

INDUSTRIAL TECHNOLOGY TRANSFER

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THE TRANSFER OF INDUSTRIAL TECHNOLOGY IS AN ESSENTIAL PART OF THE CANDU EXPORT MARKETING PROGRAM. POTENTIAL CUSTOMERS REQUIRE THE OPPORTUNITY TO BECOME SELF-SUFFICIENT IN THE SUPPLY OF NUCLEAR PLANT AND EQUIPMENT IN THE LONG TERM AND THEY REQUIRE LOCAL PARTICIPATION TO THE MAXIMUM EXTENT POSSIBLE, BEGINNING WITH THE FIRST STATION.

THE ORGANIZATION OF CANDU INDUSTRIES (OCI) HAS WORKED CLOSELY WITH ATOMIC ENERGY OF CANADA LIMITED (AECL) IN DEVELOPING COMPREHENSIVE PROGRAMS FOR THE TRANSFER OF MANUFACTURING TECHNOLOGY FROM CANADIAN COMPONENT SUPPLIERS TO THE CUSTOMER COUNTRY. OCI REPRESENTS ABOUT 50 CANADIAN COMPANIES DIRECTLY INVOLVED IN THE NUCLEAR INDUSTRY AND ITS MEMBERS ACCOUNT FOR THE SUPPLY OF ALL MAJOR NUCLEAR COMPONENTS AND OVER 90 PERCENT OF THE TOTAL NUCLEAR COMPONENT REQUIREMENT FOR A CANDU NUCLEAR STEAM SUPPLY SYSTEM.

THE OBJECTIVES OF THESE TECHNOLOGY TRANSFER PROGRAMS
ARE:-

1. TO MAKE AVAILABLE TO THE PURCHASING COUNTRY ALL NUCLEAR COMPONENT MANUFACTURING TECHNOLOGY WHICH EXISTS IN CANADA, THEREBY PERMITTING THAT COUNTRY TO ACHIEVE THE SAME LEVEL OF SELF-SUFFICIENCY AS EXISTS IN CANADA.
2. TO ASSURE THAT THE TRANSFER OF TECHNOLOGY TAKES PLACE IN AN EFFICIENT AND EFFECTIVE MANNER, THEREBY REDUCING THE COSTS AND TIME REQUIRED.
3. TO ASSURE THAT THE TECHNOLOGY OFFERED WILL REMAIN AVAILABLE FOR AN EXTENDED PERIOD OF TIME, THEREBY PLACING DECISIONS REGARDING THE TIMING OF LOCALIZATION IN THE HANDS OF THE RECIPIENT COUNTRY'S INDUSTRY AND GOVERNMENT.
4. TO PROVIDE SUFFICIENT FLEXIBILITY IN THE PROGRAMS SO THAT THEY MAY BE STRUCTURED TO MEET THE PRECISE NEEDS OF EACH CUSTOMER.

IN MOST CASES, IT IS EXPECTED THAT THE TRANSFER OF MANUFACTURING TECHNOLOGY WILL BE JUST ONE PART OF A VERY BROAD AND COMPREHENSIVE PROGRAM OFFERED TO THE CUSTOMER BY AECL. THIS BROAD PROGRAM MAY COVER ALL ASPECTS OF NUCLEAR POWER GENERATION AND THE NUCLEAR FUEL CYCLE, FROM RESEARCH AND DEVELOPMENT, ENGINEERING DESIGN, CONSTRUCTION AND PROJECT MANAGEMENT, STATION OPERATION AND CONTROL, AND INCLUDING THE EDUCATION AND TRAINING PROGRAMS NEEDED TO SUPPORT ALL PHASES OF THE INDUSTRY.

THE TRANSFER OF NUCLEAR COMPONENT MANUFACTURING TECHNOLOGY COULD OCCUR IN A VARIETY OF WAYS, HOWEVER, THE MOST TYPICAL PROGRAM WILL INVOLVE THREE PHASES:-

PHASE 1 - USE OF ESTABLISHED SOURCES

LOCAL SOURCING WILL BE USED FOR CONSTRUCTION OF THE INITIAL STATION WHERE CAPABILITIES EXIST, HOWEVER, THE MORE SPECIALIZED COMPONENTS WILL PROBABLY NEED TO BE PURCHASED FROM TRADITIONAL CANADIAN SOURCES, WITH THE PROVISION THAT THE CANADIAN SUPPLIERS OBTAIN MATERIALS AND SERVICES FROM THE PURCHASING COUNTRY WHEREVER PRACTICABLE.

PHASE 2 - TRANSITION AND TRAINING

ORGANIZATIONS IN THE PURCHASING COUNTRY WILL BE SELECTED TO RECEIVE THE TECHNOLOGY FROM THE CANADIAN MANUFACTURERS. THESE RECIPIENT ORGANIZATIONS WILL BE EXPECTED TO ACQUIRE THE TECHNOLOGY AND DEVELOP THE CAPABILITY TO ASSUME THE FULL RESPONSIBILITY FOR THE SUPPLY OF THE COMPONENTS ON FUTURE STATIONS. FOLLOWING AGREEMENT BETWEEN THE PARTIES, PERSONNEL FROM THE RECIPIENT WILL BE TRAINED IN CANADA DURING THE TIME OF MANUFACTURE OF COMPONENTS FOR THE FIRST STATION.

AT THE SAME TIME, ASSISTANCE WILL BE PROVIDED IN THE PLANNING, BUILDING AND EQUIPPING OF NEW PRODUCTION FACILITIES WHICH MAY BE NEEDED BY THE RECIPIENT.

PHASE 3 - FULL LOCALIZATION

IN THE FINAL STAGE, THE RECIPIENT ORGANIZATION WILL ASSUME FULL RESPONSIBILITY FOR THE SUPPLY OF THE COMPONENTS. HE WILL BE SUPPORTED BY TECHNICAL ASSISTANCE, TRAINING, AND MANAGEMENT ADVICE AS NEEDED. THE EXTENT AND TIMING OF LOCALIZATION WILL BE DETERMINED PRIMARILY BY THE RECIPIENT COUNTRY'S INDUSTRY AND GOVERNMENT.

IT IS DIFFICULT TO ESTABLISH SPECIFIC DETAILS REGARDING THE EXTENT OF ANY TECHNOLOGY TRANSFER AGREEMENT BECAUSE MUCH WILL DEPEND UPON THE CAPABILITIES AND REQUIREMENTS OF THE RECIPIENT ORGANIZATION. THE CLEAR INTENT, HOWEVER, IS THAT THE MANUFACTURING TECHNOLOGY AND KNOW-HOW BEING OFFERED BY CANADIAN COMPANIES WILL BE SUFFICIENT TO ENABLE THE RECIPIENT TO MANUFACTURE THE COMPONENTS IN HIS COUNTRY AND TO ASSUME FULL RESPONSIBILITY FOR THEIR FUTURE SUPPLY. DEPENDING ON THE NEEDS OF THE RECIPIENT, THE TECHNOLOGY WILL USUALLY INCLUDE THE FOLLOWING ELEMENTS:-

1. PRELIMINARY INFORMATION REGARDING FACILITIES, EQUIPMENT, PERSONNEL, SKILL LEVELS AND INVESTMENT REQUIRED, WHICH WILL ASSIST THE POTENTIAL RECIPIENT IN MAKING DECISIONS REGARDING THE EXTENT AND TIMING OF HIS INVOLVEMENT AND WHICH WILL FACILITATE THE ESTABLISHMENT OF AN AGREEMENT BETWEEN THE PARTIES.

2. MANUFACTURING TECHNICAL DATA AND KNOW-HOW USED TO PRODUCE THE COMPONENTS IN CANADA WILL BE PROVIDED WHICH NORMALLY WILL INCLUDE:-

- SHOP DRAWINGS
- ROUTE SHEETS
- SET-UP AND OPERATION INSTRUCTIONS
- SPECIFICATIONS OF PRODUCTION, TEST AND INSPECTION EQUIPMENT
- PURCHASING SPECIFICATIONS AND LISTS OF PROVEN SOURCES OF SUPPLY
- QUALITY ASSURANCE MANUALS
- INSPECTION AND TEST PLANS

3. TRAINING OF THE RECIPIENTS PERSONNEL IN CANADA UTILIZING ACTUAL PRODUCTION FLOOR PRACTISE ON IDENTICAL OR SIMILAR COMPONENTS, WHEREVER POSSIBLE. TRAINING MAY BE PROVIDED FOR MANAGERS, SUPERVISORS, ENGINEERS, TECHNICIANS, OPERATORS, INSPECTORS AND INDIRECT WORKERS, AS REQUIRED BY THE RECIPIENT.

4. TECHNICAL ASSISTANCE WILL BE PROVIDED FOR THE PLANNING AND ESTABLISHMENT OF THE RECIPIENT'S MANUFACTURING FACILITIES, AND TO ASSIST IN ALL PHASES OF THE PRODUCTION, TESTING AND INSPECTION OF THE COMPONENTS BY THE RECIPIENT.

5. PROVISION WILL BE MADE FOR THE EXCHANGE OF NEW DEVELOPMENTS IN MANUFACTURING TECHNOLOGY, THROUGHOUT THE LIFE OF THE AGREEMENT.

TECHNOLOGY TRANSFER AGREEMENTS MAY BE IN THE FORM OF JOINT VENTURES OR LICENSE AGREEMENTS DEPENDING UPON THE REQUIREMENTS OF THE RECIPIENT. IN EITHER CASE, THESE AGREEMENTS MAY BE MADE DIRECTLY BETWEEN INDIVIDUAL ORGANIZATIONS, OR AT THE CUSTOMER'S OPTION, BY MEANS OF JOINT VENTURE OR LICENSE AGREEMENTS WITH AECL. IN THE LATTER CASE, CANADIAN SUPPLIERS WILL BE FULLY COMMITTED TO AECL TO PROVIDE ALL OF THE NECESSARY TECHNICAL DATA, TRAINING AND TECHNICAL ASSISTANCE NEEDED TO FULFILL THE OBJECTIVES OF LOCALIZATION.

THE CANDU REACTOR HAS ESTABLISHED ITSELF AS THE MOST EFFICIENT AND PRODUCTIVE IN THE WORLD. THIS RECORD OF ACHIEVEMENT IS THE RESULT OF SEVERAL FACTORS, ONE OF WHICH IS THE HIGH LEVEL OF CAPABILITY WHICH HAS BEEN DEVELOPED WITHIN CANADIAN INDUSTRY. THIS CAPABILITY WAS ACHIEVED IN PART BY DIVIDING THE COMPONENT SUPPLY INTO MANY SMALLER PACKAGES IN ORDER TO FULLY UTILIZE THE EXPERTISE AND INITIATIVE OF MANY COMPANIES, SOME QUITE SMALL, FROM ALL REGIONS OF CANADA.

A COMPONENT SUPPLY INDUSTRY STRUCTURE BASED ON THE CANADIAN MODEL OFFERS SEVERAL SIGNIFICANT BENEFITS TO THE PURCHASING COUNTRY. THESE BENEFITS WILL ACCRUE TO THE MANUFACTURING SECTOR, THE ELECTRICAL UTILITY, AND TO THE GENERAL ECONOMY

BENEFITS TO THE MANUFACTURING SECTOR

1. THE CANADIAN SYSTEM PERMITS EXISTING COMPANIES TO PARTICIPATE AND BUILD UPON THE SKILLS AND FACILITIES WHICH THEY NOW HAVE.

2. CANDU REACTORS REQUIRE A LARGER NUMBER OF RELATIVELY SMALL COMPONENTS AND COMPONENT PACKAGES CAN BE TAILORED TO SUIT THE SUPPLIERS ABILITY, THUS PERMITTING GRADUAL INVOLVEMENT AT LOW RISK.

3. CAPITAL INVESTMENT IN SPECIAL FACILITIES AND EQUIPMENT IS MINIMIZED.

4. BY UPGRADING CAPABILITIES THROUGH THE CANDU PROGRAM, MANY COMPANIES CAN MOVE INTO OTHER HIGH TECHNOLOGY FIELDS, E.G. AEROSPACE, TELECOMMUNICATIONS, ETC. AS WELL AS DEVELOPING IMPROVED CAPABILITY IN CONVENTIONAL PRODUCTS, THEREBY INCREASING THEIR COMPETITIVENESS IN INTERNATIONAL MARKETS.

5. THE CANADIAN DEVELOPED QUALITY ASSURANCE SYSTEM MAKES IT EASIER AND LESS COSTLY FOR NEW COMPANIES TO ENTER THE NUCLEAR COMPONENT FIELD.

6. CANADIAN COMPANIES ARE FIRMLY COMMITTED TO THE PRINCIPLES OF TECHNOLOGY TRANSFER AND LOCALIZED MANUFACTURE.

BENEFITS TO THE ELECTRICAL UTILITY

1. THE ELECTRICAL UTILITY WILL BE ASSURED OF AN ORDERLY AND RISK FREE DEVELOPMENT OF LOCAL SUPPLY. WHERE VOLUME WARRANTS, THEY MAY FOSTER COMPETITIVE SOURCES.

2. IDEALLY, MANY COMPANIES WILL BECOME INVOLVED WITH NUCLEAR WORK BEING ONLY PART OF THEIR BUSINESS. SUCH COMPANIES WILL BE LESS SUSCEPTIBLE TO INJURY CAUSED BY CHANGES IN THE REACTOR BUILDING PROGRAM, THEREFORE, THE RISK OF LOSING AN IMPORTANT SOURCE OF SUPPLY IS MINIMIZED.

3. SMALL PACKAGES OF COMPONENTS ORDERED FROM SPECIALIZED COMPANIES REDUCES RISK OF MAJOR DELAYS WHICH MIGHT BE CAUSED IF SERIOUS DELIVERY OR QUALITY PROBLEMS SHOULD DEVELOP AT A LARGE SINGLE SOURCE.

GENERAL ECONOMIC BENEFITS

1. THE CANDU SYSTEM ENCOURAGES MORE COMPANIES TO BECOME INVOLVED, THEREBY SPREADING THE BENEFITS MORE WIDELY, INCLUDING GEOGRAPHIC DISTRIBUTION.

2. THE CANDU SYSTEM IS LESS CAPITAL INTENSIVE BUT MORE LABOUR INTENSIVE THAN OTHER SYSTEMS, THEREBY PROVIDING MORE JOB OPPORTUNITIES.

3. THE SKILLS THAT ARE DEVELOPED WILL BENEFIT THE ENTIRE COUNTRY TO INCREASE COMPETITIVENESS INTERNATIONALLY.

4. MANUFACTURING SELF-SUFFICIENCY WILL REQUIRE LESS TIME AND LOWER COSTS THAN WITH OTHER SYSTEMS.

ONE OF THE CHARACTERISTICS OF NUCLEAR COMPONENT MANUFACTURE IS THE REQUIREMENT FOR A HIGH LEVEL OF QUALITY ASSURANCE. IN EARLIER YEARS, QUALITY PROGRAMS DEVELOPED IN OTHER COUNTRIES AND FOR OTHER INDUSTRIES WERE ADAPTED FOR CANDU COMPONENT SUPPLY. HOWEVER, THESE PROGRAMS DID NOT HAVE THE FLEXIBILITY NEEDED SO ABOUT TEN YEARS AGO CANADA DEVELOPED A SIMPLE BUT COMPREHENSIVE SYSTEM OF QUALITY REQUIREMENTS WHICH HAS BEEN VERY EFFECTIVE IN ASSURING THE REQUIRED LEVEL OF QUALITY, AT A REASONABLE COST.

THIS SYTEM IS ADMINISTERED BY THE CANADIAN STANDARDS ASSOCIATION AS CSA STANDARD Z-299. FOUR LEVELS OF QUALITY ARE RECOGNIZED IN THESE STANDARDS, THEREBY PERMITTING THE SELECTION OF AN APPROPRIATE LEVEL FOR EACH COMPONENT UNDER CONSIDERATION.

THIS SYSTEM IS PARTICULARLY BENEFICIAL FOR INDUSTRIES ENTERING THE NUCLEAR FIELD, AND ESPECIALLY WHEN USING THE CANADIAN CONCEPT OF SMALLER PACKAGES BECAUSE MANY OF THESE SMALL PACKAGES REQUIRE A LOWER LEVEL PROGRAM.

EVEN WITH THIS IMPROVED SYSTEM, QUALITY PROGRAMS CAN BE EXPENSIVE TO SET UP AND EXPENSIVE TO OPERATE, HOWEVER, GOOD ADVICE IN BOTH DEVELOPMENT AND IMPLEMENTATION CAN REDUCE THESE COSTS AND WE ARE PREPARED TO PROVIDE THAT ASSISTANCE.

IN CONCLUSION, I WOULD LIKE TO RE-EMPHASIZE A FEW POINTS:-

1. CANDU MANUFACTURING TECHNOLOGY IS WORLD CLASS AS DEMONSTRATED BY THE RELIABILITY AND PERFORMANCE OF THE CANDU REACTORS IN SERVICE.
2. THE MANUFACTURING PROCESSES AND TECHNIQUES, DEVELOPED AND PROVEN IN CANADA OVER THE PAST 25 YEARS ARE AVAILABLE FOR TRANSFER, THEREBY REDUCING THE RISK, THE COST, AND THE TIME REQUIRED TO ACHIEVE LOCAL SELF-SUFFICIENCY.
3. CANADIAN INDUSTRY IS EAGER TO PARTICIPATE IN THE EXPORT MARKETING PROGRAM AND IS COMMITTED TO THE PRINCIPLES OF TECHNOLOGY TRANSFER AND LOCALIZATION OF PRODUCTION.