Table S1. ISO 37120 Indicators, Types, Functions, and Relevance to Arctic Cities.

Sustainability domain	ISO indicator type	Indicator function	Relevance to Arctic cities	Notes
Economy				
5.1 Unemployment rate	core	outcome	Low	Current employment may depend on non-renewable resource extraction
5.2 Assessed value of commercial and industrial properties as percentage of total assessed value of all properties	supporting	capacity	Low	Ignores role of arctic regional economy in city's economy
5.3 Percentage of persons in full-time employment	supporting	outcome	Revise	Exclude employment based on non-renewable resource extraction
5.4 Youth unemployment rate	supporting	outcome	Relevant	Current employment may depend on non-renewable resource extraction
5.5 Number of businesses per 100 000 population	supporting	capacity	Revise	Ignores role of arctic regional economy in city's economy
5.6 Number of new patents per 100 000 population per year	supporting	investment	Low	Ignores role of arctic regional economy in city's economy
5.7 Annual number of visitor overnight stays per 100,000	supporting	outcome	Relevant	
5.8 Number of non-stop commercial air destinations	supporting	capacity	Relevant	
5.9.1 Average household income in $US	profile		Revise	Subtract income from nonrenewable sources
5.9.2 Annual inflation rate based on average of the past five years	profile		Relevant	
5.9.3 City product per capita, $US	profile		Revise	Per capita product excluding product derived from non-renewable sources
Education				
6.1 Percentage of female school-aged population enrolled in schools	core	investment	Relevant	
6.2 Percentage of students completing primary education: survival rate	core	investment	Relevant	
6.3 Percentage of students completing secondary education: survival rate	core	investment	Relevant	
6.4 Primary education student teacher ratio	core	investment	Relevant	
6.5 Percentage of school-aged population enrolled in schools	supporting	investment	Relevant	
6.6 Number of higher education degrees per 100 000 population	supporting	capacity	Relevant	

Energy

7.1 Total end-use energy consumption per capita, GJ/year	core	outcome	Revise	Adjust for HDD
7.2 Percentage of total end-use energy derived from renewable sources	core	outcome	Relevant	
7.3 Percentage of city population with authorized residential electrical service	core	outcome	Relevant	
7.4 Number of gas distribution service connections per 100 000 population	core	outcome	Relevant	
7.5 Annual energy consumption of public buildings per year, GJ/m2	core	outcome	Revise	Adjust for HDD
7.6 Electricity consumption of public street lighting per kilometre of lighted street, kwh/year	supporting	outcome	Revise	During winter season (Sep.-March)
7.7 Average annual hours of electrical service interruptions per household	supporting	outcome	Relevant	
7.8.1 Heating degree days	profile		Relevant	
7.8.2 Cooling degree days	profile		Low	replace with solar energy potential

Environment and Climate Change

8.1 Fine particulate matter (PM2.5) concentration	core	outcome	Relevant	
8.2 Particulate matter (PM10) concentration	core	outcome	Relevant	
8.3 Greenhouse gas emissions measured in tonnes per capita	core	investment	Relevant	
8.4 Percentage of areas designated for natural protection	supporting	investment	Low	Difficult to define for city surrounded by lightly settled areas
8.5 NO2 (nitrogen dioxide) concentration	supporting	outcome	Relevant	
8.6 SO2 (sulfur dioxide) concentration	supporting	outcome	Relevant	
8.7 O3 (ozone) concentration	supporting	outcome	Revise	Replace with Carbon monoxide (CO)
8.8 Noise pollution	supporting	outcome	Relevant	
8.9 Percentage change in number of native species	supporting	investment	Revise	Number of invasive species a bigger problem for Arctic cities

Finance

9.1 Debt service ratio of municipal locally raised revenue	core	capacity	Relevant	
9.2 Capital spending as a percentage of total expenditures	core	investment	Relevant	
9.3 Own-source revenue as a percentage of total revenues	supporting	capacity	Relevant	Add percentage of municipal revenue derived from non-renewable resources

9.4 Tax collected as a percentage of tax billed	supporting	outcome	Relevant
9.5.1 Gross operating budget per capita	profile		Relevant
9.5.2 Gross capital budget per capita	profile		Relevant

Governance

10.1 Women as a percentage of total elected to city-level office	core	outcome	Relevant
10.2 Number of convictions for corruption and/or bribery by city officials per 100 000 population	supporting	outcome	Relevant
10.3 Number of registered voters as a percentage of the voting age population	supporting	investment	Relevant
10.4 Voter participation in last municipal election	supporting	investment	Relevant

Health

11.1 Average life expectancy	core	outcome	Relevant
11.2 Number of in-patient hospital beds per 100 000 population	core	capacity	Relevant
11.3 Number of physicians per 100 000 population	core	capacity	Relevant
11.4 Under age five mortality per 1 000 live births	core	outcome	Relevant
11.5 Number of nursing and mid-wifery personnel per 100 000 population	supporting	capacity	Relevant
11.6 Suicide rate per 100 000 population	supporting	outcome	Relevant

Housing

12.1 Percentage of city population living in inadequate housing	core	capacity	Relevant
12.2 Percentage of population living in affordable housing	core	outcome	Relevant
12.3 Number of homeless per 100 000 population	supporting	outcome	Relevant
12.4 Percentage of households that exist without registered legal titles	supporting	outcome	Relevant
12.5.1 Total number of households	profile		Relevant
12.5.2 Persons per unit	profile		Relevant
12.5.3 Residential vacancy rate	profile		Relevant
12.5.4 Living space (m2/person)	profile		Relevant
12.5.5 Secondary residence rate	profile		Relevant
12.5.6 Residential rental dwelling units as a percentage of total dwelling units	profile		Relevant

Population and Social Conditions

13.1 Percentage of city population living below the international poverty line	core	outcome	Relevant	
13.2 Percentage of city population living below the national poverty line	supporting	outcome	Relevant	
13.3 Gini coefficient of inequality	supporting	outcome	Relevant	
13.4.1 Annual population change	profile		Relevant	
13.4.2 Percentage of population that are foreign born	profile		Relevant	
13.4.3 Population demographics	profile		Relevant	
13.4.4 Percentage of population that are new immigrants	profile		Relevant	
13.4.5 Percentage of city population that are non-citizens	profile		Relevant	
13.4.6 Number of university students per 100 000 population	profile		Relevant	
Recreation				
14.1 Square metres of public indoor recreation space per capita	supporting	capacity	Relevant	
14.2 Square metres of public outdoor recreation space per capita	supporting	capacity	Low	Difficult to define for Arctic cities surrounded by lightly settled lands
Safety				
15.1 Number of firefighters per 100 000 population	core	capacity	Relevant	
15.2 Number of fire-related deaths per 100 000 population	core	outcome	Relevant	
15.3 Number of natural-hazard-related deaths per 100 000 population	core	outcome	Relevant	
15.4 Number of police officers per 100 000 population	core	capacity	Relevant	
15.5.Number of homicides per 100 000 population	core	outcome	Relevant	
15.6 Number of volunteer and part-time firefighters per 100 000 population	supporting	capacity	Relevant	
15.7 Response time for emergency response services from initial call	supporting	outcome	Relevant	
15.8 Crimes against property per 100 000 population	supporting	outcome	Relevant	
15.9 Number of deaths caused by industrial accidents per 100 000 population	supporting	outcome	Relevant	
15.10 Number of violent crimes against women per 100 000 population	core	outcome	Relevant	
Solid Waste				
16.1 Percentage of city population with regular solid waste collection	core	capacity	Relevant	

Indicator				
16.2 Total collected municipal solid waste per capita	core	outcome	Relevant	
16.3 Percentage of the city's solid waste that is recycled	core	outcome	Relevant	
16.4 Percentage of the city's solid waste that is disposed of in a sanitary landfill	core	outcome	Relevant	
16.5 Percentage of the city's solid waste that is treated in energy-from-waste plants	core	outcome	Relevant	
16.6 Percentage of the city's solid waste that is biologically treated and used as compost or biogas	supporting	outcome	Relevant	
16.7 Percentage of the city's solid waste that is disposed of in an open dump	supporting	outcome	Relevant	
16.8 Percentage of the city's solid waste that is disposed of by other means	supporting	outcome	Relevant	
16.9 Hazardous waste generation per capita, tonnes	supporting	outcome	Relevant	
16.10 Percentage of the city's hazardous waste that is recycled	supporting	outcome	Relevant	
Sports, and Culture				
17.1 Number of cultural institutions and sporting facilities per 100 000 population	core	capacity	Relevant	
17.2 Percentage of municipal budget allocated to cultural and sporting facilities	supporting	investment	Relevant	
17.3 Annual number of cultural events per 100 000 population	supporting	outcome	Relevant	
Telecommunications				
18.1 Number of internet connections per 100 000 population	supporting	capacity	Revise	Number of household connections
18.2 Number of mobile phone connections per 100 000 population	supporting	outcome	Relevant	
Transportation				
19.1 Kilometres of public transport system per 100 000 population	core	capacity	Relevant	
19.2 Annual number of public transport trips per capita	core	outcome	Relevant	
19.3 Percentage of commuters using a travel mode other than a personal vehicle	supporting	outcome	Relevant	
19.4 Kilometres of bicycle paths and lanes per 100 000 population	supporting	capacity	Revise	Bicyle paths and lands maintained year-round (snow and ice cleared)
19.5 Transportation deaths per 100 000 population	supporting	outcome	Relevant	
19.6 Percentage of population living within 0,5 km of public transit running at least every 20 min during peak periods	supporting	capacity	Relevant	

19.7 Average commute time	supporting	outcome	Relevant	
19.8 Number of personal automobiles per capita	supporting	capacity	Relevant	
19.9 Number of two-wheeled motorized vehicles per capita	supporting	capacity	Low	Motorcycle transportation less feasible in Arctic winters

Local agriculture and food security

20.1 Total urban agricultural area per 100 000 population	core	capacity	Low	Agriculture not feasible in large parts of the Arctic
20.2 Amount of food produced locally as a percentage of total food supplied	supporting	outcome	Revise	Include regional production as "local"
20.3 Percentage of city population undernourished	supporting	outcome	Relevant	
20.4 Percentage of city population that is overweight or obese Body Mass Index	supporting	outcome	Relevant	

Urban planning (land use)

21.1 Green area (hectares) per 100 000 population	core	capacity	Revise	Define as green area designated and maintained as municipal parks
21.2 Areal size of informal settlements as a percentage of city area	supporting	capacity	Revise	Include areas with tent camps for transient and homeless population
21.3 Jobs housing ratio	supporting	outcome	Low	Problem for Arctic cities hosting shift workers
21.4 Basic service proximity	supporting	capacity	Relevant	
21.5.1 Population density	profile		Revise	Within settled area (urban boundaries arbitrary)
21.5.2 Number of trees per 100 000 population	profile		Relevant	Only relevant if south of tree line
21.5.3 Built-up density	profile		Revise	Within settled area (urban boundaries arbitrary)

Wastewater

22.1 Percentage of city population served by wastewater collection	core	capacity	Relevant	
22.2 Percentage of the city's wastewater receiving centralized treatment	core	capacity	Relevant	
22.3 Percentage of population with access to improved sanitation	core	capacity	Relevant	
22.4 Compliance rate of wastewater treatment	supporting	outcome	Relevant	

Water

23.1 Percentage of city population with potable water supply service	core	capacity	Relevant	

23.2 Percentage of city population with sustainable access to an improved water source	core	capacity	Relevant	
23.3 Total domestic water consumption per capita, liters/day	core	outcome	Relevant	
23.4 Compliance rate of drinking water quality	core	capacity	Relevant	
23.5 Total water consumption per capita, liters per day	supporting	outcome	Revise	Measure per capita net energy used by water and wastewater systems
23.6 Average annual hours of water service interruptions per household	supporting	capacity	Relevant	
23.7 Percentage of water loss	supporting	capacity	Relevant	

Table S2. Summary of ISO 37120 Indicator Types, Functions, and Relevance to Arctic Cities.

Sustainability domain	ISO category			Function type				Relevance		Suggested new indicators
	Total indicators	Core indicators	Supporting indicators	Outcome Indicators	Capacity Indicators	Investment indicators	Relevant indicators	Modifications needed	Inappropriate indicators	
Economy	11	1	7	4	3	1	4	4	3	Percentage of regional export industry employment based on non-renewable resources (core indicator)
Education	6	4	2		5	1	6			
Energy	9	5	2	7			5	3	1	Solar energy potential (profile indicator)
Environment and Climate Change	9	3	6	6		3	6	2	1	
Finance	6	2	2	1	2	1	6			Percentage of municipal revenues derived from non-renewable resources (core indicator)
Governance	4	1	3	2		2	4			
Health	6	4	2	3	3		6			
Housing	10	2	2	2	2		10			
Population and Social Conditions	9	1	2	3			9			
Recreation	2	0	2	2			2			
Safety	10	6	4	7	3		10			
Solid Waste	10	5	5	9	1		10			
Sports, and Culture	3	1	2	1	1	1	3			
Telecommunications	2	0	2	1	1		1	1		
Transportation	9	2	7	4	5		7	1	1	
Local agriculture and food secuty	4	1	3	3	1		2	1	1	

Urban planning (land use)	7	1	3	1	3		2	4	1	
Wastewater	4	3	1	1	3		4			
Water	7	4	3	2	5		6	1		Per capita net energy used by water and wastewater systems (supporting indicator)
Total, all domains	128	46	60	59	38	9	103	17	8	