



Energy, Mines and
Resources Canada

Program Evaluation Group

Énergie, Mines et
Ressources Canada

Groupe de l'évaluation des programmes

Report No:
PE 122A/1987

PROGRAM EVALUATION STUDY
OF THE
DISTRIBUTION SYSTEM EXPANSION PROGRAM (DSEP)
VOLUME I: SUMMARY

This document was produced
by scanning the original publication.

Ce document est le produit d'une
numérisation par balayage
de la publication originale.

Canada

Q
180
C3
A45
no. 122A
1987

HEADQUARTERS LIBRARY
ENERGY, MINES AND RESOURCES CANADA
100 BROAD STREET
OTTAWA, CANADA K1A 0E4
BIBLIOTHÈQUE CENTRALE
ÉNERGIE, MINES ET RESSOURCES CANADA
680, RUE BROAD
OTTAWA, CANADA K1A 0E4

Q
180
C3
A45
no. 122A
1987

Report No:
PE 122A/1987

PROGRAM EVALUATION STUDY
OF THE
DISTRIBUTION SYSTEM EXPANSION PROGRAM (DSEP)
VOLUME I: SUMMARY

June 1987

Prepared for:
Energy, Mines and Resources
Program Evaluation Branch

Prepared by:
Quantalytics Inc.
Vancouver

HEADQUARTERS
LIBRARY - EMR
RECEIVED
DEC 14 1988
REÇU
BIBLIOTHÈQUE
CENTRALE - EMR

CONTENTS

	<u>Page</u>
1. INTRODUCTION	1
2. PROGRAM DESCRIPTION	2
2.1 Background	2
2.2 DSEP Program Components	4
3. FINDINGS WITH RESPECT TO EVALUATION ISSUES	7
3.1 Have the Economic and Social Benefits of the DSEP Program Justified its Costs?	7
3.2 What Incremental Contribution has DSEP Made to Accelerated Gas Market Expansion and Oil Displacement?	10
3.3 Were the Criteria Used in Funding Decisions the Most Appropriate?	11
3.4 Have There Been Significant Unintended Consequences of the Program?	11
3.5 How Well Did Incentives for Cost Control Work, and Were Cost Control Objectives Met?	12
4. RECOMMENDATIONS ARISING FROM THE PROGRAM EVALUATION	14
4.1 Program Funding Criteria	14
4.2 Relative Levels of Competition and Incentive Funding	14
4.3 Specification of Financial Test	15
4.4 Timing of Project Submissions and Approvals	15

SECTION 1
INTRODUCTION

In early 1987, Quantalytics Inc. was approached by Energy, Mines and Resources Canada (EMR) to complete an evaluation of the Distribution System Expansion Program. Quantalytics had previously carried out a partial analysis of the program in the latter part of 1985, and a report on this analysis was provided to EMR in January, 1986. Terms of reference for the new study were finalised in February 1987, with the intent of (a) extending the previous analysis to include all the natural gas distribution utilities that received DSEP funding, and (b) updating the analysis to take account of changes that have occurred in energy price forecasts since the previous analysis was undertaken. The report entitled Program Evaluation of the Distribution System Expansion Program, Methodology and Analysis, March 1987 (Volume II) fulfills the first intent of the contract, namely to extend the analysis to all the utilities that received funding; as such, it draws heavily on Quantalytics' January 1986 report, and should be read in the context of the energy price outlook that existed at that time. To fulfill the second intent of the contract, Quantalytics has prepared a second report entitled, Program Evaluation of the Distribution System Expansion Program, Energy Price Update, March 1987 (Volume III). This report (Volume I) provides a summary of the major findings of the program evaluation.

SECTION 2

PROGRAM DESCRIPTION

2.1 Background

In October 1980, a number of policy initiatives were announced as part of the National Energy Program that were intended to eliminate Canada's dependence on imported oil. Conservation, substitution of other energy products for oil, and an increase in the domestic supply of oil were identified as means to achieve energy security for Canada.

To achieve this goal, a number of programs were developed, focusing on different aspects of energy supply and demand in Canada. The Distribution System Expansion Program (DSEP) was one specific initiative designed to encourage the expansion of natural gas distribution mains into areas that were not served by natural gas. Legislative authority for DSEP was contained in the Canada Oil Substitution and Conservation Act.

Another program objective, to stimulate gas market expansion, was contained in the September 1981 Canada-Alberta Agreement on Energy Pricing and Taxation. Under the terms of this Agreement, funds were provided to the Government of Canada by the Province of Alberta to expand markets for Alberta-produced natural gas in markets east of Alberta. These Market Development Incentive Payments (MDIP) were used to finance four federal energy programs, including DSEP grants in provinces east of Alberta. Funds for DSEP

projects undertaken in British Columbia were provided by the Government of Canada from the Consolidated Revenue Fund.

DSEP was begun in March 1982, with funding approved by the Treasury Board for one year, and in October 1982 program approval was granted by Treasury Board through March 1987. Some \$260 million of funding was allocated to DSEP over the period 1982-87, of which \$192 million had been disbursed by May 1986. The Western Accord of March 1985 contained a provision for the termination of the Market Development Incentive Payments no later than April 30, 1986, and in May 1985 the utilities were informed that DSEP was being discontinued immediately, although existing commitments to ongoing projects would be fulfilled. In all, it is expected that the program will have disbursed about \$194 million after all outstanding funding commitments have been met.

DSEP provided financial assistance to gas distributors to assist in the expansion of their distribution networks where such expansion would not otherwise have been financially viable. All natural gas distributors in Canada, except those in Alberta, were eligible for DSEP assistance, which took the form of direct contributions in-aid-of-construction. In all, 19 natural gas distribution utilities in British Columbia, Saskatchewan, Manitoba, Ontario and Quebec participated in the program.

Between 1982/83 and 1986/87, there were 2,000 successful project applications, and 1,744 projects proceeded to construction and were funded. The total eligible capital costs of the funded projects were \$356 million, of which federal contributions amounted to \$194 million. Ninety-eight thousand gas customers are forecast to be added of which almost 59,000 had attached to these projects by the middle of 1986. When attachments are complete, it is estimated that there will be an annual displacement of 932,000 cubic meters of oil.

2.2 DSEP Program Components

Two funding approaches were adopted for DSEP, referred to as "DSEP/ Competition" and "DSEP/Incentive Funding", respectively. The Competition component of the program was designed for large extension projects, and the Incentive Funding component for small in-fill projects.

All extension projects, regardless of total capital cost, were eligible for submission to DSEP Competition. The viability of each candidate project was evaluated by EMR using a discounted cash flow financial test, and the contribution required to make the project viable was calculated. The utility also submitted an estimate of the required contribution using the financial test applied in its own mains extension policy. The required federal contribution was taken to be the lesser of the EMR-calculated and the utility-calculated contribution.

All projects in the competition were ranked according to their cost-effectiveness in displacing oil (i.e., the required dollar contribution from DSEP per cubic meter of oil displaced). Projects were then approved according to this cost-effectiveness ranking, subject to a cut-off level for cost-effectiveness (referred to as the "off-oil criterion") of \$120 per cubic meter in 1982/83, and \$90 per cubic meter in 1983/84 and 1984/85.

The Incentive Funding component of DSEP was designed to encourage utilities to expand their existing market, particularly through infill projects. A specified amount of funding was allocated annually by EMR to each utility, based on the total gas sales volumes of the utility, the potential number of gas expansion projects indicated by the utility, and past performance in connecting DSEP customers. The funds were applied as contributions in-aid-of-construction for approved projects with a total capital cost less than

\$250,000. To determine the projects which were eligible for DSEP funding, projects were evaluated using the utility's own financial test for mains extensions. Only projects which were not financially viable according to this test, and which met the off-oil criterion, were eligible for DSEP funding.

Total commitments to the Program over the period 1982/83 to 1986/87 were \$193.7 million, of which \$119.0 million was for Competition and \$74.7 million was for Incentive Funding.

SECTION 3

FINDINGS WITH RESPECT TO EVALUATION ISSUES

3.1 Have the Economic and Social Benefits of the DSEP Program Justified its Costs?

The fundamental question asked in the evaluation about the expansions of natural gas distribution systems funded under the DSEP program, is whether, from the standpoint of the Canadian economy, the expected returns of the projects undertaken justify the costs. More precisely, the question addressed is whether the costs to Canada of meeting the energy needs of customers presently served by DSEP-funded facilities, or who are expected in the future to be served by such facilities, are greater, or less, with natural gas service being available to these customers.

Rather than producing economic benefits directly in the form of increased consumption, DSEP projects were intended to reduce the cost to Canada of meeting the energy needs of the customers that are provided natural gas service by DSEP-funded facilities. The principal economic benefits of DSEP projects are thus the social cost savings of the fuels displaced by natural gas. In the sample of 107 DSEP projects selected for detailed analysis, light fuel oil, liquefied petroleum gas (LPG), electricity, heavy fuel oil and wood were identified as the fuels displaced, with light fuel oil being by far the most important form of displaced energy. The cost savings from fuels displaced by DSEP projects depends on their value, or best alternative use outside of the project, which requires a careful analysis of the social opportunity costs of the various fuels. In addition, there is a benefit (or avoided cost) resulting from

the fact that consumers no longer bear the cost of replacing or installing new equipment to burn these displaced fuels.

The detailed results of the two benefit-cost analyses conducted of the Program are reported in Volume II (as at January 1986) and Volume III (as at March 1987). A summary of the results is shown below in Exhibit 1; the results in column 1 are taken from Volume II and the results in columns 2 and 3 are taken from Volume III. The detailed oil oil, natural gas and other energy price forecasts used are described in the respective Volumes.

The results indicate that DSEP was a good program in terms of present and expected future net economic benefits for Canada. The range of the estimated net benefits of DSEP over 20 years range is \$640-680 million, expressed in 1985 dollars and calculated at a 7 per cent social discount rate. The corresponding range of net benefits using a 10 per cent social discount rate is \$400-470 million.

Exhibit 1
DSEP Net Economic Benefits
(\$1985 Millions)

	<u>Oil Price Scenario</u>		
	Western Accord ¹	US\$15/bbl	US\$10-22/bbl
7 Percent SDR	658	676	640
10 Percent SDR	401	469	429

1. Scenario adopted by Energy Policy Analysis Sector of EMR for analysis of fiscal provisions of the Western Accord, signed in March 1985.

These positive results were subjected to a number of sensitivity tests, involving decreased customer attachments, increased social opportunity costs of natural gas, and

reduced social opportunity costs of displaced fuels, and were found to be robust.

The estimates shown in Exhibit 1 indicate that the net benefits of the Program are generally slightly higher for the more recent analysis (columns 2 and 3) than for the earlier analysis (column 1). Although lower oil price expectations since the time that the earlier analysis was conducted have exerted a negative influence on estimated net benefits, these net benefits are sensitive only to price differences between natural gas and other fuels. While the forecast prices of petroleum products are now lower than in the previous analysis, the price differences between natural gas and petroleum products have not changed as much. In addition, EMR's forecast social opportunity costs of electricity are uniformly higher in all provinces than in the earlier analysis.

Moreover, since Quantalytics' earlier analysis was done, EMR staff have made substantial changes to the project data files, including: data corrections; the entry of actual capital cost data for projects that had not been completed at the time of the earlier analysis (which are generally lower than the estimated capital costs for these projects used previously); and changes in estimated oil displacement volumes resulting from revisions in project scope. These changes appear to contribute to the small estimated increase in the net economic benefits of the Program, despite the overall deterioration in the energy price outlook that has occurred since the earlier analysis was done.

An attempt is made in the analysis reported in Volume II to examine the incremental effect of DSEP, recognising the simultaneous effects of other federal energy programs at the end-user level --principally COSP and ICAP -- that were also aimed at achieving oil displacement and gas market expansion.

It appears that the Canada Oil Substitution Program (COSP) probably did accelerate the capture of potential DSEP customers to some extent, but there is considerable uncertainty about the magnitude of this effect. For the purpose of the DSEP evaluation, the analysis of the effect of COSP is limited to estimating an upper bound on the proportion of the total net benefits of DSEP that can be attributed to COSP. Our analysis indicates that of the previously-estimated net benefits of DSEP of \$658 million in the reference case, at a 7 per cent social discount rate, the portion attributable to COSP was something less than \$322 million. Hence, regardless of the actual effects of COSP on attachment rates, it appears that the net benefits attributable to DSEP remain positive and significant.

With respect to the Industrial Conversion Assistance Program (ICAP), it is concluded that the take-up of this program by industrial customers attaching to DSEP facilities was very limited, so that the availability of ICAP assistance was not a significant factor affecting the net benefits attributable to DSEP.

The overall conclusion that has emerged from the two economic analyses conducted of the Program is that DSEP has been a good program mainly because it has encouraged the substitution of natural gas, which is a relatively low-valued fuel in a social sense on account of the availability of surplus natural gas reserves, for oil products, which are relatively higher-valued. The fact that EMR efficiently targeted DSEP program funds to obtain maximum oil displacements and the fact that the utilities tended to come in under budget in constructing their projects also contributed to the success of the program from an economic standpoint.

3.2 What Incremental Contribution has DSEP Made to Accelerated Gas Market Expansion and Oil Displacement?

Our analysis indicates that, by 1990, an estimated 17.6

petajoules (457,000 m³) of oil (light and heavy fuel oil combined) are expected to be displaced as a result of DSEP, which represents about 80 per cent of the total fuel displacements of the Program on an energy basis. This oil displacement is relatively small in the overall picture of Canadian consumption of oil products, which the National Energy Board currently projects at 2,700-2,800 PJ in 1990. With respect to gas market expansion, an estimated 20.9 PJ of additional natural gas sales are expected, by 1990, as a result of the Program. This compares with the National Energy Board's current projection for Canadian natural gas consumption of 2100-2200 PJ in 1990.

3.3 Were the Criteria Used in Funding Decisions The Most Appropriate?

Our analysis indicates that the project ranking criterion used by EMR (dollars of federal contribution per cubic meter of oil displaced) to determine the projects it would fund, was fairly good in selecting projects that generated large net economic benefits (i.e., large net present value of benefits per dollar of federal contribution). For the sample of 107 DSEP projects that were analysed in detail, a rank correlation was computed between the project ranking based on the EMR criterion and the project ranking based on estimated net present per dollar of federal contribution. The computed (absolute) value of the rank correlation between the two measures was found to be 0.82, indicating a fairly high degree of conformity between the two sets of rankings.

3.4 Have There Been Significant Unintended Consequences of the Program?

In the course of the evaluation, we examined the question of whether DSEP, through its provision of financial incentives to the gas distribution utilities, provided unintended incentives to do socially less valuable projects first. A

majority of the utilities interviewed indicated that, at the time DSEP was terminated, they had already saturated or were close to saturating the worthwhile potential for extensions of their distribution systems. The general view expressed to us was that DSEP, as part of the overall National Energy Program, had allowed the operational personnel in the utilities to operate in an environment in which management up to the Board level had been receptive to measures to promote a rapid expansion of gas markets. Thus, if the expansion could be shown to be financially sound, then capital budgets for expansion were increased accordingly. In other words, there appears to have been little, if any, adverse influence of the DSEP program on the ranking of potential projects, that involved a "crowding-out" of more worthwhile projects by DSEP projects.

3.5 How Well Did Incentives for Cost Control Work, and Were Cost Control Objectives Met?

Our analysis indicates that the variance between the estimated and actual construction costs of individual projects was often quite large. However, the utilities provided in all cases what we believe are reasonable explanations for the differences. Despite this high variance for individual projects, actual construction costs were about 10 per cent less than estimated construction costs for all projects overall. The gas distribution utilities believed the cost control procedures put in place by EMR -- in which the utilities absorbed 100 per cent of cost overruns, and refunded to EMR 100 per cent of cost underruns -- to be reasonable given that DSEP was a grant program.

Almost all the utilities interviewed indicated that they had experienced some difficulties with the timetable of project submissions and approvals -- particularly the second round of approvals that took place in August and September of each year. In some cases, late approvals and the resulting delay in the commencement of construction may have led to

increased construction costs due to adverse weather conditions.

The utilities interviewed indicated a high level of satisfaction with the day-to-day administrative procedures in place for DSEP and the speed and efficiency with which enquiries and problems about the program were dealt with by DSEP administrators. The administrative procedures do not appear to have resulted in unnecessarily high costs to comply with EMR's information requirements.

SECTION 4

RECOMMENDATIONS ARISING FROM THE PROGRAM EVALUATION

4.1 Program Funding Criteria

On account of the lack of complete conformity between the respective rankings of projects based on the criterion adopted by EMR and an economic criterion specified in terms of project net benefits, we recommend that, in the future, EMR consider foregoing the use of displaced oil volumes as a proxy of net economic benefits, and consider instead a more explicit analysis of these benefits on a project-by-project basis. This suggestion is premised, in part, on the assumption that any future program like DSEP would involve fewer projects, fewer utilities and fewer regions, so that the administrative arguments for using a simplified project selection criterion based on oil displacement volumes would not be as important a consideration in formulating any future version of the test.

With respect to the method of project ranking, we recommend that net economic benefits per dollar of federal contribution be used. Use of this ranking method will maximise the aggregate net benefits of the set of selected projects compared with any other allocation of the limited budget among candidate projects.

4.2 Relative Levels of Competition and Incentive Funding

It appears from our analysis that it would have been feasible, from an administrative point of view, to have run all projects through the competition process, and that this would have offered the potential for EMR to have saved resources, or alternatively to have caused an increase in the number of projects funded, and thereby an increase in

the amount of oil displaced and net benefits generated. We recommend, therefore, that in any possible future program greater emphasis be placed on the competition mechanism.

4.3 Specification of Financial Test

Based on conservation trends identified by most of the utilities, we recommend that in any future program of this type, information on long-run trends in gas usage rates be sought from the utilities or estimated directly by EMR, and provision made to incorporate these trends into the financial test.

The financial test specified by EMR assumes that selling price margins for natural gas are maintained in real terms over time. Some of the utilities interviewed questioned the validity of this assumption, given the regulated nature of the industry, and there is no question that the behaviour of selling price margins over time will have a considerable effect on the viability of any particular DSEP project. If consideration is given to reactivating the DSEP program, or a program like DSEP, we recommend that an analysis of selling price margins over time be conducted, and that this analysis form part of the documentation on the standard financial test.

4.4 Timing of Project Submissions and Approvals

Each year, the incentive component of the DSEP program was administered in two rounds, with applications submitted on or before either April 1 or August 1. The utilities were notified of projects that had been approved by the beginning of May and September, respectively. The utilities indicated that in some cases the timing of project approvals may have led to higher-than-necessary construction costs. In the event that DSEP were to be resurrected, or a program mounted with similar objectives, we recommend that the timing of approvals be reviewed with the utilities with the intent of

moving the second round of approvals forward in time, if that should be their desire.

DUE DATE

JUL 11 1997

HEADQUARTERS LIBRARY
ENERGY, MINES AND RESOURCES CANADA
585 BROAD STREET
OTTAWA, CANADA K1A 0S8
BIBLIOTHÈQUE CENTRALE
ÉNERGIE, MINES ET RESSOURCES CANADA
585 RUE BROAD
OTTAWA, CANADA K1A 0S8

HO Lib - NRCan / Biblio. centrale - RNCan 580 Booth



3 2364 00054 2532