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INTRODUCTION

This Workbook and the related Energy Efficiency Planning Guide have been prepared for The Mining Association of Canada (MAC) with the guidance of the MAC Task Force on Energy Conservation. These publications reflect the current status of the industry-related issues discussed, and will be updated, as new developments require. These documents are intended to assist all metal mining companies in their pursuit of energy efficiency.

VCR OVERVIEW

The National Action Program on Climate Change (NAPCC), a consensus of federal, provincial and territory governments, set out the principles, strategic directions and opportunity areas that Canada will pursue to reduce greenhouse gas emissions. To support this, the Voluntary Challenge and Registry (VCR) was established in 1995 by Natural Resources Canada (NRCan) as a recording facility for industry participation. The VCR program invites Canadian organizations to express their intention to participate and develop action plans to reduce net greenhouse gas emissions. The registry will publicly document the commitments, action plans, progress and achievements of all participants in the Voluntary Challenge.

In September of 1997, the VCR will be reconstituted as a stand-alone corporation, reflecting the partnership between the public and private sectors. Two-thirds of its funding will come from the private sector, and one-third from government.

THE MINING ASSOCIATION OF CANADA – INDUSTRY OVERVIEW

The mining industry has a long history of energy efficiency improvements. In 1996, MAC established the Mining Energy Conservation Task Force as the primary vehicle for monitoring energy performance and for encouraging continuous improvement in energy efficiency. In doing so, MAC continues to work with the Canadian Industry Program for Energy Conservation (CIPEC) in developing a clear picture of energy use for the various components of the mining industry. The current estimate is that the mining industry accounts for approximately 8% of Canada's industrial energy demand, with the metal mining sector consuming 3.3%.

Although energy use decreased by 10.1% between 1990 and 1995, metal production decreased only 6.0% for the same period. This was due, in part, to the industry's determination to reduce operating costs to help enhance their competitiveness in world markets. While members of MAC remain committed to supporting the VCR and its objectives, greenhouse gas emissions within the metals mining sector are principally a function of energy use. Since MAC members are already engaged in a movement to improve energy efficiency, and are already monitoring their energy efficiency, more effective results will be achieved in reducing greenhouse gas emissions by maintaining the current energy efficiency focus. To help reinforce this cost reduction focus, it is recommended that the data included in VCR action plans be reported in terms of energy efficiency improvements.

VCR REGISTRATION AND ACTION PLAN OVERVIEW

This will also allow the Canadian metals mining industry to leverage its ongoing improvements in the efficient use of energy, as a competitive advantage in world markets. Even today, the Canadian industry has shown clear leadership in exploiting this international advantage. Reinforcing this energy efficiency focus will only serve to strengthen this leadership position.

The Voluntary Challenge and Registry Program is being strengthened through the development of a more rigorous reporting process. Consistency of reported actions would be improved through structured plans, best practices and benchmarks. While new participants will be encouraged to enter the VCR process through Tier 1 commitments, industry leaders will be urged to become Tier 2 participants. MAC has developed this workbook to help guide mining industry participants through the Tier 2 reporting process. Companies that accept the Tier 2 challenge will be expected to provide comprehensive plans with the following elements:

- A statement of Senior Management commitment
- A quantified baseline for 1990
- A forecast for the year 2000
- A statement of the goals for improvement set by the company
- Details on the new and innovative actions they will take to meet goals
- A quantified analysis of the impact of their actions
- Information on their approach to employee and other stakeholders

All information reported to the Registry will be in the public domain. This openness is a key design feature of the Registry that will provide credibility to the information submitted, as well as value and validity to the recognition provided. The public will have access to the letters of intent and action plans as filed. In addition, summary reports will be prepared from Registry data. These reports will list examples of voluntary commitments, actions, results achieved, numbers of participants, etc. Because submissions to the Registry will be public, it is the responsibility of participants to screen their reports for sensitive or confidential information.

Registration in, and action plans submission to, the VCR Program is strictly voluntary. There are some mandatory requirements for participation, there are other components that are recommended, but not essential. To help participants understand this distinction, a schedule of VCR Program component requirement has been included as follows

The Following information has been adapted from the VCR TIER II published guidelines for registration.

1. SENIOR MANAGEMENT SUPPORT

You Must:

A Tier II action plan must include a statement by senior management endorsing the action plan and committing to its implementation.

You are Encouraged to:

Organizations are encouraged to reiterate that support when there are changes to senior management.

2. BASELINE

You Must:

- a) A Tier II action plan must include a quantified baseline.
- b) The baseline must also include a description of the methodology used to calculate the baseline.

You Should:

- a) The baseline should be reported in terms of kWh per unit of product output.
- b) The baseline should be based on 1990, where appropriate, and organizations should provide an explanation for the use of another base year.

You are Encouraged to:

Where appropriate, organizations are encouraged to include baselines calculated on an energy or emissions per unit of production basis.

3. TARGET AND PROJECTED EMISSIONS

You Must:

- a) A Tier II plan must include a target.
- b) The target and projections must, at a minimum, be for the year 2000.

You Should:

The target should be set in the context of a projection based on the methodology established for the baseline.

You are Encouraged to:

Organizations are encouraged to estimate targets for the post-2000 period. Organizations are encouraged to report the economic trends that underlie their projections.

4. MEASURES TO ACHIEVE TARGETS

You Must:

A Tier II action plan must include the actions planned to achieve the target, including a description of the measures, their anticipated impact and a timeframe for their implementation.

5. RESULTS ACHIEVED

You Must:

A Tier II action plan must include a description and quantified impact of the key actions/measures taken to date from the base year. The results achieved must be calculated according to the baseline methodology and should be updated annually.

6. EDUCATION

You Must:

A Tier II action plan must include a description of the organization’s employee awareness or education program to inform its employees of its VCR action plan and climate change in general.

You are Encouraged to:

Organizations are encouraged to extend such programs to their customers, peers and suppliers.

7. MANAGEMENT PRACTICES

You are Encouraged to:

Organizations are encouraged to report on proactive practices that have been implemented, such as changes to procurement policy, employee incentives, participation in R&D, etc.

Where deemed appropriate, members can submit their reports using greenhouse gas emissions.

EXECUTIVE SUMMARY

The Executive Summary should review the highlights of the action plan on one or two pages. It is recommended that you focus on the mandatory requirements for the Tier Two VCR Program.

The following is a good checklist for action plan completeness:

- Does the index of the report give the reader a quick overview of the content?
- Are the appropriate sections included?
- Are titles written in a consistent style?
- Is there an executive summary?
- Are the most important comments presented first?
- Is the organization's commitment clear?
- Are related comments combined?
- Have all calculations followed a consistent quantifiable technique?
- Have graphics been used to emphasis progress?
- Is there sufficient supporting detail presented in exhibits or appendices?

**SENIOR
MANAGEMENT
COMMITMENT**

The action plan should include a statement by senior management to the effect that the action plan has their full support, and that specific goals will be established and actions taken that limit CO₂ emission through the more efficient use of energy. The statement of support may also include demonstrated action by senior management such as periodic meetings on progress or inclusion of updates on the organization's efforts at board meetings. The following information should be considered in preparing this section:

Company Profile

This overview should focus on providing a clear description of the organizations activities within Canada. Use the company's annual reports to layout the organizations profile with regards to:

- Core business activities including types of products and annual production, etc;
- Structure and location of head office, divisions and individual operations; and,
- Ownership, subsidiaries, and partnerships in other operations.

Describe any major changes to operations, such as restructuring, acquisitions, divestitures, facility modernization and closures since 1990.

Commitment to Energy Efficiency Action Planning

- Specify how your organization's energy efficiency commitment is aligned with the industry's overall commitment to a 1% reduction in energy consumption per year from 1990 to 2000, as stated by CIPEC.
- Describe how the company will meet its commitment through execution of the action plan.
- Summarize the specific commitments the company has made to accomplish the goal throughout the balance of the plan.
- Provide a list of definitions with specific emphasis on the denominators that will be used to measure energy efficiency.

Commitment Letter From CEO, Chairman or Other Senior Officer

Management commitment and leadership could include:

- Setting goals in reducing energy costs, thereby helping the bottom line;
- Allocating resources to acquire the skills, equipment, controls, processes, and monitoring systems needed to achieve energy efficiency targets;

- Appointing an Energy Champion – a key manager who has the authority to implement programs within the organization to achieve the goals set by the CEO and approved by the Board of Directors; and,
- Positive statements about your energy efficiency achievements to date.

**ENERGY EFFICIENCY
BASELINE**

The calculation of a baseline for energy use is a fundamental first step in understanding your energy efficiency profile. The baseline calculations should include all forms of energy, and should be reconciled with your annual combined energy billings for all energy types.

Energy Efficiency Measurement Methodology

Energy efficiency is a measure of the quantity of energy on a unit of production basis (e.g. Dividing the total kWhs of consumption by total tonnes of product-output for any given period, will produce the energy use for that product, for that period). It is a far better way to measure of an organization's energy efficiency than could be achieved by looking at changes in annual energy consumption. For example, while the purchase or disposal of business units will affect consumption, it will not affect energy efficiency. Nor will energy efficiency be affected by changes in either product pricing or energy costs.

This methodology is consistent with the mining industry's move to become more competitive in world markets, because organizations will be motivated to get lower levels of energy consumption per product-output. It also allows the industry to demonstrate a clear commitment to the reduction of greenhouse gas emissions, even in times of high product growth.

To ensure consistency in the action plans and reports submitted by any one organization, and also between organizations across the mining industry, a series of suggested standard factors has been developed as follows.

**PRIMARY MINING
ACTIVITY CATEGORIES**

To help ensure consistency in the VCR Action Plans and progress reports the following mining activity definitions are recommended:

Mining

Should include all activities such as the breaking, removal and transport of material to the concentrator.

Concentrating

Should include all activities used to prepare ore, including crushing, grinding, flotation, separation, screening and cleaning processes.

Smelting

Should refer to the high temperature processes which alter the concentrate by oxidation or reduction of various elements, in order to prepare a product suitable for immediate use, sale or further refining.

Refining

Should include the final finishing processes that provide a high-grade product to the manufacturer or user from the feedstock, normally consisting of a concentration or smelted product.

Note: All waste produced in each category of activity should be included in that category of activity (mine rocks, tailings, slag and by-products such as acid). The energy used in processing or handling waste or by-products is included in each activity category.

**MINING PRODUCT
CATEGORIES**

The following product categories are recommended for measuring energy efficiency:

Product Examples	
Gold	Troy Ounces
Silver	
Copper	Tonnes, or Pounds
Lead	
Zinc	
Iron Ore	
Nickel	
Industrial Minerals	
Other	

**ENERGY EFFICIENCY
BASELINE STATEMENT**

To complete your energy efficiency statement you will need to convert all forms of energy use to total kilowatt-hours (kWh) for each product category, for each primary mining activity. You can report for each division/operation or you can submit one report for the entire corporation.

The following would be a typical baseline report chart:

Facility Name: Specify
 Location: Specify Reporting Period: 1990
 Product Category: Copper

Activity	Weight of Metal in Product	Energy Use
Mining	Tonnes hoisted	90 kWh/tonne
	or Delivered to the dump slip	60 kWh/tonne
Concentrating	Pounds of contained metal	0.5 kWh/pound
Smelting	Pounds smelted	1.5 kWh/pound
Refining	Pounds refined	1.5 kWh/pound

**CONSISTENT
AGGREGATE INDUSTRY
REPORTING**

MAC intends to gather the data reported from the VCR report submitted by its members and produce an aggregate industry report on changes in energy efficiency. This data will be incorporated in MAC’s annual reporting on the environment, and also in the CIPEC annual report.

It is recommended that you select those factors that best fit your organization’s reporting procedures, and then use these factors consistently in all subsequent reporting for the VCR. By choosing from the categories included in the Workbook, it will help maintain consistency between the various reports submitted by an individual company, and between reports submitted on an industry-wide basis.

**ESTABLISHING A
BASELINE**

Where possible, the baseline should be calculated using your 1990 energy use and production figures. Where this is not feasible, (for example, where the company or organization did not exist in 1990), the earliest possible year for which data is available should be used. The baseline information should be consistent and prepared in the most appropriate categories for ongoing reporting. It is recommended that you pick a reporting format (details and presentation) that can be used in reporting progress in the future.

In developing your baseline report, you will need to consider future reporting requirements, and the need for accurate comparisons between reporting periods. Remember that your objective is to show improvements in the energy efficiency of your operation. These improvements will be indicative of corresponding reductions in CO₂ emissions.

Joint Ownership

In cases where facilities are jointly owned, it is suggested that either the principal owner report all the energy use, or that proportionate ownership be used to divide the energy use reporting. You should state clearly in your action plan what approach has been taken in reporting, and identify your partner company, so that overlap of reporting is avoided.

Offsets

In some cases, your organization may be involved in certain activities that reduce or sequester emissions, and in doing so provide you an offset. Carbon sequestration refers to enhancements of sinks and reservoirs for greenhouse gases, primarily in forest and agriculture. These offsets should be reported in detail in your action plans. More information on this subject is contained in the VCR Participants Handbook (August 1995) available from the VCR office in Ottawa.

ENERGY EFFICIENCY TARGETS

The action plan should include a stated objective or target for future energy efficiency improvements for at least the year 2000. Participants are encouraged to set targets for the post-2000 period as well.

Industry Targets

The Mining Association is committed to achieving an overall reduction in energy consumption, across the Canadian industry of 1% per year trendline to the Year 2000. This target has been developed in cooperation with CIPEC, and aligns the industry with the National Action Program on Climate Change.

Corporate Targets

You should consider setting your own ambitious targets. Your leadership will be repaid in bottom line cost savings many times over in the future. Remember that there is “No finish line” when setting targets for continual improvement. Set what you can achieve as you learn and develop more expertise on energy management. However, be careful that the targets included in your VCR action plan are realistic within the timeframes stated.

Data Presentation Format

It is recommended that you include charts and/or tables for the following data components:

- 1990 Baseline
- Energy Efficiency Improvements to 1996
- Energy Efficiency Projections to 2000 and beyond

Using the same format as your baseline report, you can show all of these components on one table as follows:

Activity	Weight of Metal in Product	1990 Baseline	1996 Actual	2000 Target
Mining	Tonnes hoisted	90 kWh/tonne	85 kWh/tonne	81 kWh/tonne
	or Delivered to the dump slip	60 kWh/tonne	56 kWh/tonne	54 kWh/tonne
Concentrating	Pounds of contained metal	0.5 kWh/pound	0.47 kWh/pound	0.45 kWh/pound
Smelting	Pounds smelted	1.5 kWh/pound	1.41 kWh/pound	1.35 kWh/pound
Refining	Pounds refined	1.5 kWh/pound	1.41 kWh/pound	1.35 kWh/pound

**MEASURES TO
ACHIEVE TARGETS**

This section will include those measures that comprise your organizational plans to implement from your reporting date until at least 2000. Describe your planned action(s) and indicate the targeted date of completion. Using the same methodology used for calculating your energy efficiency baseline, estimate the impact of the planned actions.

Monitoring Plan

Supporting the VCR energy efficiency management monitoring system will involve at least the following actions:

- Measure
- Record
- Report

Comments on the VCR reporting data should be included in all annual reports. Many companies will also include this information in their environmental reports.

RESULTS ACHIEVED

In this section you will concentrate on providing a description of the actions that your organization has completed from 1990 to the date of the report preparation (we recommend reporting up to your fiscal year end for 1996). One method is to list the changes by year on a graph, with text data listing projects completed, along with accompanying incremental changes from the 1990 baseline information. Use the baseline methodology to calculate the energy efficiency changes.

Another choice would be to show only the 1990 and 1996 figures in a chart and list the changes made over that time period, with an allocation of the total change from actions completed during that period. However, in future reporting, you must reference the action to a specific year of completion with the corresponding change in energy efficiency.

MAINTAINING TIER II STATUS

Annual VCR updates should be filed with the VCR office in Ottawa. Annual reporting is mandatory for Tier Two participants. The annual update should have the following format:

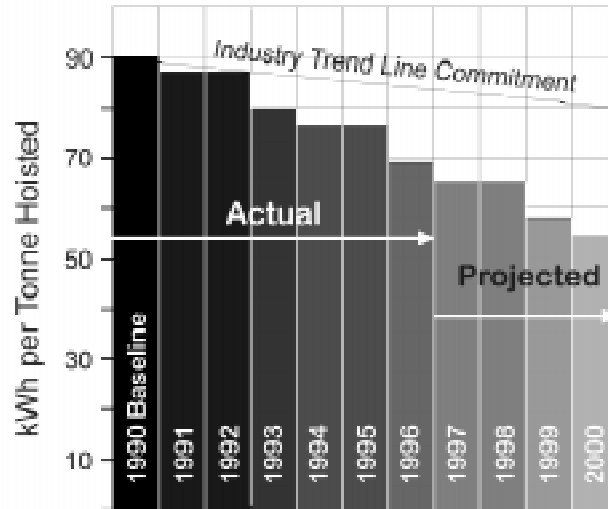
- Provide a chart with the 1990 baseline data, the latest reporting year data;
- Show energy efficiency changes and action plan modifications for each subsequent year;
- Update any changes in measures to achieve year 2000 targets; and,
- Provide success stories.

Using the same format as your baseline report, you can report the results achieved to date on a table as follows:

Activity	Weight of Metal in Product	1990 Baseline	Current Period	2000 Target
Mining	Tonnes hoisted	90 kWh/tonne	83 kWh/tonne	81 kWh/tonne
	or Delivered to the dump slip	60 kWh/tonne	55 kWh	54 kWh/tonne
Concentrating	Pounds of contained metal	0.5 kWh/pound	0.46 kWh/pound	0.45 kWh/pound
Smelting	Pounds smelted	1.5 kWh/pound	1.38 kWh/pound	1.35 kWh/pound
Refining	Pounds refined	1.5 kWh/pound	1.38 kWh/pound	1.35 kWh/pound

This table can also be illustrated with a chart as follows:

Total Energy Use in Copper Mining Operations



Management Practices

MANAGEMENT PRACTICES

There are many proactive management practices that support an organization’s effort to improve energy efficiency that could be included in the action plan. For example, a company may revise its procurement procedures to purchase more energy efficient products from more energy efficient suppliers. Or, a company may modify its research and development activities to focus more on energy efficiency developments. It is recommended that you show some evidence of proactive changes in management practices that will help shift the organization’s culture to a more efficient use of natural resources.

**EDUCATION AND
AWARENESS**

To maintain the momentum and sustain interest in your organization's energy management program, you need to ensure open, continuous and effective internal communications flow regarding your energy efficiency objectives and VCR Program targets. Select the most appropriate media (technology, style, form) to communicate the company's message, and the most effective use of resources (financial, human, and organizational) to achieve and maintain good communications.

Your VCR action plan will be posted on the VCR's Internet site, where it may be reviewed critically by outside organizations. Ensure that the planning document is complete, and represents the company and the industry in an objective, defensible manner.

**EXTERNAL
COMMUNICATIONS
STRATEGY**

Effective communications require a thoughtfully developed message and a strategy to ensure this message brings positive results to the company:

- Develop the contents of your story into a realistic and accurate message;
- Use the information gained in development of the VCR action plan to develop the company's message about its environmental and energy use programs;
- Do not raise expectations in the minds of employees or relevant third parties above the level that your organization can realistically deliver; and,
- Truthfulness and objectivity are imperative.

When preparing internal programs, the new Handbook on Employee Education and Awareness will be a very helpful reference. (See Appendix.)

**INTERNAL EDUCATION
AND AWARENESS
STRATEGY**

Build momentum and awareness. Communication and marketing tools are an excellent vehicle for promoting your commitment to energy efficiency. Payoffs come in terms of increased understanding and acceptance of your energy management plan. Design your employee education program to sell the direct and indirect benefits of energy management:

- Increasing profits and cost-effectiveness;
- Lowering operating and production costs;
- Protecting the environment;
- Enhancing the quality of product or service to the customer;
- Energy savings can be reinvested in further energy efficiency; and,
- Stimulating local economies through investment in energy efficiency.

ENERGY EFFICIENCY PLANNING GUIDE

The Energy Efficiency Planning Guide has been developed as a partner document for this VCR Workbook. It is a practical manual that provides assistance to organizations in the development and execution of a detailed energy efficiency plan. It can help organizations identify and exploit a full range of cost-effective opportunities for reducing or eliminating energy waste through improvements in energy efficiency. Information in the Guide has been organized in sections that mirror this Workbook.

This Guide is directed primarily towards assisting the leader of your energy efficiency planning team, although the topics covered should be of interest to anyone involved in energy efficiency planning. The information is useful in building upon and improving the current organizational approach to energy efficiency and reviews the following:

- The importance of obtaining executive-level support for energy management, how to get it, and how to keep it;
- Who should be involved in planning for energy management ventures;
- How to get everyone in the organization to commit to the energy efficiency plan;
- How to set goals and integrate energy management planning within the organization's formal and informal management structures;
- How to formulate the energy efficiency strategy and report on the organization's energy efficiency activities;
- How to determine the contractual and financial arrangements that are most applicable to the organization;
- How to market energy management planning to all stakeholders to ensure their participation and support;
- How to collect the information and technical data needed to develop, implement and monitor the plan; and,
- Techniques for sustaining the organization's commitment to the long-term energy efficiency plan.

PACKAGING THE VCR ACTION PLAN

Document format should be a paper copy and an electronic copy on a 3.5" diskette in MS Word or WordPerfect file format (any Windows version). Use a font size of 10 or greater, with all tables in portrait format with graphics in PowerPoint, metafile, or bitmap.

It is the company's responsibility to check the reporting document for proprietary information, as all documents (letter of intent, action plan and progress reports) will be posted on the Internet. If the company logos are included, ensure that a statement is included prohibiting unauthorized use of your logo, or other registered trademarks.

KEY CONTACTS AND REFERENCES

Voluntary Challenges Program

Nick McCartney
Canada's Climate Change Voluntary Challenge & Registry Office
Natural Resources Canada
580 Booth Street, 19th Fl.
Ottawa, Ontario K1A 0E4
Tel: (613) 996-6698
Fax: (613) 947-6799
Email: nmccartney@nrcan.gc.ca

VCR Internet Inquiries

Format inquiries relating to Internet posting should be directed to:

Sarah Mullin
Tel: (613) 947-9520
Email: smullin@nrcan.gc.ca

Industrial Energy Programs

Philip B. Jago
Chief, Industrial Energy Efficiency Initiative
Natural Resources Canada
580 Booth Street, Room 18B5
Ottawa, Ontario K1A 0E4
Tel: (613) 995-6839
Fax: (613) 947-4121
Email: pjago@nrcan.gc.ca

 **MAC Corporate Energy Efficiency Success Stories Form**

Enter your energy efficiency success story for one year only on each form.

The focus of the story is related to which time period:

- Prior Successes
- 1996 Case Studies
- 2000 Benchmarks
- Current Year

Please identify the area that contributes the major savings to the plan:

- Mining
- Concentrating
- Refining
- Smelting

Describe the action plan that resulted in significant improvement in lowering the Annual operating costs.

What capital costs, if any, were required to complete the action plan?

What was the payback period?

Will this action plan be used in other company locations or operating units?

Other project benefits (lower operating costs, improve human resource benefits, environmental benefits)

Other project information (costs, etc.)

Company: _____ Date: _____

Contact Person: _____

Would you or someone from your company attend an annual "Industry Energy Efficiency Success Story Showcase Seminar"?

Fax completed story to: Mr. Dan Paszkowski, The Mining Association of Canada, (613) 233-8897

SAMPLE PLAN

The following are samples elements of a typical VCR Plan submission. They are provided for general guidance only, and it is not recommended that they be copied word-for-word into your plan.

1. EXECUTIVE SUMMARY

This action plan is our first submission to CIPEC and the VCR office. Minco is committed to implement this plan to the year 2000 and achieve a 10% improvement in energy efficiency. The improvement in energy efficiency results from innovative measures cross all Minco operations including: improved efficiency of vehicle fleets and all transportation functions; installation of high efficiency electric motors, high performance fans, the new waste heat recovery systems at underground mines.

Minco operates ten operating divisions across Canada that extract copper, produce concentrate and operate a smelter. Our 3,000 employees are committed to energy efficiency in daily operations. Our training and communications programs promote energy efficiency awareness throughout our entire organization. Our Chairman and CEO leads the company with aggressive capital investment plans, the latest industry benchmarked energy efficiency process improvement methods, and in the communications and training for continuous improvements in energy efficiency. Our annual business plan includes our energy efficiency targets for each division, while our employee gain sharing program shares the bottom line savings with employees.

2. SENIOR MANAGEMENT COMMITMENT

Minco Canada Inc. is a wholly Canadian owned operation. In 1990, eight mines were operating. The Alpha mine was acquired in 1994 and the Beta mine opened in 1995. The 1990 energy use baseline data has been adjusted to reflect the operation of all ten mines.

All Division operating officers are committed to our year 2000 targets on energy efficiency, and measures are incorporated into their respective business plans. It is also one of the performance measures in their remuneration package. Our Chairman and CEO has lead the energy efficiency targeting within Minco. Our capital investment plans include over \$25 million for energy efficiency upgrading by the year 2000. Our purchasing operations regularly purchase energy efficient equipment when existing equipment is being replaced. Our suppliers are an active part of our energy efficiency planning, and have accepted our stringent energy efficiency targets within the design replacements for all Divisions.

3. OUR 1990 ENERGY EFFICIENCY BASELINE DATA IS AS FOLLOWS:

Activity	Weight of Metal in Product	Energy Use
Mining	Tonnes hoisted	90 kWh/tonne
Concentrating	Pounds of contained metal	0.5 kWh/pound
Smelting	Pounds smelted	1.5 kWh/pound

4. OUR 1996 ENERGY STATUS AND OUR TARGET FOR THE YEAR 2000 IS AS FOLLOWS:

Activity	Weight of Metal in Product	ENERGY USE		
		1990 Baseline	Current Period	2000 Target
Mining	Tonnes hoisted	90 kWh/tonne	69 kWh/tonne	70 kWh/tonne
Concentrating	Pounds of contained metal	0.5 kWh/pound	0.46 kWh/pound	0.45 kWh/pound
Smelting	Pounds smelted	1.5 kWh/pound	1.38 kWh/pound	1.35 kWh/pound

5. ACTION PLAN TO ACHIEVE TARGETS

a) Capital Investment

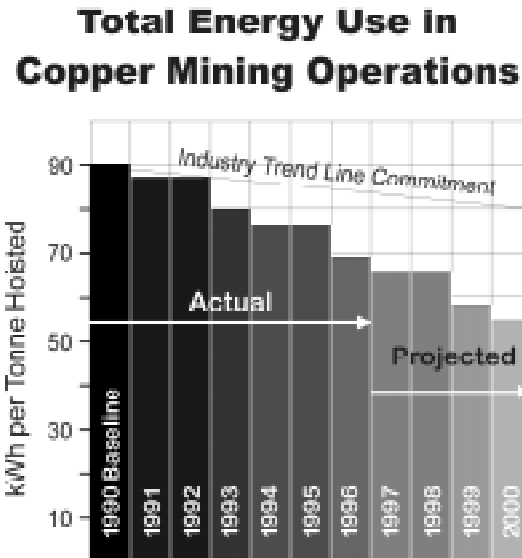
The major expenditure is a new state-of-the-art smelter for the Alpha Division costing \$25 million, with a planned for completion in 1999. The targeted energy usage for this operation in the year 2000 is 1.35 kWh per pound of smelted product, a 10% improvement from our 1990 baseline.

b) Housekeeping and Maintenance replacement programs

All divisions will achieve an incremental 1% improvement in energy efficiency in each operating year through to 2000. Motors, lamp retrofit, fans, switching to natural gas, and new waste heat recovery techniques will drive our energy efficiency program to the targeted levels.

c) Results Achieved

Since 1990 the corporation has made significant progress towards our 2000 goal. The data shown here illustrates that in 1996 we have reached our 2000 goal at six of our Divisions and with the capital investment targets for the Alpha mine planned for 1999, we will meet or exceed our year 2000 plans in all activities.



6. MANAGEMENT PRACTICES

At Minco, we are managing our business with initiatives that will make a difference to our overall energy efficiency.

Our management programs provide internal incentives to encourage all employees to work toward improved energy efficiency. The business plan of each division establishes numerical targets for energy efficiency, which are articulated to all employees. Dedicated energy efficiency specialists assist operating staff in the technical development of projects, the planning of production configurations, and daily energy and emissions optimization.

7. EDUCATION AND AWARENESS ACTIVITIES

To coordinate energy management programs and to improve energy utilization, we have a corporate Energy Management Steering Committee. Through our workshop program, our energy efficiency targets are communicated to all those employees.

Minco is attempting to become a “learning organization,” and devotes an average of six percent of total payroll costs to employee education, training and on-the job development activities. Training packages covering energy efficiency and environmental matters are delivered regularly to all new employees.

Minco Divisions collaborate with the local community and share knowledge of energy efficiency lighting systems, building heating and controls with the community at large. In 1996 we released our first Environmental, Health and Safety Report, and we plan to do this every other year.

CALCULATION OF EQUIVALENT KWH FOR VARIOUS FUELS

	Consumption	x energy content	x conversion factor	= equivalent kWh
		MJ	1/3.6	= kWh
		Btu	1/3413	= kWh
EXAMPLES:				
Fuel	Consumption	x energy content	x conversion factor	= equivalent kWh
anthracite coal	C (metric) tonnes	x 30,000 MJ/tonne	x 1/3.6	= C x 8333.3 kWh
anthracite coal	C tons	x 25,800,000 Btu/ton	x 1/3413	= C x 7559.3 kWh
no. 2 oil	C litres	x 38.68 MJ/litre	x 1/3.6	= C x 10.74 kWh
no. 2 oil	C Barrels	x 5,880,000 Btu/bbl	x 1/3423	= C x 1722.8 kWh
natural gas	C cubic metres	x 37.2 MJ/cubic metre	x 1/3.6	= C x 10.33 kWh
natural gas	C cubic feet	x 1.0 Btu/cubic foot	x 1/3413	= C x .000293 kWh
OTHER ENERGY CONTENT FACTORS				
Fuel	metric		imperial	
coke - metallurgical	30,200 MJ/tonne		26.0 x 10 ⁶ Btu/ton	
crude oil	38.5 MJ/litre		5.8 x 10 ⁶ Btu/bbl	
no. 4 oil	40.1 MJ/litre		6.04 x 10 ⁶ Btu/bbl	
no. 6 oil - 1.0% S	40.5 MJ/litre		6.11 x 10 ⁶ Btu/bbl	
kerosene	37.68 MJ/litre		0.167 x 10 ⁶ Btu/Imperial Gal.	
diesel fuel	38.68 MJ/litre		0.172 x 10 ⁶ Btu/Imperial Gal.	
gasoline	36.2 MJ/litre		0.156 x 10 ⁶ Btu/Imperial Gal.	
propane	50.3 MJ/kg		0.02165 x 10 ⁶ Btu/lb.	

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