative funds requirement forecast



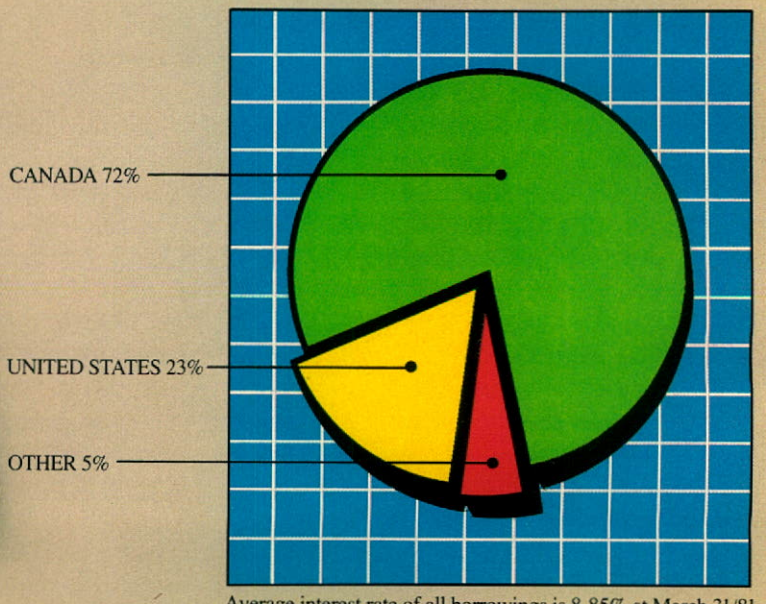
# Where to borrow.

Most borrowing takes the form of long-term bonds (20 to 30 years), through government trusteed funds, issues to the public, or through private placements arranged by brokers.

Hydro usually looks first to Canada as a source of funds, but on occasion we must go elsewhere — usually to the United States, but also to Europe. Hydro's credit rating is a vital factor in attracting investments from these sources.

Hydro has the highest possible rating: triple A from Moody's Investors Service and from Standard & Poor's Corporation, the two major financial rating agencies in the U.S.


Bonds issued by B.C. Hydro




Average interest rate of all borrowings is 8.85% at March 31/81.

# Conclusion.

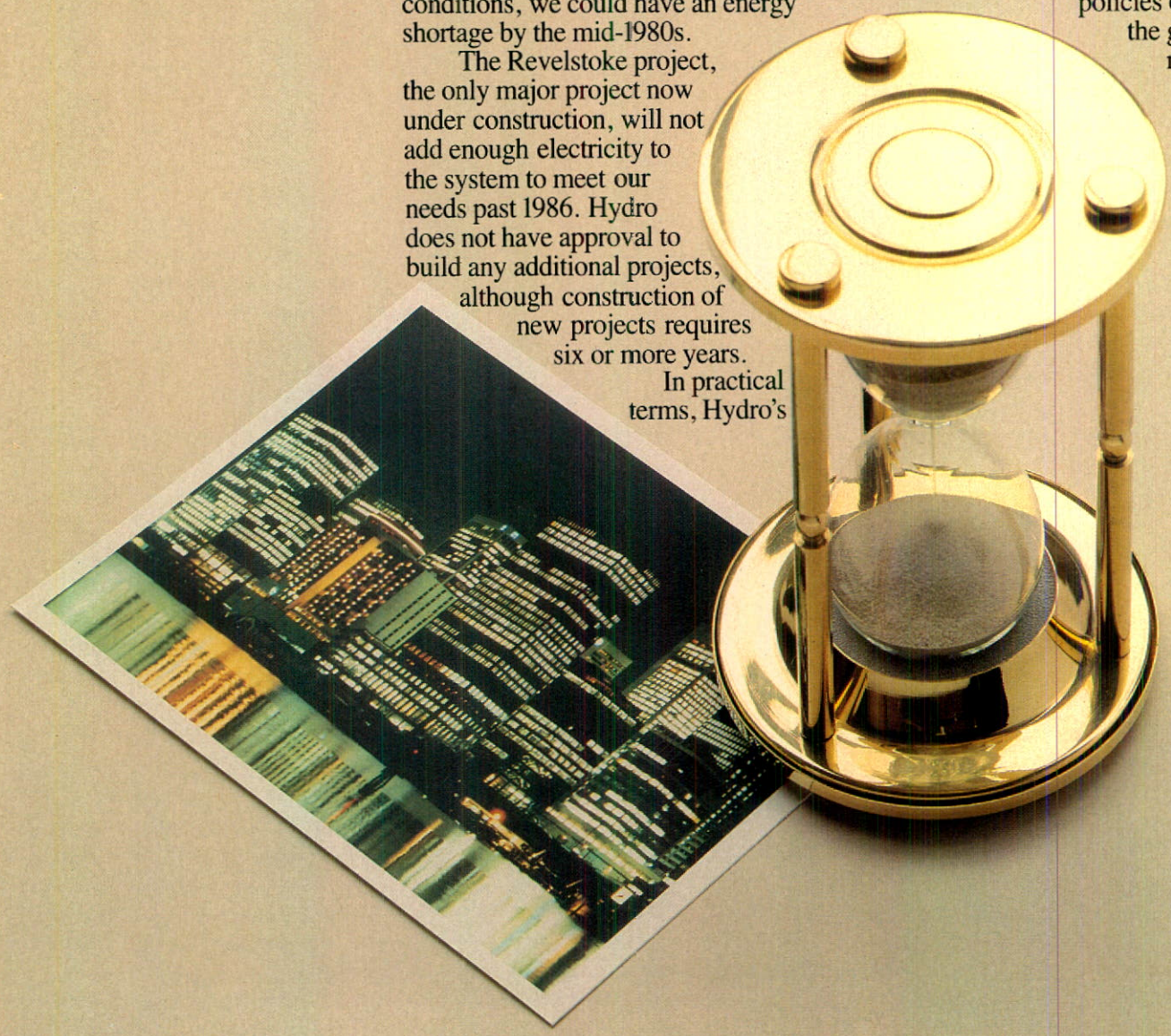
Hydro's load forecast indicates an annual growth in electric demand in British Columbia of 6.1 per cent over the 11 years from April 1, 1980 to March 31, 1991.

If this forecast is met or surpassed and if British Columbia experiences critical streamflow conditions, we could have an energy shortage by the mid-1980s.

The Revelstoke project, the only major project now under construction, will not add enough electricity to the system to meet our needs past 1986. Hydro does not have approval to build any additional projects, although construction of new projects requires six or more years.

In practical terms, Hydro's only feasible projects to meet growing electrical needs in the middle to late 1980s are the Site C hydroelectric development on the Peace River and Hat Creek coal-fired thermal generation.

Hydro has the technical and financial ability to build the projects that will ensure British Columbians a secure energy future, while at the same time maintaining the social, economic and environmental policies of the government.



# Glossary.

**Capability:**
The amount of energy a generating plant can produce in a given time (usually a year). For a hydro plant it relates not only to the size of the generating equipment, but also to the availability of water. For example, with a small amount of water available the plant could be operated at capacity for short time, then closed down or output greatly reduced so the average level of energy production would be much less than the plant capacity.

**Capacity:**
Maximum rated output of a machine, apparatus or station.

**Critical Water Conditions or Critical Water Sequence:**
A period of adverse streamflows which actually occurred in the past. It is expected that critical water periods may recur at any time in the future, and would cause all hydroelectric reservoirs then in operation to be drawn down to minimum levels in order to sustain service to firm loads. Critical water conditions thus serve as a design test of the capability of a hydroelectric system to meet forecast electric loads under adverse reservoir inflows.

**Flue Gas Desulphurization:**
Process, often called ''scrubbing'', of removing sulphur dioxide from gases given off by combustible material containing sulphur, such as coal.

**Load Forecast:**
An estimate of the customers' power and energy consumption at some future time.

**Streamflow:**
The volume of water passing a given point in a stream or river in a given period of time.

## Abbreviations.

**W** (watt): the basic unit of electric power, expressing the rate at which electric energy is expended.

**kW** (kilowatts): 1 000 watts.

**kW·h** (kilowatt-hour): a unit of work or energy equal to that expended at the rate of one kilowatt in one hour.

**GW·h** (gigawatt-hour): 1 000 000 kilowatt-hours.

**MW** (megawatts): 1 000 kilowatts or 1 000 000 watts, a measure of electric power.

**mg/kJ $SO_2$:** measurement of the weight of sulphur dioxide per thousand units of heat produced from burning coal.