

## Data Appendix for “The Effect of New Technology on Energy Consumption”

**Table A1 – International Patent Classifications Used**

***Industrial Technologies***

*Waste heat:*

F01K 17	Steam engine plants; Steam accumulators; Engine plants not otherwise provided for; Engines using special working fluids or cycles/Use of steam or condensate extracted or exhausted from steam engine plant
F01K 19	Steam engine plants; Steam accumulators; Engine plants not otherwise provided for; Engines using special working fluids or cycles/Regenerating or otherwise treating steam exhaust from steam engine plant
F01K 23	Steam engine plants; Steam accumulators; Engine plants not otherwise provided for; Engines using special working fluids or cycles/Plants characterized by more than one engine delivering power to the plant, the engines being driven by different fluids
F02G	Hot gas or combustion product positive-displacement engine plants; Use of waste heat of combustion engines, not otherwise provided for

*Heat Pumps:*

F25B 13	Refrigeration machines, plants or systems; Combined heating and refrigeration systems, e.g. heat pump systems/Compression refrigeration machines, plants, or systems, with reversible cycle, e.g. for use as heat pumps
F25B 29	Refrigeration machines, plants or systems; Combined heating and refrigeration systems, e.g. heat pump systems/Combined heating and refrigeration systems, e.g. heat-pump systems

*Heat exchange:*

F28	Heat exchange in general
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*Continuous casting:*

B22D 11	Casting of metals; Casting of other substances by the same processes or devices/Continuous casting of metals, i.e. casting in indefinite lengths
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**Table A1 – International Patent Classifications Used (continued)***Metallurgical processes:*

C21D	Modifying the physical structure of ferrous metals; General devices for heat treatment of ferrous or non-ferrous metals or alloys; Making metal malleable by decarburisation, tempering, or other treatments
C22B 4	Production or refining of metals; Pretreatment of raw materials/Electrothermal treatment of ores or metallurgical products for obtaining metals or alloys
C23C	Coating metallic material; Coating material with metallic material; Surface treatment of metallic material by diffusion into the surface, by chemical conversion or substitution; Coating by vacuum evaporation, by sputtering, by ion implantation or by chemical vapour deposition, in general
C25C	Processes for the electrolytic production, recovery or refining of metals; Apparatus therefor
C25D	Processes for the electrolytic or electrophoretic production of coatings; electroforming; apparatus therefor

*Production of aluminum:*

C22B 21	Production or refining of metals; Pretreatment of raw materials/Obtaining aluminum
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*Paper production:*

D21C 11	Production of cellulose by removing non-cellulose substances from cellulose-containing materials; Regeneration of pulping liquors; Apparatus therefor/Regeneration of pulp liquors
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*Combustion:*

F02	Combustion engines; Hot-gas or combustion-product engine plants
F02B 19	Internal-combustion piston engines; Combustion engines in general/Engines with precombustion chambers
F23	Combustion apparatus; Combustion processes
F23L 7	Air supply; Draught-inducing; supplying non-combustible liquid or gas/Supplying non-combustible liquid or gases, other than air, to the fire, e.g. oxygen, steam
F23L 15	Air supply; Draught-inducing; supplying non-combustible liquid or gas/Heating of air supplied for combustion
F23N 5	Regulating or controlling combustion/Systems for controlling combustion

**Table A1 – International Patent Classifications Used (continued)****Supply Technologies***Using waste as fuel:*

F23G 5	Cremation furnaces; Consuming waste by combustion/Incineration of waste; Incinerator constructions; Details, accessories or control therefor
F23G 7	Cremation furnaces; Consuming waste by combustion/Incinerators or other apparatus for consuming industrial waste, e.g. chemicals

*Solar Energy:*

F03G 7	Spring, weight, inertial, or like motors; Mechanical-power-producing devices or mechanisms, not otherwise provided for or using energy sources not otherwise provided for/ Mechanical-power-producing devices or mechanisms, not otherwise provided for or using energy sources not otherwise provided for
F24J 2	Production or use of heat not otherwise provided for/Use of solar heat, e.g. solar collectors
H01L 25	Semiconductor devices; Electric solid state devices not otherwise provided for/Assemblies consisting of a plurality of individual semiconductor or other solid state devices, e.g. solar panels
H01L 31	Semiconductor devices; Electric solid state devices not otherwise provided for/Semiconductor devices sensitive to infra-red radiation, light, electromagnetic radiation of shorter wavelength, or corpuscular radiation and adapted for the conversion of the energy of such radiation into electrical energy or for the control of electrical energy by such radiation; Processes or apparatus peculiar to the manufacture or treatment thereof or parts thereof; Details thereof
H01L 35	Semiconductor devices; Electric solid state devices not otherwise provided for/Thermoelectric devices comprising a junction of dissimilar materials, i.e. exhibiting a Seebeck or Peltier effect with or without other thermoelectric effects or thermomagnetic effects; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof; Details thereof
H01L 37	Semiconductor devices; Electric solid state devices not otherwise provided for/Thermoelectric devices without a junction of dissimilar materials; Thermomagnetic devices, eg. using Nernst-Ettinghausen effect; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof
H02N 6	Electric machines not otherwise provided for/Generators in which light radiation is directly converted into electrical energy

**Table A1 – International Patent Classifications Used (continued)***Wind power:*

F03D Wind motors

*Coal gasification:*

C10J 3 Production of producer gas, water-gas, synthesis gas from solid carbonaceous material, or mixtures containing these gases; Carburetting air or other gases/Production of combustible gases containing carbon monoxide from solid carbonaceous fuels

C10K 3 Purifying or modifying the chemical compositions of combustible technical gases containing carbon monoxide/Modifying the chemical composition of combustible technical gases containing carbon monoxide to produce an improved fuel, e.g. one of different calorific value, which may be free of carbon monoxide

*Coal liquefaction:*

C10G 1 Cracking hydrocarbon oils; Production of liquid hydrocarbon mixtures from materials other than hydrocarbons, e.g. by destructive hydrogenation; Recovery of hydrocarbon oils from oil-shale, oil-sand, or gases; Refining mixtures mainly consisting of hydrocarbons; Reforming of naphtha; Mineral Waxes/Production of liquid hydrocarbon mixtures from oil shale, oil-sand, or non-melting solid carbonaceous or similar materials, e.g. wood, coal

*Fuel Cells:*

H01M 8 Processes or means, e.g. batteries, for the direct conversion of chemical into electrical energy/Fuel cells; Manufacture thereof

**Table A2 – Concordance Between U.S. and Canadian Industry Codes**

<b>Canadian Industrial Classifications</b>		<b>U.S. Industrial Classifications</b>	
<i>Aluminum</i>			
2951	Primary Production of Aluminum	3334	Primary Aluminum
<i>Automotive</i>			
3231	Motor Vehicle Industry	3771	Motor Vehicles and Car Bodies
<i>Chemicals</i>			
3711	Industrial Inorganic Chemical Industries, nec	2812	Alkalies and Chlorine
3712	Industrial Organic Chemical Industries, nec	2813	Industrial Gases
3721	Chemical Fertilizers Industry	2816	Industrial Pigments
3729	Other Agricultural Chemical Industries	2819	Industrial Inorganic Chemicals, nec
3799	Other Chemical Products Industries, nec	2822	Synthetic Rubber
		2842	Polishes and Sanitation Goods
		2843	Surface Active Agents
		2861	Gum and Wood Chemicals
		2865	Cyclic Crudes and Intermediates
		2869	Industrial Organic Chemicals, nec
		2873	Nitrogenous Fertilizers
		2874	Phosphatic Fertilizers
		2879	Agricultural Chemicals, nec
		2892	Explosives
		2895	Carbon Black
		2899	Chemical Preparations, nec
		3482	Small Arms Ammunition
		3483	Ammunition, Exc. For Small Arms, nec
<i>Copper</i>			
2959	Other Non-Ferrous Smelting & Refining	3331	Primary Copper
		3332	Primary Lead
		3333	Primary Zinc
		3339	Primary Nonferrous Metals, nec
<i>Electrometallurgical Products</i>			
2911	Ferro-Alloys Industry	3313	Electrometallurgical Products
<i>Glass Industry</i>			
3561	Primary Glass & Containers Industry	3229	Pressed and Blown Glass, nec
3562	Glass Products Exc. Containers Industry	3231	Products of Purchased Glass
<i>Iron Foundries</i>			
2941	Iron Foundries	3321	Gray and Ductile Iron Foundries
		3322	Malleable Iron Foundries
<i>Metal Coating</i>			
3041	Custom Coating of Metal Products Industry	3471	Plating and Polishing
3921	Jewelry & Silverware Industry	3479	Metal Coating and Allied Services
		3911	Jewelry, Precious Metal
		3914	Silverware and Plated Ware
		3915	Jewelers' Materials & Lapidary Work
		3961	Costume Jewelry
<i>Plastic Film &amp; Sheet</i>			
1611	Foamed & Expanded Plastic Products Industry	2821	Plastic Materials and Resin
1621	Plastic Pipe & Pipe Fittings Industry	3041	Rubber & Plastics Hose & Belting
1631	Plastic Film & Sheeting Industry	3079	Miscellaneous Plastic Products
1699	Other Plastic Products Industries, nec	3081	Unsupported Plastics Film & Sheet
3731	Plastic & Synthetic Resin Industry	3082	Unsupported Plastics Profile Shapes
		3083	Laminated Plastics Plate & Sheet
		3085	Plastics Bottles
		3088	Plastics Plumbing Fixtures
		3089	Plastic Products, nec

**Table A2 – Concordance Between U.S. and Canadian Industry Codes (continued)**

<b>Canadian Industrial Classifications</b>		<b>U.S. Industrial Classifications</b>	
<i>Pulp and Paper</i>			
2711	Pulp Industry	2611	Pulp Mills
<i>Rolling, Casting, and Extruding</i>			
2919	Other Primary Steel Industries	3361	Aluminum Foundries
2961	Aluminum Rolling, Casting & Extruding	3362	Brass, bronze, and copper foundries
2971	Copper Rolling, Casting & Extruding	3369	Nonferrous foundries, nec
2999	Other Rolling, Casting & Extruding	3549	Metalworking machinery, nec
3052	Wire & Wire Rope Industry	3623	Welding apparatus, electric
3059	Other Wire Products Industries	3312	Blast Furnaces and Steel Mills
3381	Communications & Energy Wire & Cable	3316	Cold Finishing of Steel Shapes
		3399	Primary Metal Products, nec
		3315	Steel Wire and Related Products
		3341	Secondary Nonferrous Metals
		3351	Copper Rolling and Drawing
		3353	Aluminum Sheet, Plate, and Foil
		3354	Aluminum Extruded Products
		3355	Aluminum Rolling and Drawing, nec
		3356	Nonferrous Rolling and Drawing, nec
		3357	Nonferrous Wiredrawing & Insulating
		3399	Primary Metal Products
		3463	Nonferrous Forgings
		3496	Miscellaneous Fabricated Wire Products
		3497	Metal Foil and Leaf
<i>Steel Foundries</i>			
2912	Steel Foundries	3324	Steel Investment Foundries
		3325	Steel Foundries, nec
<i>Steel Pipes and Tubes</i>			
2921	Steel Pipe & Tube Industry	3317	Steel Pipe and Tubes