



TECHNOLOGY TRANSFER IN CANDU MARKETING

NOTES FOR A PRESENTATION

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INTRODUCTION

MR. CHAIRMAN, DISTINGUISHED GUESTS, LADIES AND GENTLEMEN: IT IS A PLEASURE TO BE HERE TODAY, SHARING THIS PLATFORM WITH OTHER SPEAKERS ON THE TOPIC OF EXPORTS OF ELECTRICITY AND TECHNOLOGY.

MY CONTRIBUTION TO THIS MORNING'S DISCUSSION WILL DEAL WITH THE TRANSFER OF CANDU NUCLEAR TECHNOLOGY.

"TECHNOLOGY TRANSFER" IS BECOMING A COMMON BUZZ-WORD AMONG INTERNATIONAL MARKETING PEOPLE - AND IS THEREFORE OFTEN USED VAGUELY OR ERRONEOUSLY. SOME THINK OF IT AS A KIND OF "FOREIGN AID" WE GIVE TO THE DESERVING, LIKE SENDING STEEL HATCHETS TO A STONE AGE TRIBE. SOME THINK IT GOES FURTHER, LIKE BUILDING A FOUNDRY SO THEY CAN MAKE THEIR OWN HATCHETS. OTHERS WOULD SUGGEST WE BUILD THEM A HOSPITAL TO TREAT THOSE WHO HAVE USED THEIR HATCHETS TOO ENTHUSIASTICALLY! BUT ALL OF THESE CONCEPTS ASSUME TECHNOLOGY TRANSFER IS A ONE-WAY PROCESS, INITIATED BY THE GIVER OF THE TECHNOLOGY.

IN FACT, TECHNOLOGY TRANSFER IS A JOINT ENDEAVOR BETWEEN RECEIVER AND SUPPLIER. IT INVOLVES ADAPTING THE SUPPLIER'S TECHNOLOGY TO NEW PHYSICAL CONDITIONS AND A DIFFERENT SOCIO-ECONOMIC ENVIRONMENT. EXPERIENCE HAS SHOWN THAT TECHNOLOGY TRANSFER IS SUCCESSFUL WHEN INITIATED AT THE REQUEST OF THE CLIENT. THE REQUEST IS A DIRECT INDICATION OF THE RECEIVER'S DESIRES AND CAPABILITIES.

IN THE FOLLOWING REMARKS, I SHALL DISCUSS:

1. HOW THE CANDU PROGRAM LENDS ITSELF TO TECHNOLOGY TRANSFER
2. THE SCOPE OF CANDU TECHNOLOGY TRANSFER
3. THE BENEFITS AND PROBLEMS ASSOCIATED WITH TECHNOLOGY TRANSFER

CANDU PROGRAM AND TECHNOLOGY TRANSFER

AS I SUGGESTED EARLIER, THE PROCESS OF TECHNOLOGY TRANSFER IS SUCCESSFUL WHEN INITIATED BY THE CLIENT; THE REQUEST REFLECTS A DESIRE AND CAPACITY TO RECEIVE. CANADA HAS LEARNED MUCH IN THE EXPERIENCE OF SUPPLYING CANDU POWER SYSTEMS TO INDIA, PAKISTAN, ROMANIA, ARGENTINA, AND KOREA IN THE COURSE OF THE PAST 20 YEARS, AS WELL AS THE EXPERIENCE OF NEGOTIATING WITH MANY OTHER COUNTRIES DURING THE SAME PERIOD.

SPECIFICALLY, WE HAVE LEARNED THAT TECHNOLOGICAL COLONIALISM IS DEAD. TODAY, MANY CLIENT-NATIONS ARE NOT APT TO PURCHASE GOODS AND SERVICES OUTRIGHT, OR ACCEPT THE BUILDING OF SUPPLIER "BRANCH PLANTS" WITHIN THEIR BOUNDARIES. MANY DEVELOPING INDUSTRIAL NATIONS RECOGNIZE THE SHORTCOMINGS OF THESE MEANS OF ACQUIRING TECHNOLOGY AND, WHEREVER POSSIBLE, SEEK AN ARRANGEMENT THAT IS OF MORE ECONOMIC AND SOCIAL BENEFIT TO THEIR NATION.

ONE ARRANGEMENT IS THE LICENSED TRANSFER OF TECHNOLOGY. ANOTHER IS THE ESTABLISHMENT OF JOINT ENTERPRISES BETWEEN SUPPLIER AND CLIENT-NATION.

THESE OPTIONS OFFER SPECIFIC BENEFITS TO BOTH RECEIVERS AND SUPPLIERS. MOREOVER, BOTH OPTIONS GIVE AN IMPORTANT ADVANTAGE TO THE CANDU SYSTEM IN THE INTERNATIONAL NUCLEAR MARKETPLACE.

CANDU'S INTERNATIONAL ADVANTAGE LIES WITH ITS INTEGRATION. SINCE ITS INCEPTION THE CANDU PROGRAM HAS RESTED ON THREE CORNERSTONES - ATOMIC ENERGY OF CANADA LIMITED, CANADIAN ELECTRICAL UTILITIES, AND THE CANADIAN MANUFACTURING INDUSTRY. ENGINEER. OPERATOR. SUPPLIER. WORKING UNDER THE DIRECTION OF THE ENGINEER, THE CANDU PROGRAM HAS, WITH SINGLENES OF PURPOSE, DEVELOPED AND REFINED THE CANDU NUCLEAR REACTOR SYSTEM.

AND, I MIGHT ADD, RATHER SUCCESSFULLY.

I SHALL NOT LABOUR THE TECHNICAL MERITS OF CANDU. SUFFICE TO SAY THAT ITS 1981 PERFORMANCE - SEVEN OF THE TOP TEN COMMERCIAL REACTORS IN THE WORLD WERE CANDU UNITS - HAS REINFORCED ITS TECHNICAL REPUTATION.

HOWEVER, I DO WISH TO EMPHASIZE THAT THE STRUCTURE OF THE NUCLEAR PROGRAM IN CANADA HAS, IN FACT, BEEN ONE OF THE KEYS TO CANDU'S SUCCESS.

UNLIKE THE TECHNOLOGIES POSSESSED BY SUCH MAJOR COMPETITORS AS FRANCE AND GERMANY, CANDU TECHNOLOGY WAS DEVELOPED IN THE COUNTRY NOW MARKETING IT INTERNATIONALLY. RESEARCH WORK ON HEAVY WATER REACTORS BEGAN IN CANADA IN 1942 - 40 YEARS AGO! THE GOVERNMENT OF CANADA HAS, OVER THE YEARS, INVESTED CONSIDERABLE AMOUNTS OF CAPITAL IN THE ESTABLISHMENT AND MAINTENANCE OF AECL'S RESEARCH AND DEVELOPMENT CENTRES AND IN THE BUILDING OF RESEARCH AND PROTOTYPE REACTORS. CANADIAN

ELECTRICAL UTILITIES, MOST NOTABLY ONTARIO HYDRO, HAVE WORKED HAND-IN-HAND WITH AECL IN REFINING AND PROVING THE CANDU SYSTEM. CANADIAN NUCLEAR MANUFACTURERS, NOW STRUCTURED AS THE ORGANIZATION OF CANDU INDUSTRIES, SUPPLY MORE THAN 80% OF THE COMPONENTS THAT ARE USED IN CANDU POWER PLANTS.

IT IS THIS INTEGRATION, THIS TEAMWORK AMONG SUPPLIERS, UTILITIES, AND DESIGN ENGINEERS WHICH NOW STANDS US IN GOOD STEAD AS WE ATTEMPT TO WIN INTERNATIONAL CONTRACTS. THE GOVERNMENTS OF CLIENT-NATIONS EMBARKING ON A NUCLEAR POWER PROGRAM ARE, AS MENTIONED EARLIER, SEEKING A SYSTEM THAT WILL BE OF MAXIMUM SOCIO-ECONOMIC BENEFIT TO THEIR COUNTRY. THE CANDU APPROACH LOOKS GOOD: MANY MANUFACTURERS SUPPLYING MANY RELATIVELY SIMPLE COMPONENTS; A RELIABLE SYSTEM TESTED AND PROVEN BY ELECTRICAL UTILITIES; A NUCLEAR PROGRAM ADMINISTERED BY A GOVERNMENT AGENCY, AECL.

TEAMWORK - GOVERNMENT, UTILITY, MANUFACTURER. NOW, WHAT DO WE HAVE TO OFFER IN TERMS OF TECHNOLOGY TRANSFER?

SCOPE OF TECHNOLOGY TRANSFER

CANADA, THROUGH AECL, CANADIAN ELECTRICAL UTILITIES, AND THE ORGANIZATION OF CANDU INDUSTRIES, CAN OFFER VARIOUS TECHNOLOGY TRANSFER PACKAGES. THE CONTENT OF EACH PACKAGE CAN BE TAILORED TO THE CLIENT-NATION'S NEEDS AND CAPABILITIES. SUCH A PACKAGE COULD INCLUDE ALL THE HARDWARE AND SOFTWARE NECESSARY TO FACILITATE THE COMPLETE, AND I STRESS THE WORD COMPLETE, DEVELOPMENT OF A SELF-SUFFICIENT NUCLEAR INFRASTRUCTURE IN THE CLIENT-NATION.

THE MOST GENERAL MEANS OF TECHNOLOGY TRANSFER WOULD BE THROUGH TRANSFER OF DOCUMENTATION, ON-THE-JOB TRAINING PROGRAMS IN CANADA AND IN THE CLIENT-NATION, CONSULTING AND OTHER SUPPORT FROM SPECIFIC TECHNOLOGY SUPPLIERS, AND LONG TERM ATTACHMENT OF CLIENT-NATION PERSONNEL TO CANADIAN SUPPLIERS.

MORE SPECIFICALLY, AECL CAN TRANSFER TO CLIENT-NATIONS THE DESIGN RIGHTS TO CANDU ENGINEERING TECHNOLOGY. THIS CAN BE ACCOMPLISHED THROUGH ATTACHMENT OF THE CUSTOMER'S ENGINEERS TO AECL'S OFFICES IN CANADA, THE TRANSFER OF APPROPRIATE DOCUMENTATION, AND THE ATTACHMENT OF CANADIAN ENGINEERS TO THE CUSTOMER'S ENGINEERING OFFICES. THIS IS EXACTLY WHAT WAS DONE FOR INDIA IN THE 1960'S. ANOTHER POSSIBILITY OF FACILITATING THE TRANSFER OF DESIGN TECHNOLOGY IS THE ESTABLISHMENT OF A JOINT ENGINEERING COMPANY IN THE CLIENT-NATION.

TO HELP CLIENT-NATIONS DEVELOP A DOMESTIC URANIUM FUEL SUPPLY CYCLE CANADA CAN TRANSFER URANIUM EXPLORATION, MINING, AND REFINING TECHNOLOGY AND THE COMPLETE CANDU FUEL MANUFACTURING TECHNOLOGY. THIS PACKAGE WOULD INCLUDE INFORMATION AND ASSISTANCE ON AIRBORNE SURVEY METHODS, GEOCHEMICAL TECHNIQUES, URANIUM EXTRACTION TECHNIQUES, THE REFINING OF ORE CONCENTRATE AND THE MANUFACTURE OF FUEL MATERIALS, AND THE DESIGN, CONSTRUCTION, COMMISSIONING, AND OPERATION OF CANDU SYSTEM FUEL PLANTS. SUCH A TRANSFER WOULD PROVIDE THE CLIENT-NATION WITH AN AUTONOMOUS FUEL CYCLE, FROM URANIUM EXPLORATION THROUGH TO FABRICATED AND INSPECTED FUEL BUNDLES.

MANUFACTURERS OF CANDU COMPONENTS ARE PREPARED TO TRANSFER THE FOLLOWING ELEMENTS TO CLIENT-NATION MANUFACTURERS IN AN EFFORT TO ESTABLISH A SELF-SUFFICIENT NUCLEAR INFRASTRUCTURE IN THE COUNTRY OF THE CANDU PURCHASER:

- PROCESS SPECIFICATIONS
- ENGINEERING DRAWINGS
- PROCEDURES
- MANUFACTURING EQUIPMENT
- MANUFACTURING START-UP ASSISTANCE
- INSPECTION PROCEDURES
- QUALITY ASSURANCE PROGRAMS
- PRODUCTION STANDARDS
- IN-PLANT TRAINING IN CANADA
- ENGINEERING AND TECHNICAL ASSISTANCE.

WHILE AECL USUALLY OFFERS TO PROVIDE THE INITIAL HEAVY WATER INVENTORY FOR A CANDU REACTOR, WE CAN TRANSFER OUR BASIC HEAVY WATER PRODUCTION TECHNOLOGY TO INTERESTED CLIENT-NATIONS. THIS COULD INCLUDE COMPREHENSIVE DOCUMENTATION OF AECL'S GIRDLER-SULPHIDE PROCESS AND PLANT TECHNOLOGY, TRAINING OF CLIENT-NATION PERSONNEL AT AECL FACILITIES, AND CLIENT-NATION ACCESS TO OUR NON-GIRDLER-SULPHIDE TECHNOLOGIES.

AECL ALSO IS PREPARED TO TRANSFER RESEARCH AND DEVELOPMENT TECHNOLOGY. NATURALLY WE RECOMMEND AS FIRST PRIORITY, TRANSFER OF PROGRAMS IN SUBJECT AREAS MOST RELEVANT TO THE SUCCESSFUL INSTALLATION AND OPERATION OF CANDU REACTORS. THESE PROGRAMS INCLUDE: MATERIALS SCIENCE; SYSTEMS CHEMISTRY; THERMALHYDRAULICS; REACTOR PHYSICS; CONTROL AND INSTRUMENTATION; NUCLEAR FUEL; ADVANCED FUEL CYCLES; ENVIRONMENTAL STUDIES AND WASTE MANAGEMENT.

FINALLY, AECL'S ACHIEVEMENTS IN RADIOISOTOPE TECHNOLOGY REPRESENT AN ADVANTAGE NO OTHER REACTOR SUPPLIER POSSESSES. INDUSTRIAL APPLICATIONS CAN BE MOST ATTRACTIVE TO A COUNTRY WITH A DEVELOPING MANUFACTURING INDUSTRY. IN MANY OF OUR CLIENT-NATIONS, APPLICATIONS IN FOOD IRRADIATION AND NUCLEAR MEDICINE ARE OF PRIME IMPORTANCE.

IN ADDITION TO THESE AREAS OF TRANSFER, RELATED CANDU EXPERTISE IN THE AREAS OF PROJECT AND CONSTRUCTION MANAGEMENT, PLANT OPERATION AND MAINTENANCE, AND EDUCATIONAL AND TRAINING SUPPORT CAN BE MADE AVAILABLE.

AS YOU CAN SEE, TRANSFER OF CANDU TECHNOLOGY CAN BE ALL-ENCOMPASSING. INDEED, LET ME TAKE THAT POINT ONE STEP FURTHER: IF CANADA IS GOING TO WIN ANY MAJOR INTERNATIONAL NUCLEAR CONTRACTS, TRANSFER OF CANDU TECHNOLOGY MAY WELL HAVE TO BE ALL-ENCOMPASSING.

IN A WORD, IF WE DON'T TRANSFER, WE DON'T SELL.

BENEFITS OF TECHNOLOGY TRANSFER

ESSENTIALLY, I HAVE JUST ARTICULATED A MARKETING STRATEGY. IT IS A STRATEGY THAT RECOGNIZES THE NATURE OF A FIERCELY COMPETITIVE INDUSTRY; IT IS A STRATEGY THAT IS IN TUNE WITH THE REALITIES OF THE PRESENT INTERNATIONAL MARKETPLACE; FINALLY, IT IS A STRATEGY THAT OFFERS SUBSTANTIAL BENEFITS TO BOTH SUPPLIER AND RECEIVER.

FOR CLIENT-NATIONS, THE BENEFITS OF TRANSFER OF CANDU TECHNOLOGY ARE CONSIDERABLE. THE OBVIOUS BENEFITS OF CHEAP, PLENTIFUL ELECTRIC POWER ARE, OF COURSE, THE RAISON D'ETRE FOR EMBARKING ON A

NUCLEAR POWER PROGRAM. SELECTION OF THE CANDU SYSTEM, MOREOVER, WILL MAXIMIZE THE DIRECT INDUSTRIAL BENEFITS OF SETTING UP A NUCLEAR INFRASTRUCTURE IN THE SHORTEST POSSIBLE TIME. EACH OF THE POSSIBLE AREAS OF TECHNOLOGY TRANSFER OUTLINED EARLIER ENTAILS INDUSTRIAL EXPANSION AND CREATES THOUSANDS OF RELATED JOBS.

SIMILARLY, THE TRANSFER OF CANDU TECHNOLOGY CAN HAVE INDIRECT EFFECTS ON THE SOCIO-ECONOMIC STATUS OF THE ENTIRE CLIENT-NATION. A BETTER STANDARD OF LIVING; POSSIBLE ENERGY INDEPENDENCE; IMPROVED EDUCATION FACILITIES AND AN INCREASE IN ADVANCED EDUCATION ARE BUT SOME OF THE SPINOFF BENEFITS.

ULTIMATELY, OF COURSE, A FULL SCALE TRANSFER OF CANDU TECHNOLOGY WILL LEAD TO INDEPENDENCE IN THE PRODUCTION OF NUCLEAR ENERGY FOR THE CLIENT-NATION. FAR FROM HURTING CANADA, SUCH AN OCCURRENCE WOULD BE TO OUR GREAT BENEFIT.

MOST IMMEDIATELY, SALE OF THE CANDU TECHNOLOGY WILL DIRECTLY BENEFIT AECL AND OUR ENTIRE NUCLEAR INDUSTRY. I NEED NOT DESCRIBE FOR YOU THE IMMENSE BOOST THIS WILL GIVE US ALL IN CONTINUING WORK FOR THE BALANCE OF THE DECADE.

PROBLEMS OF TECHNOLOGY TRANSFER

THESE THEN ARE SOME OF THE BENEFITS. WHAT ARE SOME OF THE PROBLEMS?

THE MOST IMMEDIATE PROBLEMS OF TECHNOLOGY TRANSFER WILL BE THOSE IN THE MINDS OF PEOPLE ON BOTH THE SUPPLIER'S AND THE RECIPIENT'S SIDE. THERE MAY BE SOME OF YOU IN THE AUDIENCE TODAY, FOR INSTANCE,

WHO WONDER IF WE AREN'T DOING OURSELVES A DISSERVICE BY "GIVING AWAY" OUR HARD-WON TECHNOLOGY. AND THERE MAY BE OTHERS IN CLIENT-NATIONS WHO ARE SUSPICIOUS THAT WE ARE REALLY KEEPING BACK "THE GOOD PARTS" SO THAT THE CLIENT-NATION WILL REMAIN DEPENDENT ON CANADA FOR HIGH TECHNOLOGY COMPONENTS OF ITS NUCLEAR STATIONS. SUCH ATTITUDES CAN ONLY BE ALTERED BY THE ACTUAL EXPERIENCE OF DOING BUSINESS WITH EACH OTHER.

I SAID EARLIER THAT IF WE DON'T TRANSFER, WE DON'T SELL. IF WE DO TRANSFER WE MAY BE ABLE TO INCREASE CANDU'S SHARE OF THE WORLD'S NUCLEAR POWER SUPPLY. THIS COULD RESULT IN MORE MONEY FLOWING INTO CANADIAN SUPPLIERS' POCKETS. HOW MUCH MONEY? ONE EXAMPLE SHOULD SUFFICE. AECL'S BID IN MEXICO IS DIRECTED AT A PLANNED 20 000 MW NUCLEAR GENERATING CAPACITY BY THE YEAR 2000. IF WE ARE SUCCESSFUL IN OUR PROPOSAL THE RESULTANT BUSINESS WOULD BE WORTH SOME SEVERAL HUNDRED MILLION DOLLARS PER YEAR TO THE END OF THE CENTURY.

IN THE LONG TERM, TRANSFER OF CANDU TECHNOLOGY MAY LEAD CANADIAN FIRMS INTO JOINT MANUFACTURING, PRODUCT DEVELOPMENT, AND MARKETING VENTURES WITH CONSORTIA OF THEIR FORMER CUSTOMERS. FOR EXAMPLE, A MEXICAN/CANADIAN CONSORTIUM MIGHT HAVE SINGULAR SUCCESS IN SELLING AND BUILDING CANDU STATIONS IN CENTRAL AND SOUTH AMERICA. SIMILARLY A KOREAN/CANADIAN CONSORTIUM MIGHT BE EQUALLY SUCCESSFUL IN ASIA.

BEYOND THE DIRECT AND POTENTIAL BENEFITS TO CANADA'S NUCLEAR INDUSTRY AFFORDED BY TECHNOLOGY TRANSFER LIE THE INDIRECT BENEFITS OF INCREASED BILATERAL TRADE OPPORTUNITIES. LINKS FORGED

THROUGH THE DEVELOPMENT OF OVERSEAS NUCLEAR PROGRAMS CAN OPEN DOORS FOR OTHER CANADIAN MANUFACTURERS.

TECHNOLOGY TRANSFER MEANS SURVIVAL

GIVEN THE CONDITIONS OF TODAY'S INTERNATIONAL NUCLEAR MARKETPLACE, TRANSFER OF CANDU TECHNOLOGY IS ONE OF THE MEANS OF THE SURVIVAL OF THE CANADIAN NUCLEAR INDUSTRY AS WE NOW KNOW IT.

MANY COUNTRIES POISED TO EMBARK ON NUCLEAR PROGRAMS WANT TO DEVELOP AN INDIGENOUS NUCLEAR INFRASTRUCTURE AND ARE WELL-SUITED, IN TERMS OF MANUFACTURING CAPABILITIES, TO PRODUCE CANDU COMPONENTS.

OUR PRODUCT, CANDU, HAS BEEN DESIGNED AROUND THE PRESSURE TUBE CONCEPT, AND PRESSURE TUBES ARE MUCH SIMPLER TO MANUFACTURE IN A MEDIUM-SCALE INDUSTRIAL BASE THAN ARE PRESSURE VESSELS. THE CANDU REACTOR USES NATURAL URANIUM FUEL, WHICH IS WIDELY AVAILABLE IN NATURE AND REQUIRES NO SPECIALIZED ENRICHMENT OR REPROCESSING FACILITIES. THE USE OF ON-POWER REFUELLING IS ONE OF THE FACTORS THAT FACILITATES CAPACITY FACTORS SOME 20 PERCENTAGE POINTS BETTER THAN PRESSURIZED LIGHT WATER REACTORS. THE CAPITAL COSTS FOR HEAVY WATER ARE OFFSET BY VERY LOW FUELLING COSTS.

IN SHORT, THE ADVANTAGES OF THE CANDU SYSTEM ARE NUMEROUS AND ATTRACTIVE.

STILL, IT'S TIME WE ACKNOWLEDGED THAT DEVELOPING NATIONS POISED TO EMBARK ON A NUCLEAR POWER PROGRAM WANT AND NEED MORE THAN THE WORLD'S BEST NUCLEAR

SYSTEM. THE SELECTION OF A PARTICULAR NUCLEAR SYSTEM MAY, IN MANY CASES, BE MADE MORE ON THE BASIS OF SOCIO-ECONOMIC BENEFITS TO THE CLIENT-NATION THAN ON TECHNICAL MERIT OF THE SYSTEM.

FORTUNATELY, THE CANDU SYSTEM HAS MORE TO OFFER THAN SIMPLE TECHNICAL EXCELLENCE. DEVELOPING NATIONS CAN MANUFACTURE CANDU'S QUALITY ASSURED COMPONENTS MORE READILY BECAUSE OF THEIR RELATIVE SIMPLICITY AND OUR - AND HERE I MEAN THE ENTIRE CANADIAN NUCLEAR INDUSTRY - OUR WILLINGNESS TO SHARE OUR ENGINEERING, OPERATING, AND MANUFACTURING TECHNOLOGY AND EXPERTISE.

LADIES AND GENTLEMEN, I SUBMIT TO YOU THAT THE TRANSFER OF CANDU TECHNOLOGY AFFORDS OUR INDUSTRY UNPARALLELED OPPORTUNITY TO GAIN AN EXPANDING ROLE IN SATISFYING THE DEMAND OF DEVELOPING INDUSTRIAL NATIONS FOR PLENTIFUL, INEXPENSIVE ELECTRIC POWER.

THANK YOU.