Aarhus PRTR implementation cost analysis

Structure and explanation of the economic model

File ***1 Facility_1***

Name of matrix/vector	Definition ("input" is given by the administrator of the model (UNECE) or by the user)	Content
a0 (n×1), n=1,...,56 (country)	input	corporate tax rate in the first reporting period (year 0)
a1 (n×1), n=1,...,56 (country)	input	same concept as vector a0 with the difference that this vector is referred to the second reporting time period (year 1)
b (n×1), n=1,...,56 (country)	input	discount rate
AS0 (n×s), n=1,...,56 (country), s=1,...,4 (staff type for facilities)	input	gross annual salary (US$) for the four facility staff types
AS1 (n×s), n=1,...,56 (country), s=1,...,4 (staff type for facilities)	input	same concept as matrix AS0 with the difference that this matrix is referred to the second reporting time period (year 1)
c0 (n×1), n=1,...,56 (country)	input	income tax rate per facility employees in the first reporting period (year 0) (**needed** if we consider net salary in calculations) **(would influence tot cost (and MEH)**
c1 (n×1), n=1,...,56 (country)	input	same concept as vector c0 with the difference that this vector is referred to the second

		reporting time period (year 1) (**needed** if we consider net salary in calculations) **(would influence tot cost (and MEH)**
d0 (n×1), n=1,...,56 (country)	input	employee benefits (as % of salary) in the first reporting period (year 0)
d1 (n×1), n=1,...,56 (country)	input	same concept as vector d0 with the difference that this vector is referred to the second reporting time period (year 1)
B0 (n×s), n=1,...,56 (country), s=1,...,4 (staff type for facilities)	input	overhead costs (as fraction of salary) in the first reporting period (year 0)
B1 (n×s), n=1,...,56 (country), s=1,...,4 (staff type for facilities)	input	same concept as matrix B0 with the difference that this matrix is referred to the second reporting time period (year 1)
C0 (n×s), n=1,...,56 (country), s=1,...,4 (staff type for facilities)	C0[n,s]=AS0[n,s]×(1+d0[n]+B0[n,s])	loaded salary in the first reporting period (year 0) (**if we use net salary, A[n,s] will be replaced by the net salary matrix**)
C1 (n×s), n=1,...,56 (country), s=1,...,4 (staff type for facilities)	C1[n,s]=AS1[n,s]×(1+d1[n]+B1[n,s])	same concept as matrix C0 with the difference that this matrix is referred to the second reporting time period

		(year 1) (**if we use net salary, A[n,s] will be replaced by the net salary matrix**)
D0 (n×s), n=1,...,56 (country), s=1,...,4 (staff type for facilities)	D0[n,s]= $\frac{C0[n,s]}{C0[n,1]}$	equivalent managerial hours (EMH) calculated as depending on the loaded salary
D1 (n×s), n=1,...,56 (country), s=1,...,4 (staff type for facilities)	D1[n,s]= $\frac{C1[n,s]}{C1[n,1]}$	same concept as matrix D0 with the difference that this matrix is referred to the second reporting time period (year 1)
E (z×t), z=(p+q)×s, p=1,...,5 (general initial action), q=1,...,3 (general final action), s=1,...,4 (staff type for facilities), t=0,1 (time period (year))	**input**	hours of work required for each of the initial and final actions required by the four kinds of facility staff in the different time periods
F0 (n×(p+q)), n=1,...,56 (country), p=1,...,5 (general initial action), q=1,...,3 (general final action)	F0[n,i]=E[i,0] + E[i+1,0]×D0[n,2] + E[i+2,0]×D0[n,3] + E[i+3,0]×D0[n,4], i=1,5,9,13,...,z-3, z=(p+q)×s	equivalent managerial hours of work needed for each of the initial and final actions required by the four kinds of facility staff in the first time period (year 0)
F1 (n×(p+q)), n=1,...,56 (country), p=1,...,5 (general initial action), q=1,...,3 (general final action)	F1[n,i]=E[i,1] + E[i+1,1]×D1[n,2] + E[i+2,1]×D1[n,3] + E[i+3,1]×D1[n,4], i=1,5,9,13,...,z-3, z=(p+q)×s	same structure as matrix F0 with the difference that F1 is referred to the second time period (year 1)
G0 (s×(m+c+e)),	input	hours of work required

s=1,...,4 (staff type for facilities), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action)		for measuring, calculating or estimating the emissions required by the four kinds of facility staff in the different time periods (same concept as matrix E with the difference in the actions considered and in the fact that matrix is distinguished across reporting time periods (matrix G0 and G1) for calculation reasons)
G1 (s×(m+c+e)), s=1,...,4 (staff type for facilities), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action)	input	same structure as matrix G0 with the difference that matrix G1 is referred to the second time period (year 1)
HH0 (n×(m+c+e)), n=1,...,56 (country), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action)	HH0[n,i]=G0[1,i] + G0[2,i]×D0[n,2] + G0[3,i]×D0[n,3] + G0[4,i]×D0[n,4], i=m+c+e	equivalent managerial hours of work needed for measuring, calculating or estimating the emissions required by the four kinds of facility staff in the second time period (year 1) (same concept as matrix F0 with the difference in the actions considered)
I0 ((m+c+e)×n), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), n=1,...,56 (country)	=(HH0)’	
HH1 (n×(m+c+e)),	HH1[n,i]=G1[1,i] + G1[2,i]×D1[n,2] + G1[3,i]×D1[n,3] + G1[4,i]×D1[n,4],	same structure as matrix HH0 with the difference

n=1,...,56 (country), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action)	i=m+c+e	that HH1 is referred to the second time period (year 1)
I1 ((m+c+e)×n), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), n=1,...,56 (country)	=(HH1)'	same structure as matrix I0 with the difference that I1 is referred to the second time period (year 1)

File *2 Facility_2*

Name of matrix/vector	**Definition ("input" is given by the administrator of the model (UNECE) or by the user)**	**Content**
gtotal0 (n×1), n=1,…,56 (country)	=ga0 + gw0 + gl0 + gww0 + gt0 + gh0 + gn0	Total number of pollutants reported by the facilities of each country in the first reporting time period (year 0)
gtotal1 (n×1), n=1,…,56 (country)	=ga1 + gw1 + gl1 + gww1 + gt1 + gh1 + gn1	same concept as vector gtotal0 with the difference that this vector monitors the second reporting time period (year 1)
j0 (n×1), n=1,…,56 (country)	j0[n]= $\sum_{j=1}^{p} F0[n, j]$, p=1,...,5 (general initial action)	total number of EMHs needed for the initial actions for each country in the first reporting time period (year 0)
k0 (n×1), n=1,…,56 (country)	k0[n]=j0[n] × C0[n,1]	cost for initial actions in the first reporting time period (year 0) per facility
l0 (n×1), n=1,…,56 (country)	l0[n]=k0[n] × w[n]	total cost for initial actions in the first reporting time period (year 0) (including all facilities)
o0 (n×1), n=1,…,56 (country)	o0[n]= $\sum_{j=p+1}^{p+q} F0[n, j]$, p=1,...,5 (general initial action), q=1,...,3 (general final action)	same concept as vector j0 with the difference that this vector monitors the final actions
n0 (n×1), n=1,…,56	n0[n]=o0[n] × C0[n,1]	same concept as vector k0 with the difference that this

(country)		vector monitors the final actions
p0 (n×1), n=1,…,56 (country)	p0[n]=n0[n] × x0[n]	same concept as vector l0 with the difference that this vector monitors the final actions
o1 (n×1), n=1,…,56 (country)	o1[n]= $\sum_{j=p+1}^{p+q} F1[n,j]$, p=1,...,5 (general initial action), q=1,...,3 (general final action)	same concept as vector o0 with the difference that this vector monitors the second reporting time period (year 1)
n1 (n×1), n=1,…,56 (country)	n1[n]=o1[n] × C1[n,1]	same concept as vector n0 with the difference that this vector monitors the second reporting time period (year 1)
p1 (n×1), n=1,…,56 (country)	p1[n]=n1[n] × x1[n]	same concept as vector p0 with the difference that this vector monitors the second reporting time period (year 1)
h0t (1×n), n=1,…,56 (country)	=ha0 + hw0 + hl0 + hww0 + ht0 + hh0 + hn0	EMHs in one country using the employee threshold approach
h0 (n×1), n=1,…,56 (country)	=(h0t)’	
q0 (n×1), n=1,…,56 (country)	q0[n]=h0[n] × C0[n,1]	total cost for MCE actions in each country in the first reporting time period (year 0)
h1t (1×n), n=1,…,56 (country)	=ha1 + hw1 + hl1 + hww1 + ht1 + hh1 + hn1	same concept as vector h0t with the difference that this vector monitors the second reporting time period (year 1)
h1 (n×1), n=1,…,56 (country)	=(h1t)’	
q1 (n×1), n=1,…,56 (country)	q1[n]=h1[n] × C1[n,1]	same concept as vector q0 with the difference that this vector monitors the second reporting time period (year 1)
i0t (1×n), n=1,…,56 (country)	=ia0 + iw0 + il0 + iww0 + it0 + ih0 + in0	same concept as vector h0t with the difference that this vector uses the capacity threshold
i0 (n×1), n=1,…,56 (country)	=(i0t)’	
r0 (n×1), n=1,…,56 (country)	r0[n]=i0[n] × C0[n,1]	same concept as vector q0 with the difference that this vector uses the capacity threshold

i1t (1×n), n=1,…,56 (country)	=ia1 + iw1 + il1 + iww1 + it1 + ih1 + in1	same concept as vector i0t with the difference that this vector monitors the second reporting time period (year 1)
i1 (n×1), n=1,…,56 (country)	=(i1t)’	
r1 (n×1), n=1,…,56 (country)	r1[n]=i1[n] × C1[n,1]	same concept as vector r0 with the difference that this vector monitors the second reporting time period (year 1)
s0 (n×1), n=1,…,56 (country)	=l0 + p0 + q0	total national facility cost in each country in the first reporting period (year 0) using the employee threshold approach
t0 (n×1), n=1,…,56 (country)	=l0 + p0 + r0	same concept as vector s0 with the difference that this vector uses the capacity threshold approach
s1 (n×1), n=1,…,56 (country)	=p1 + q1	same concept as vector s0 with the difference that this vector monitors the second reporting time period (year 1)
t1 (n×1), n=1,…,56 (country)	=p1 + r1	same concept as vector s1 with the difference that this vector uses the capacity threshold approach

File ***3 mapping pollutants to activities_EPER and Aarhus Guidance info***

Name of matrix/vector	**Definition (“input” is given by the administrator of the model (UNECE) or by the user)**	**Content**
A1 (u×v), u=1,...,86 (pollutant), v=1,...,67 (activity)	input	if there is a 1 in a cell, that specific pollutant is likely to be released into air; otherwise, if there is a 0 in a cell, that specific pollutant is <u>not</u> likely to be released into air. Information gathered by EPER data available about 2001 reports and the draft version of the Aarhus Protocol Guidance (pages 59, 60)
A1t (v×u), v=1,...,67 (activity), u=1,...,86 (pollutant)	=(A1)’	
W1 (u×v),	input	same concept as matrix A1 with the

u=1,...,86 (pollutant), v=1,...,67 (activity)		difference that the medium monitored consists of the releases into water
W1t (v×u), v=1,...,67 (activity), u=1,...,86 (pollutant)	=(W1)’	
L1 (u×v), u=1,...,86 (pollutant), v=1,...,67 (activity)	input	same concept as matrix A1 with the difference that the medium monitored consists of the releases into land
L1t (v×u), v=1,...,67 (activity), u=1,...,86 (pollutant)	=(L1)’	
WW1 (u×v), u=1,...,86 (pollutant), v=1,...,67 (activity)	input	same concept as matrix A1 with the difference that the medium monitored consists of the transfers of water waste
WW1t (v×u), v=1,...,67 (activity), u=1,...,86 (pollutant)	=(WW1)’	
T1 (u×v), u=1,...,86 (pollutant), v=1,...,67 (activity)	input	same concept as matrix A1 with the difference that the medium monitored consists of the transfers of non-water pollutant-specific waste
T1t (v×u), v=1,...,67 (activity), u=1,...,86 (pollutant)	=(T1)’	
H1 (u×v), u=1,...,86 (pollutant), v=1,...,67 (activity)	input	same concept as matrix A1 with the difference that the medium monitored consists of the transfers of non-water waste-specific hazardous waste
H1t (v×u), v=1,...,67 (activity), u=1,...,86 (pollutant)	=(H1)’	
N1 (u×v),	input	same concept as matrix A1 with the

u=1,...,86 (pollutant), v=1,...,67 (activity)		difference that the medium monitored consists of the transfers of non-water waste-specific non-hazardous waste
N1t (v×u), v=1,...,67 (activity), u=1,...,86 (pollutant)	=(N1)'	

File *4.1 MEAandNational_air* (for all the other media the structure and the content of the file has the same concept)

Name of matrix/vector	**Definition ("input" is given by the administrator of the model (UNECE) or by the user)**	**Content**
A2M (n×l), n=1,...,56 (country), l=1,...,11 (MEA)	input	maps which MEA each country has RAAAed
A3M (u×l), u=1,...,86 (pollutant), l=1,...,11 (MEA)	input	maps which pollutants each MEA monitors with the same requirements of the Aarhus PRTR
A3Mt (l×u), l=1,...,11 (MEA), u=1,...,86 (pollutant)	=(A3M)'	
A4M (n×u), n=1,...,56 (country), u=1,...,86 (pollutant)	=A2M · A3Mt	one cell is 0 if the country does not monitor that pollutant, or >0 if the country does monitor that pollutant
A2N (n×o), n=1,...,56 (country), o=1,...,6 (national PRTR)	input	same concept as matrix A2M with the difference that this matrix monitors national PRTRs
A3N (u×o), u=1,...,86 (pollutant), o=1,...,6 (national PRTR)	input	same concept as matrix A3M with the difference that this matrix monitors national PRTRs
A3Nt (o×u), o=1,...,6 (national PRTR), u=1,...,86 (pollutant)	=(A3N)'	
A4N (n×u), n=1,...,56 (country), u=1,...,86 (pollutant)	=A2N · A3Nt	same concept as matrix A4M with the difference that this matrix monitors national PRTRs
A4L (n×u), n=1,...,56 (country), u=1,...,86 (pollutant)	input	one cell is 0 if the licensing system for one country does not include that pollutant; it is 1, if it does include that pollutant

A4 (n×u), n=1,...,56 (country), u=1,...,86 (pollutant)	A4N + A4M + A4L	one cell is 0 if one country does not monitor that pollutant; it is **>0**, if it does monitor that pollutant
A5 (n×u), n=1,...,56 (country), u=1,...,86 (pollutant)	if A4[n,u]>0, A5[n,u]=1; else, A5[n,u]=0	one cell is 0 if one country does not monitor that pollutant; it is **1**, if it does monitor that pollutant
A6 (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	=(A5)'	
A7E (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	A7E[,n]=m1-A6[,n]	for the employee threshold approach, this matrix gives the Aarhus pollutants that each country still needs to monitor to comply with the Aarhus PRTR
A71E (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	if A7E[n,u]=1, A71E[n,u]=1; else, A71E[n,u]=0	same concept as matrix A7E but further scanning because there are pollutants monitored by one country and not required by the Aarhus PRTR (this would lead to -1 values in the matrix that would generate unreasonable decreases in the cost)
A7C (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	A7C[,n]=m2-A6[,n]	same concept as A7E with the difference that this matrix uses the capacity threshold approach
A71C (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	if A7C[n,u]=1, A71C[n,u]=1; else, A71C[n,u]=0	same concept as matrix A71E but this matrix uses the capacity threshold approach
A80 ((m+c+e)×u), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), u=1,...,86 (pollutant)	input	one cell is 0, if that MCE action is required by that pollutant in the first reporting time period (year 0); it is 1, if that MCE action is not required by that pollutant in the first reporting time period (year 0)
A81 ((m+c+e)×u), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), u=1,...,86 (pollutant)	input	same concept as matrix A80 with the difference that this matrix monitors the second reporting time period (year 1)

A90 (n×u), n=1,...,56 (country), u=1,...,86 (pollutant)	=Z0 · A1t	says how many times each pollutant is monitored by all activities in one country in the first time period (year 0)
A91 (n×u), n=1,...,56 (country), u=1,...,86 (pollutant)	=Z1 · A1t	same concept as matrix A90 with the difference that this matrix monitors the second time period (year 1)
ga0 (n×1), n=1,...,56 (country)	ga0[n]= $\sum_{j=1}^{86} A90[n, j]$	total numbers of times in which each pollutant is monitored by each country in the first time period (year 0)
ga1 (n×1), n=1,...,56 (country)	ga1[n]= $\sum_{j=1}^{86} A91[n, j]$	same concept as vector ga0 with the difference that this matrix monitors the second time period (year 1)
A100 (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	=(A90)’	
A101 (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	=(A91)’	same concept as matrix A100 with the difference that this matrix monitors the second time period (year 1)
A11E0 (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	A11E0[u,n]=A100[u,n] × A71E[u,n]	which of the total number of times is required by the Aarhus and not implemented yet (incremental) – and so to be considered – using the employee threshold approach in the first time period (year 0)
A11E1 (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	A11E1[u,n]=A101[u,n] × A71E[u,n]	same concept as matrix A11E0 with the difference that this matrix monitors the second time period (year 1)
A11C0 (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	A11C0[u,n]=A100[u,n] × A71C[u,n]	same concept as matrix A11E0 with the difference that this matrix uses the capacity threshold approach
A11C1 (u×n), u=1,...,86 (pollutant), n=1,...,56 (country)	A11C1[u,n]=A101[u,n] × A71C[u,n]	same concept as matrix A11C0 with the difference that this matrix monitors the second time period (year 1)
A12E0 ((m+c+e)×n), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), n=1,...,56 (country)	=A80 · A11E0	gives the “unit” hours that each action requires in each country using the employee threshold in the first time period (year 0)

A12E1 ((m+c+e)×n), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), n=1,...,56 (country)	=A81 · A11E1	same concept as matrix A12E0 with the difference that this matrix monitors the second time period (year 1)
A12C0 ((m+c+e)×n), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), n=1,...,56 (country)	=A80 · A11C0	same concept as matrix A12E0 with the difference that this matrix uses the capacity threshold approach
A12C1 ((m+c+e)×n), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), n=1,...,56 (country)	=A81 · A11C1	same concept as matrix A12C0 with the difference that this matrix monitors the second time period (year 1)
A13E0 ((m+c+e)×n), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), n=1,...,56 (country)	A13E0[i,n]=A12E0[i,n] × I0[i,n], i=1,...,(m+c+e)	gives the EMHs required by each action in each country using the employee threshold approach in the first reporting time period (year 0)
ha0 (1×n), n=1,...,56 (country)	ha0[j]= $\sum_{i=1}^{90} A13E0[i, j]$, i=1,...,(m+c+e)	gives the total EMHs required in one country for the first reporting time period (year 0) using the employee threshold
A13E1 ((m+c+e)×n), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), n=1,...,56 (country)	A13E1[i,n]=A12E1[i,n] × I1[i,n], i=1,...,(m+c+e)	same concept as matrix A13E0 with the difference that this matrix monitors the second time period (year 1)
ha1 (1×n), n=1,...,56 (country)	ha1[j]= $\sum_{i=1}^{90} A13E1[i, j]$, i=1,...,(m+c+e)	same concept as vector ha0 with the difference that this vector monitors the second time period (year 1)
A13C0 ((m+c+e)×n), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action),	A13C0[i,n]=A12C0[i,n] × I0[i,n], i=1,...,(m+c+e)	same concept as matrix A13E0 with the difference that this matrix uses the capacity threshold approach

n=1,...,56 (country)		
ia0 (1×n), n=1,...,56 (country)	ia0[j]= $\sum_{i=1}^{90} A13C0[i, j]$, i=1,...,(m+c+e)	same concept as vector ha0 with the difference that this vector uses the capacity threshold approach
A13C1 ((m+c+e)×n), m=1,...,30 (measurement action), c=1,...,30 (calculation action), e=1,...,30 (estimation action), n=1,...,56 (country)	A13C1[i,n]=A12C1[i,n] × I1[i,n], i=1,...,(m+c+e)	same concept as matrix A13C0 with the difference that this matrix monitors the second time period (year 1)
ia1 (1×n), n=1,...,56 (country)	ia1[j]= $\sum_{i=1}^{90} A13C1[i, j]$, i=1,...,(m+c+e)	same concept as vector ia0 with the difference that this vector monitors the second time period (year 1)

File 5 *Number of facilities*

Name of matrix/vector	**Definition ("input" is given by the administrator of the model (UNECE) or by the user)**	**Content**
w (n×1), n=1,...,56 (country)	input	total number of facilities for initial actions (only in the first reporting period (year 0))
x0 (n×1), n=1,...,56 (country)	**=function(w) or input**	total number of reporting facilities = number of reports per country in the first reporting time period (year 0)
x1 (n×1), n=1,...,56 (country)	**=function(w) or function(x0) or input**	same concept as vector x0 with the difference that this vector monitors the second time period (year 1)
Y (n×v), n=1,...,56 (country), v=1,...,67 (activity)	input	gives the number of facilities involved in the initial assessing for specific country and activity (only in the first reporting period (year 0))
Z0 (n×v), n=1,...,56 (country), v=1,...,67 (activity)	**=function(Y) or input**	gives the number of facilities reporting for specific country and activity in the first reporting time period (year 0)
Z1 (n×v), n=1,...,56 (country), v=1,...,67 (activity)	**=function(Y) or function(Z0) or**	same concept as matrix Z0 with the difference that this matrix monitors the second time period (year 1)

	input	

File ***6 Pollutants_Media Aarhus(m vectors)***

Name of matrix/vector	**Definition ("input" is given by the administrator of the model (UNECE) or by the user)**	**Content**
m1 (u×1), u=1,…,86 (pollutant)	input	one cell is 0, if that pollutant is not monitored by the Aarhus PRTR for air releases for employee threshold
m2 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m1 with the difference that this vector uses the capacity threshold approach
m3 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m1 with the difference that this vector monitors water releases
m4 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m3 with the difference that this vector uses the capacity threshold approach
m5 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m1 with the difference that this vector monitors land releases
m6 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m5 with the difference that this vector uses the capacity threshold approach
m7 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m1 with the difference that this vector monitors water waste
m8 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m7 with the difference that this vector uses the capacity threshold approach
m9 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m1 with the difference that this vector monitors waste with the pollutant specific threshold
m10 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m9 with the difference that this vector uses the capacity threshold approach
m11 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m1 with the difference that this vector monitors hazardous waste
m12 (u×1), u=1,…,86	input	same concept as vector m11 with the difference that this

(pollutant)		vector uses the capacity threshold approach
m13 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m1 with the difference that this vector monitors non-hazardous waste
m14 (u×1), u=1,…,86 (pollutant)	input	same concept as vector m13 with the difference that this vector uses the capacity threshold approach

File *7 Regulator* (in the table below, we analyze only the first reporting time period (year 0); for the second reporting time period (year 1) the concept is the same as for the first one (year 0)) (all vectors monitor (have one dimension across) countries)

Name of matrix/vector	**Definition ("input" is given by the administrator of the model (UNECE) or by the user)**	**Content**
r01 (n×1), n=1,...,56 (country)	if agency of the regulator that deals with the Aarhus Protocol is decentralized, r01[n]=1; else, r01[n]=0 (input)	if it is decentralized, coordination costs are to be considered
r02 (n×1), n=1,...,56 (country)	input	percentage of fixed hours more of the engineer's work required to coordinate the decentralized operations
r03 (n×1), n=1,...,56 (country)	input	same concept as vector r02 with the difference that this vector monitors the additional hour percentage required by the administrator
r04 (n×1), n=1,...,56 (country)	input	fixed hours needed by one engineer if the regulator has got centralized operations
r05 (n×1), n=1,...,56 (country)	r05[n]= $r04[n]\times(1+r01[n]\times r02[n])$	fixed hours needed by one engineer in reality, i.e. taking into account whether the regulator has got centralized or decentralized operations
r06 (n×1), n=1,...,56 (country)	input	same concept as vector r04 with the difference that this vector monitors the administrator
r07 (n×1), n=1,...,56 (country)	r07[n]= $r06[n]\times(1+r01[n]\times r03[n])$	same concept as vector r05 with the difference that this vector monitors the administrator

r08 (n×1), n=1,...,56 (country)	input	hours required by one engineer to process the data received about pollutants per report
r09 (n×1), n=1,...,56 (country)	input	same concept as vector r08 with the difference that this vector monitors the administrator
r010 (n×1), n=1,...,56 (country)	r010[n]=r08[n] × $\frac{gtotal0[n]}{x0[n]}$	total number of variable hours required by the engineer
r011 (n×1), n=1,...,56 (country)	r011[n]=r09[n] × $\frac{gtotal0[n]}{x0[n]}$	same concept as vector r010 with the difference that this vector monitors the administrator
r012 (n×1), n=1,...,56 (country)	=r05+r010	total hours required by the engineer
r013 (n×1), n=1,...,56 (country)	=r07+r011	same concept as vector r012 with the difference that this vector monitors the administrator
r014 (n×1), n=1,...,56 (country)	input	number of annual working hours per engineer
r015 (n×1), n=1,...,56 (country)	input	same concept as vector r014 with the difference that this vector monitors the administrator
r016 (n×1), n=1,...,56	r016[n]= $\frac{r012[n]}{r014[n]}$	number of required engineers
r017 (n×1), n=1,...,56	r017[n]= $\frac{r013[n]}{r015[n]}$	same concept as vector r016 with the difference that this vector monitors the administrator
r018 (n×1), n=1,...,56	input	employee benefits (as % of gross salary)
r019 (n×1), n=1,...,56	input	OH costs per engineer (as % of gross salary)
r020 (n×1), n=1,...,56	input	same concept as vector r019 with the difference that this vector monitors the administrator
r021 (n×1), n=1,...,56	input	gross annual salary per engineer
r022 (n×1), n=1,...,56	input	same concept as vector r021 with the difference that this vector monitors the administrator

r023 (n×1), n=1,...,56	input	income tax rate per regulator employees (needed only if we calculate the loaded salary using the net salary) **needed?**
r024 (n×1), n=1,...,56	r024[n]=r021[n] × (1 + r018[n] + r019[n])	loaded salary per engineer
r025 (n×1), n=1,...,56	r025[n]=r022[n] × (1 + r018[n] + r020[n])	same concept as vector r024 with the difference that this vector monitors the administrator
r026 (n×1), n=1,...,56	r026[n]=r024[n] × r016[n]	total loaded salary for all engineers (=labour cost for engineers)
r027 (n×1), n=1,...,56	r027[n]=r025[n] × r017[n]	same concept as vector r026 with the difference that this vector monitors the administrator
r028 (n×1), n=1,...,56	=r026 + r027	total loaded salary (=labour cost)
r029 (n×1), n=1,...,56	input	fixed IT cost
r030 (n×1), n=1,...,56	input	variable IT cost per number of pollutants reported
r031 (n×1), n=1,...,56	r031[n]=r030[n] × **gtotal0**[n]	total variable IT cost
r032 (n×1), n=1,...,56	=r029 + r031	total IT cost
r033 (n×1), n=1,...,56	=r028 + r032	total cost for the regulator

File *8 Total costs*

Name of matrix/vector	**Definition ("input" is given by the administrator of the model (UNECE) or by the user)**	**Content**
ts0 (n×1), n=1,…,56 (country)	=s0 + r033	total national cost in each country using the employee threshold approach in the first reporting period (year 0)
tt0 (n×1), n=1,…,56 (country)	=t0 + r033	same concept as vector ts0 with the difference that this vector uses the capacity threshold approach
ts1 (n×1), n=1,…,56 (country)	=s1 + r133	same concept as vector ts0 with the difference that this vector monitors the second reporting

		period (year 1)
tt1 (n×1), n=1,…,56 (country)	=t1 + r133	same concept as vector ts1 with the difference that this vector uses the capacity threshold approach

Notes:

1. Default value and Potential corrections;
2. Possibility to input everything (i.e. blank country);
3. Capital letters or Mx...(Capital letters)=matrix; small letters=vector;
4. (Usually first letter in acronyms for matrices or vectors) **A**=**a**ir releases; **W**=**w**ater releases; **L**=**l**and releases; **WW**=**w**ater **w**aste transfers; **T**=non-water pollutant specific waste **t**ransfers; **H**=non-water waste-specific **h**azardous waste transfers; **N**=non-water waste-specific **n**on-hazardous waste transfers;
5. As for sub-activity 7a in the Aarhus PRTR: in order to report for this activity, only one of the three options (i, ii and iii) is necessary to be verified; that is why inside matrices A1, W1, L1, WW1, T1, H1 and N1 all the three options (i, ii and iii) are mapped to the same pollutants;
6. Except for i and j (used for counting in different points with different meanings), all other subscripts are used with the same meaning throughout this explanation; this is the following for each subscript: **(the table is new!)**

Subscript	Use
n	country
s	staff type for facilities
p	number of general initial actions
q	number of final actions
t	time periods (years)
m	number of actions for measurements
c	number of actions for calculations
e	number of actions for estimations
z	=(p+q)×s
y	=(m+c+e)×s
u	number of pollutants
v	number of activities
l	number of MEAs
o	number of national PRTRs

7. All costs are expressed in US$;
8. **The number of decimal figures used changes from to variable taken into consideration.**

Assumptions:

1. All facilities in one specific activity "produce" a pollutant for which a 1 is in the activity-medium matrix;
2. All pollutants absorb\ the same quantity of each activity;
3. All activities that are grouped in EPER and single in the Aarhus PRTR contribute in the pollution;

4. Across countries we assume that facilities in the same activity are likely to produce the same pollutants, as a consequence – for example – of the same technological level, etc.;
5. The driver to determine the variable labour hours for the regulator is the average number of pollutants per report the regulator receives;
6. The driver to determine the variable IT cost for the regulator is the number of pollutants reported to the regulator;
7. Initial actions only in the first reporting time period (year 0);
8. Contracts for labour costs (for both facilities and the regulator) are on a task-basis. Therefore, fractions of employees can exist;
9. Employees have the same productivity across countries for both facilities and the regulator. Therefore, the number of hours required by one action – for example – is the same across the different countries (matrix E is the same across all countries).