Financial Modelling for Energy Transitions: Hands-on Lecture 4: Volumes of Finance

Section Title		Contents
1.	Calibrating Volumes of Finance (Data Publication)	*Instructions for inputting volumes of finance from a data publication sheet into MINFin's Financing Baseline*
2.	Developing a new Financing Baseline	*Instructions for collecting data to create a new Financing Baseline in MINFin without a data publication sheet*
3.	Adding missing volumes from project documents	*Example walk through for collecting data from a project document to inform project volumes of finance in MINFin*
4.	Visualising Historic Financing Volumes	*Description of the initial visualisations of historic volumes of financing in MINFin's Data Visualisation Dashboard*

Learning Outcomes

By the end of this exercise, you will be able to:

1. Download and access the MINFin Demo Projects Sheet from Zenodo
2. Use the MINFin Demo Data Publication Sheet to input project financing data into MINFin
3. Understand the process and methodology behind developing a Financing Baseline
4. Locate the visualisation of relevant data on the "Data Visualisation" tab.

To calibrate the country's historical financing terms for power sector development, we must build a historic "financing baseline" for MINFin's projections. The typical time horizon for the baseline is 2010 to present, although this may be adjusted based on sector scale. If including all transaction details is impractical, users may opt for a shorter period, such as 2015 to present. This data can be sourced from a Country Case Study Data Publication Sheet if available on Zenodo, otherwise users will need to calibrate their own baseline. This hands-on exercise outlines two methods for calibrating the financing baseline: ① Calibrating from a Data Publication Sheet and ② Developing a New Financing Baseline. It then moves to part ③, where users will be provided with a demo document to learn how to add missing volumes from project documents.

1. Calibrating Volumes of Finance (Data Publication)

This section outlines the process of extracting data from the MINFin Demo Data Publication Sheet and inputting it into MINFin's Financing Baseline sheet.

1. Before proceeding, ensure you have downloaded the MINFin Demo Data Publication Sheet from the previous hands-on exercise. If you haven't, here is the link again. The "Financing Baseline" sheet in MINFin Demo Data Publication Sheet contains a list of 9 projects from 35 financiers. Each row in this data represents an individual commitment towards each project.

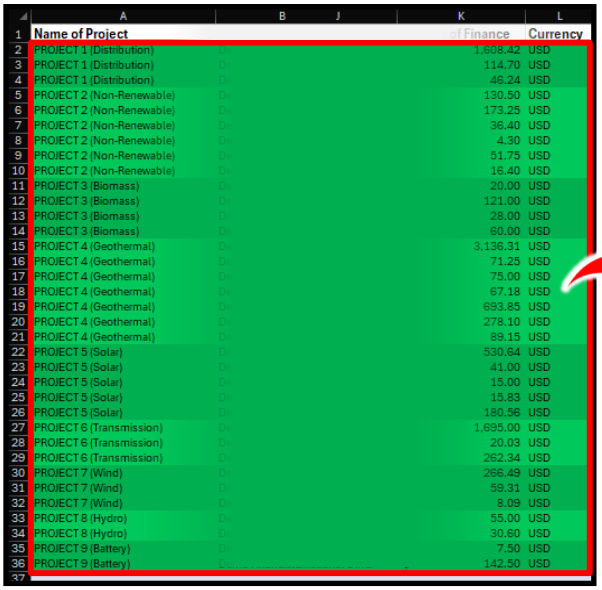
Each column contains the parameters shown above, these represent:

Column Name	Description
Name of Project	The name of the project receiving financing.
Name of Financier	The name of the financial organisation that is to carry out transactions.
Technology	The type of energy technology being financed, e.g., geothermal or biomass.
Financing Source	The classification of financiers by sources, encompassing (1) International Financial Institution concessional loans, (2) Domestic Public Sector concessional loans, (3) International commercial loans, and (4) Domestic commercial loans.
Year	The year in which the loan agreement is signed and finance is committed.
Type of Finance	The classification of the financing source as either debt or equity.
Financing Sector	The classification of the financing source according to whether public or private: public being finance provided by national and local government or development banks; and private finance being provided by individuals, businesses, or commercial investors.
Financial Institution	A more granular breakdown of financiers based on the following taxonomy: Bilateral Agency, Multilateral Agency, Foreign Government, National Government, National Development Bank, Climate Funds, Commercial Bank, and Private Equity Fund.
Origin of Finance	The geographic source of the financing, categories include International OECD, International China, International Other, and Domestic.
Volume of Finance	The principal value of the finance provided in Million US$.
Rate of Return	The interest rate for loans, and for equity, the Expected Rate of Return (ERR).
Currency	The currency in which financing is committed and repaid.

2. To move this data into MINFin we must copy the data in the "Financing Baseline" sheet in MINFin Demo Data Publication Sheet into the cells shaded yellow in MINFin's "Financing Baseline" sheet. To do this, we must copy the data in cells A2:L36 of the Demo Data Publication Sheet and paste these cells into cells A49:L83 of the MINFin Model's "Financing Baseline" sheet.

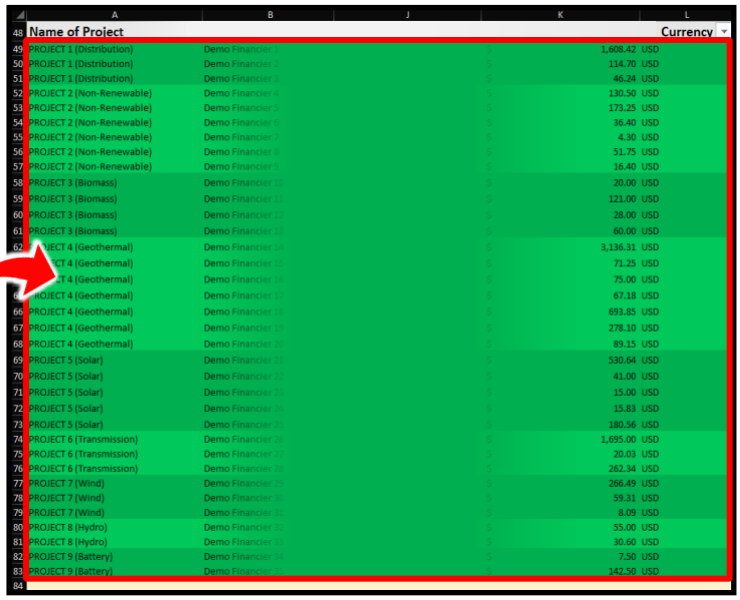
Ensure that only the relevant data from the MINFin Demo Data Publication Sheet is copied, as certain sections in the MINFin model are protected and contain formulas for currency conversions. Therefore, you cannot copy and paste the entire dataset at once.

MINFin Demo Data Publication Sheet



	A	K	L
1	Name of Project	Finance	Currency
2	PROJECT 1 (Distribution)	1,608.42	USD
3	PROJECT 1 (Distribution)	114.70	USD
4	PROJECT 1 (Distribution)	46.24	USD
5	PROJECT 2 (Non-Renewable)	130.50	USD
6	PROJECT 2 (Non-Renewable)	173.25	USD
7	PROJECT 2 (Non-Renewable)	36.40	USD
8	PROJECT 2 (Non-Renewable)	4.30	USD
9	PROJECT 2 (Non-Renewable)	51.75	USD
10	PROJECT 2 (Non-Renewable)	16.40	USD
11	PROJECT 3 (Biomass)	20.00	USD
12	PROJECT 3 (Biomass)	121.00	USD
13	PROJECT 3 (Biomass)	28.00	USD
14	PROJECT 3 (Biomass)	60.00	USD
15	PROJECT 4 (Geothermal)	3,136.31	USD
16	PROJECT 4 (Geothermal)	71.25	USD
17	PROJECT 4 (Geothermal)	75.00	USD
18	PROJECT 4 (Geothermal)	67.18	USD
19	PROJECT 4 (Geothermal)	693.85	USD
20	PROJECT 4 (Geothermal)	278.10	USD
21	PROJECT 4 (Geothermal)	89.15	USD
22	PROJECT 5 (Solar)	530.64	USD
23	PROJECT 5 (Solar)	41.00	USD
24	PROJECT 5 (Solar)	15.00	USD
25	PROJECT 5 (Solar)	15.83	USD
26	PROJECT 5 (Solar)	180.56	USD
27	PROJECT 6 (Transmission)	1,695.00	USD
28	PROJECT 6 (Transmission)	20.03	USD
29	PROJECT 6 (Transmission)	262.34	USD
30	PROJECT 7 (Wind)	266.49	USD
31	PROJECT 7 (Wind)	59.31	USD
32	PROJECT 7 (Wind)	8.09	USD
33	PROJECT 8 (Hydro)	55.00	USD
34	PROJECT 8 (Hydro)	30.60	USD
35	PROJECT 9 (Battery)	7.50	USD
36	PROJECT 9 (Battery)	142.50	USD
37			

MINFin Model

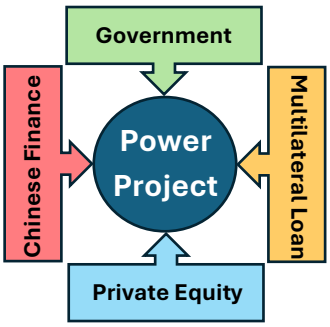


	A	B	J	K	L
48	Name of Project				Currency
49	PROJECT 1 (Distribution)	Demo Financier 1		1,608.42	USD
50	PROJECT 1 (Distribution)	Demo Financier 2		114.70	USD
51	PROJECT 1 (Distribution)	Demo Financier 3		46.24	USD
52	PROJECT 2 (Non-Renewable)	Demo Financier 4		130.50	USD
53	PROJECT 2 (Non-Renewable)	Demo Financier 5		173.25	USD
54	PROJECT 2 (Non-Renewable)	Demo Financier 6		36.40	USD
55	PROJECT 2 (Non-Renewable)	Demo Financier 7		4.30	USD
56	PROJECT 2 (Non-Renewable)	Demo Financier 8		51.75	USD
57	PROJECT 2 (Non-Renewable)	Demo Financier 9		16.40	USD
58	PROJECT 3 (Biomass)	Demo Financier 10		20.00	USD
59	PROJECT 3 (Biomass)	Demo Financier 11		121.00	USD
60	PROJECT 3 (Biomass)	Demo Financier 12		28.00	USD
61	PROJECT 3 (Biomass)	Demo Financier 13		60.00	USD
62	PROJECT 4 (Geothermal)	Demo Financier 14		3,136.31	USD
63	PROJECT 4 (Geothermal)	Demo Financier 15		71.25	USD
64	PROJECT 4 (Geothermal)	Demo Financier 16		75.00	USD
65	PROJECT 4 (Geothermal)	Demo Financier 17		67.18	USD
66	PROJECT 4 (Geothermal)	Demo Financier 18		693.85	USD
67	PROJECT 4 (Geothermal)	Demo Financier 19		278.10	USD
68	PROJECT 4 (Geothermal)	Demo Financier 20		89.15	USD
69	PROJECT 5 (Solar)	Demo Financier 21		530.64	USD
70	PROJECT 5 (Solar)	Demo Financier 22		41.00	USD
71	PROJECT 5 (Solar)	Demo Financier 23		15.00	USD
72	PROJECT 5 (Solar)	Demo Financier 24		15.83	USD
73	PROJECT 5 (Solar)	Demo Financier 25		180.56	USD
74	PROJECT 6 (Transmission)	Demo Financier 26		1,695.00	USD
75	PROJECT 6 (Transmission)	Demo Financier 27		20.03	USD
76	PROJECT 6 (Transmission)	Demo Financier 28		262.34	USD
77	PROJECT 7 (Wind)	Demo Financier 29		266.49	USD
78	PROJECT 7 (Wind)	Demo Financier 30		59.31	USD
79	PROJECT 7 (Wind)	Demo Financier 31		8.09	USD
80	PROJECT 8 (Hydro)	Demo Financier 32		55.00	USD
81	PROJECT 8 (Hydro)	Demo Financier 33		30.60	USD
82	PROJECT 9 (Battery)	Demo Financier 34		7.50	USD
83	PROJECT 9 (Battery)	Demo Financier 35		142.50	USD
84					

3. Once this is completed, we have successfully inserted financing baseline data for the volumes and sources of commitments into the MINFin Model. This data still lacks terms of financing; however this will be covered in following lectures and exercises.

2. Developing a new Financing Baseline

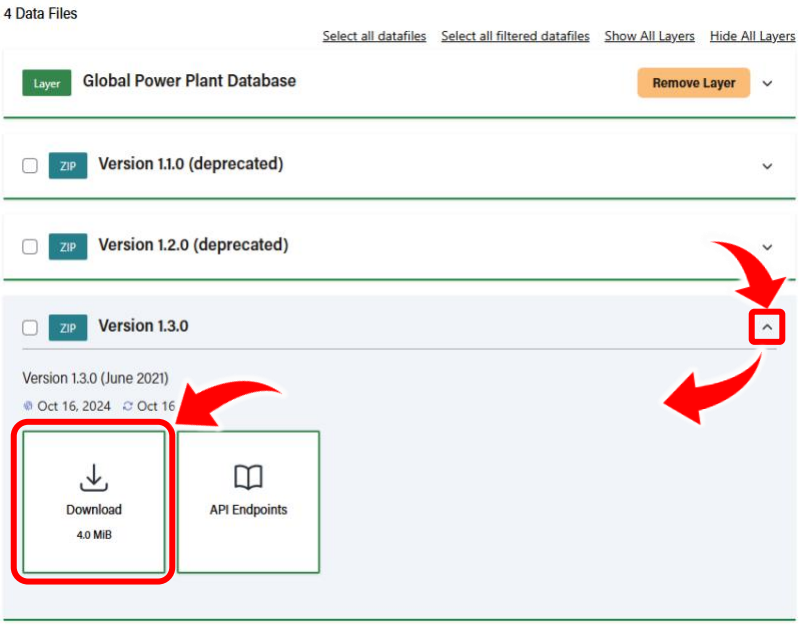
In instances where the country assessed either lacks a MINFin Demo Data Publication Sheet, or users may have chosen to generate their own financing baseline based on their own data sources, it is important to understand how to proceed.



As covered in the lecture, power projects will often use a blended structure of financiers from multiple sources. This can include national government financing, multilateral loans, Chinese finance and private equity to list a few. By separating out these independent sources of finance within MINFin we are able to assess how each source contributes to the overall capital structures and costs of capital experienced in the development of the power sector.

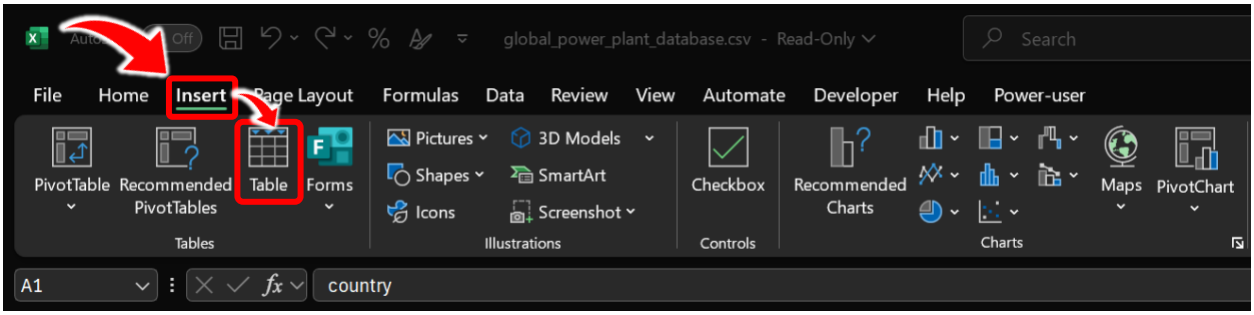
2.1 Establishing a comprehensive list of power projects

1. The first step in this process is to establish a comprehensive list of power projects developed within the country within the selected modelling time horizon. This includes both generation and grid investments, across a range of capacities. A good starting point for this data collection is the GEM or WRI Database. An example of how to download from these resources such as the WRI database:



2. A ZIP file containing the excel database of many power of the key global power projects can be downloaded here

3. Once the CSV file is opened, convert the data into a table by selecting the entire sheet using "Ctrl + A" and using the "Insert" tab and selecting "Table" ensuring that the option "My Table has Headers" is selected ☑.



4. Next simply filter the "Country" column in column B to only include projects in the target country. This will give a preliminary list of power projects within the country from which to build the financing baseline.

2.2 Identifying total project cost

1. Once you have your list of power projects well established, it is important to establish an overall project cost (this can often be found in project reports published by financiers and financial institutions such as the World Bank), or through individual google searches.

It is crucial to ensure that all financing is accounted for within a project, gaps can be identified by comparing the sum of financing accounted for against this overall investment cost for the project.

Below is a table of useful resources to aid in identifying financiers of individual power projects. This list is by no means exhaustive, and the composition of projects blended financing will likely come from project specific reports, especially for private and commercial financing. These reports should shed light on the capital structures of these projects, including Debt financing and Equity financing volumes, individual commitments from financiers (or percentages of equity financing) and the currencies in which these commitments are made.

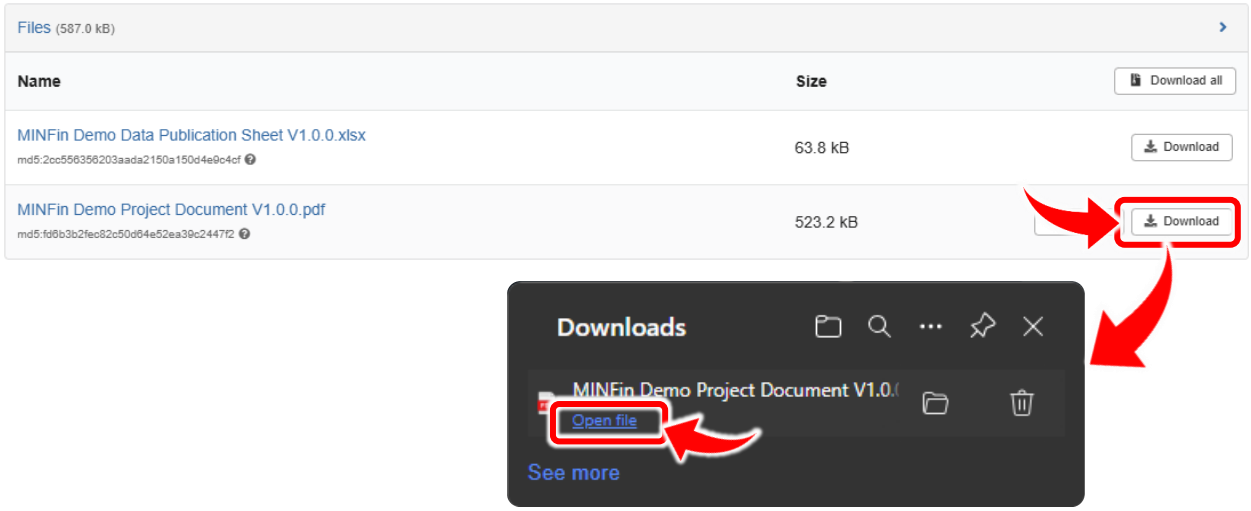
Database	Type	Coverage of energy	Type of financier	Origin of financier
WRI	Assets	Generation only	Na.	Na.
IRENA (CPI/OECD)	Finance (Renewable)	Comprehensive	Public	International
OECD DAC CRS	Finance	Electricity	Public	Int'l (OECD only)
WB-PPI	Finance	Electricity	Private/Public	International
BU China	Finance	Electricity	Public	Int'l (Chinese only)
CPI Climate Finance	Finance	Comprehensive	Public/Private	Int'l/Domestic

Other Datasets			
African Dev. Bank	Primarily Africa	InterAmerican Dev. Bank	Primarily South America
Asian Dev. Bank	Primarily Asia	Islamic Dev. Bank	Mixed (Islamic Countries)
Asian Infra. Invest. Bank	Primarily Asia	European Invest. Bank	Mixed
World Bank	Global	European Bank for Rec. Dev.	Mixed
Climate Investment Fund	Global (Climate)	Global Environment Facility	Global (Climate)

5. Once a comprehensive list of Projects, Financiers, Commitment Volumes and Currencies has been established, and input into their appropriate columns (Columns A, B, K and L respectively), users must enter project and information regarding the project characteristics (**Technology** and **Source** – E.g. | Solar | Renewable |) and financier characteristics outlined in the page 2 of this Hands-On Exercise.
6. Once this data has been collected and input into MINFin's "Financing Baseline" tab, the volumes portion of the MINFin baseline is done.

3. Adding missing volumes from project documents

1. To complete this task, you need to download an example project finance sheet from the following link.



2. Once downloaded, open the file and navigate to the first page of the document, titled "Project Sheet for 300MW Wind Project (2014)". This is a condensed preview of what many project documents will look like. We can see that this is a project overview document published by MDB1, who is co-financing through a concessional loan.

[X] Loan	[ ] Credit	[ ] Grant	[ ] Guarantee	[ ] Other:
Project ID: Demo Loan Datasheet Lending Instrument: Specific Investment Loan Lending Terms (MDB1 Concessional): 38-year maturity including 8 years' Grace period			Sectors: Power (58%), Renewable energy (34%), Public Administration (8%) Themes: Infrastructure services for private sector development (62%), Climate Change (30%), Rural Services (8%)	

3. Further down, we find additional project information about the co-financiers and their commitments. This table lists the Debt and Equity contributions from each financier. It also states, "*The project will be financed in USD denominated loans*" indicating that all volumes were committed in millions USD.

SOURCE	Commitment
Debt Finance	
(AfDB) MDB1	$186.11
(EIB)MDB2	$232.63
(KfW / AFD) Bilateral Dev.	$139.59
(CTF) Climate Fund 1	$33.23
(Standard Bank) Commercial Banks	$73.77
Total:	$665.33
Equity Financing	
BORROWER/RECIPIENT	$50.51
(AITF) Climate Fund 2	$9.97
(FMO) Bilateral Agency	$42.54
(Bank Plc.) Com Dom	$41.21
(ENGIE) Com Intl	$21.93
Total:	$166.16

4. With each commitment from each financier clearly outlined, we can start to input this data into MINFin. Financing has been provided by 5 loan facilities, and 5 equity shareholders, including the "Borrower" who we can see is in fact the National government, enacted through an SOE. For now, we do not need to account for the Grant amount when verifying if all project financing has been included, as it will be incorporated into the "Funding Baseline" later.

Borrower:
National Government

Responsible Agencies:
SOE of National Government

The project is called "300MW Wind Project (Demo)," which should be entered for all 10 commitments. Next, list the 10 named financiers, and specify the technology (Onshore Wind) and source (Renewable) for each. Finally, include the year (2014) and the financing type (Debt or Equity) for each financier.

	A	B	C	D	E	F	G
48	Name of Project	Name of Financier	Technology	Source	Year	Financing Source	Type of Finance
84	300MW Wind Project (Demo)	(AfDB) MDB1	Onshore Wind	Renewable	2014		Loan
85	300MW Wind Project (Demo)	(EIB)MDB2	Onshore Wind	Renewable	2014		Loan
86	300MW Wind Project (Demo)	(KfW / AFD) Bilateral Dev.	Onshore Wind	Renewable	2014		Loan
87	300MW Wind Project (Demo)	(CTF) Climate Fund 1	Onshore Wind	Renewable	2014		Loan
88	300MW Wind Project (Demo)	(Standard Bank) Commercial B	Onshore Wind	Renewable	2014		Loan
89	300MW Wind Project (Demo)	National Government	Onshore Wind	Renewable	2014		Equity
90	300MW Wind Project (Demo)	(AITF) Climate Fund 2	Onshore Wind	Renewable	2014		Equity
91	300MW Wind Project (Demo)	(FMO) Bilateral Agency	Onshore Wind	Renewable	2014		Equity
92	300MW Wind Project (Demo)	(Bank Plc.) Com Dom	Onshore Wind	Renewable	2014		Equity
93	300MW Wind Project (Demo)	(ENGIE) Com Intl	Onshore Wind	Renewable	2014		Equity

5. We can also easily fill in the volumes and currency data straight from this table:

	K	L
48	Volume of Finance	Currency
84	$ 186.11	USD
85	$ 232.63	USD
86	$ 139.59	USD
87	$ 33.23	USD
88	$ 73.77	USD
89	$ 50.51	USD
90	$ 9.97	USD
91	$ 42.54	USD
92	$ 41.21	USD
93	$ 21.93	USD

6. Reading further in the text we can make the following assumptions

Financing	Source	Sector	Institution	Origin
(AfDB) MDB1	Lending stated as concessional, and International so **Conc_IFI**	AfDB is funded by government commitments, so **Public**	Stated as Multilateral Bank, operated by African countries so **Multilateral Agency**	Multilateral and African so **International Other**
(EIB)MDB2	Looking at loan terms compared to Com. Banks, low rates, and International so **Conc_IFI**	EIB is funded by European government commitments, so **Public**	Stated as Multilateral Bank operated by multiple EU countries so **Multilateral Agency**	Multilateral but EU countries so **International OECD**
(KfW / AFD) Bilateral Dev.	Looking at loan terms compared to Com. Banks, low rates, and International so **Conc_IFI**	KfW and AFD are funded by German and French Governments respectively so **Public**	KfW and AFD lend from France and Germany respectively, so **Bilateral Agency**	Origins are Germany and France, both OECD countries, so **International OECD**
(CTF) Climate Fund 1	Whilst loan terms are higher, still much lower than Com. Banks, so **Conc_IFI**	CTF is funded by commitments from global governments, so **Public**	CTF, part of the Climate Investment Fund (CIF) is a **Climate Fund**	Financed by global contributions, mix of all sources, so **International Other**
(Standard Bank) Comm. Bank	Commercial loan terms, and from international sources so **Comm_Intl**	Standard bank is not government funded, and so is **Private**	Standard bank is a **Commercial Bank**	Sourced from South Africa as stated in the document, so **International Other**
BORROWER	Stated to be the National Government so **Conc_DPS**	Government funded investment, so **Public**	**National Government**	National Government so **Domestic**
(AITF) Climate Fund 2	Concessional Climate fund from international sources so **Conc_IFI**	Funded by a collection of government commitments so **Public**	Stated as a climate fund (Africa Infra. Trust Fund) so **Climate Fund**	Commitments from countries including EU and African so **International Other**
(FMO) Bilateral Agency	The FMO provides concessional financing from the Dutch Government, so **Conc_IFI**	FMO is funded by the Dutch Government, so **Public**	FMO lends directly from the Netherlands to the project, so **Bilateral Agency**	Sourced from the Netherlands so **International OECD**
(Bank Plc.) Com Dom	Bank Plc. Is a commercial domestic bank, so **Comm_Dom**	Bank Plc. is not government funded, and so is **Private**	Bank Plc. is stated as a **Commercial Bank**	Sourced from a domestic commercial bank so **Domestic**
(ENGIE) Com Intl	ENGIE is a commercial international private equity fund, so **Comm_Intl**	ENGIE is a private equity fund, not government funded so **Private**	As stated ENGIE is a **Private Equity Fund**	ENGIE is a French multinational electric utility company, so **International OECD**

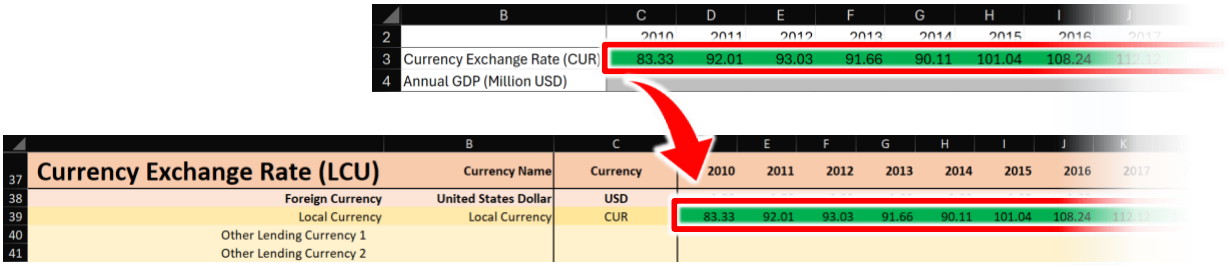
7. Once this is all extracted, we can complete the data input to produce this:

	F	G	H	I	J
84	Conc_IFI	Loan	Public	Multilateral Agency	International Other
85	Conc_IFI	Loan	Public	Multilateral Agency	International OECD
86	Conc_IFI	Loan	Public	Bilateral Agency	International OECD
87	Conc_IFI	Loan	Public	Climate Funds	International Other
88	Comm_Intl	Loan	Private	Commercial Bank	International Other
89	Conc_DPS	Equity	Public	National Government	Domestic
90	Conc_IFI	Equity	Public	Climate Funds	International Other
91	Conc_IFI	Equity	Public	Bilateral Agency	International OECD
92	Comm_Dom	Equity	Private	Commercial Bank	Domestic
93	Comm_Intl	Equity	Private	Private Equity Fund	International OECD

8. Once this is completed, the data for the volumes of finance and financier characteristics from this project have been entered into MINFin.

However, whilst this the terms of finance in this project are entirely denominated in USD, some projects will contain a blend of foreign and locally denominated loans. MINFin automatically applies user defined exchange rates to each currency in order to project costs of capital and also highlight how repayment of external debts can change based on currency projections. Whilst MINFin lets users define their own currency projections, this MINFin Demo Data Publication Sheet includes a "(Demo) Macroeconomic Data" sheet that contains a Currency Exchange data for our CUR currency. The exchange rate for USD to LCU is always 1 and can be found here, however for our other currencies we must define the rates.

To input this data into MINFin, the "**Currency Exchange Rate (LCU)**" section, for Local currency, below USD, input the abbreviation for the local currency, which in this instance is "CUR". Now to source the data, from the "(Demo) Macroeconomic Data" in the MINFin Demo Data Publication Sheet, select the "Currency Exchange Rate (CUR)" data between the columns labelled 2010 and 2070, and copy this across into the cells to the right of the "Currency Column", as shown below:



Once this has been completed, MINFin will use these currency projections to automatically translate commitments into both local and foreign denominations.

4. Visualising Historic Financing Volumes in MINFin

Once this is completed, we can take an initial look at the composition of financing in the power sector of our demo country. By navigating to the “Visualisation Dashboard” tab in the MINFin Model and selecting the visualizations under the “Historic Financing” heading, we can find visualizations of the historic financing baseline. Since data on the terms of financing for these projects has not yet been inputted from the Demo Data Publication Sheet or the MINFin Demo Projects Sheet, graphs assessing terms of financing will be empty.

Here we can see that concessional financing, especially from international sources (Conc_IFI) constitute a significant portion of financing in the historic baseline for this sector at over 70% of financing. Much of this is shown to come from Multilateral Agencies and is comprised largely of debt financing. Equity financing comes primarily from domestic sources, including private equity and national government equity investments.