RE-Powering America's Land:
A Primer for Using RE-Powering Data to Screen Sites for Renewable Potential

The U.S. Environmental Protection Agency (EPA) recognizes the overall environmental benefit of siting renewable energy projects on contaminated lands, landfills, and mine sites. To facilitate the implementation of these reuse projects, EPA's RE-Powering America's Land Initiative developed site screening tools in collaboration with the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL).

Topics

Introduction to RE-Powering Site Screening

The RE-Powering Mapper (KMZ) and the RE-Powering Screening Dataset spreadsheet (XLS) serve as preliminary screening tools for renewable energy potential at contaminated lands, landfills, and mines sites nationwide. These tools provide high-level screening results for four renewable energy technologies: solar, wind, biomass, and geothermal. Sites are vetted based on four primary characteristics:

- Renewable energy resource,
- Acreage,
- Distance to transmission lines, and
- Distance to transportation infrastructure.[1]

This reference guide provides users with tips for using the RE-Powering Screening Dataset spreadsheet, which contains detailed site information on over 60,000 contaminated lands, landfills, and mine sites. Local communities, potential developers, regulators, and other interested stakeholders are encouraged to use these tools to assess potential for future renewable energy projects on contaminated lands, landfills, and mine sites.

Examples of how this data may be helpful for RE-Powering stakeholders include, but are not limited to:

- Community stakeholders: Create a report to show all contaminated sites and/or landfills with renewable energy potential within their city or county.
- City planners: Develop a priority list of landfills with potential for solar energy development, including those with landfill gas potential or existing infrastructure.
- Renewable energy developers: Identify sites in target markets that meet requirements specific to their product offering.
- Remediation professionals: Consider potential reuse opportunities with renewable energy when evaluating and selecting remedies.

RE-Powering America's Land Initiative

Through the RE-Powering America's Land Initiative, the EPA promotes the reuse of potentially contaminated lands, landfills, and mine sites for renewable energy through a combination of tailored redevelopment tools, as well as site-specific technical support.

The Initiative aims to revitalize degraded land by promoting renewable energy as a productive end use, when aligned with the community vision for the site.

Advantages of Reuse
Potentially contaminated lands, landfills, and mine sites offer developers a unique value proposition for renewable energy deployment by:

- Leveraging existing infrastructure
- Reducing project cycle times through streamlined permitting and zoning
- Improving project economics with reduced land costs and tax incentives
- Building a sustainable land development strategy by using contaminated lands
- Gaining community support
- Protecting open space

For more information, go to:
www.epa.gov/renewableenergyland/

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[1] For additional information on the screening process or data contained in the spreadsheet, please refer to the "Data Documentation for Mapping and Screening Criteria for Renewable Energy Generation Potential on EPA and State Tracked Sites"

Exercises

RE-Powering Screening Dataset: Spreadsheet Contents & Organization

The RE-Powering Screening Dataset spreadsheet provides a more detailed view of site characteristics and renewable energy resources on over 60,000 EPA- and state-tracked sites. Tracked sites include: sites where EPA or states are involved with cleanup or reclamation; sites that have received grants from EPA or states; or sites that participate in EPA or state programs.

This information is organized into fields among five major categories:

- *Site identification*: Provides site name, location, acreage, and links to remediation programs.
- *Policy*: Indicates if site is located in a state with a Renewable Energy Portfolio Standard (RPS) or within a Renewable Energy Zone (REZ).
- *Renewable Energy Potential*: Indicates positive screening results for each renewable energy technology, from small- to utility-scale development potential.
- *Infrastructure*: Provides data on proximity to critical infrastructure and identifies nearby urban areas.
- *Renewable Energy Resource Data*: Provides quantitative resource data for solar, wind, biomass, landfill gas, and geothermal technologies.

The RE-Powering Screening Dataset spreadsheet consists of three worksheets, which appear as three different tabs in the lower left hand corner of your screen.

- *Read Me:* Provides name and detailed descriptions of all data attributes.
- *Screening Criteria:* Provides an overview of the estimated project capacity and screening criteria used.
- *Data:* Includes all the information about 60,000-plus sites currently tracked by RE-Powering and states. The information is sorted by State (ST), City, and then Site Name.

This information can be used a variety of ways: to identify sites with renewable energy potential or, conversely, to identify renewable energy opportunities for a given site.

To facilitate use of the spreadsheet, several exercises are provided to enable users to create custom lists and summary reports by using the "Filter" and "PivotTable" functions available in MS Excel.

Identifying sites with Data Filters

The RE-Powering Screening Dataset spreadsheet is provided in MS Excel format. This software includes a feature that allows users to filter large datasets for particular attributes, e.g., sites located in the State of Delaware or sites within one mile of transmission lines. This feature can be used to filter based on a single attribute or multiple attributes in combination. These instructions were written for MS Office Excel 2007.
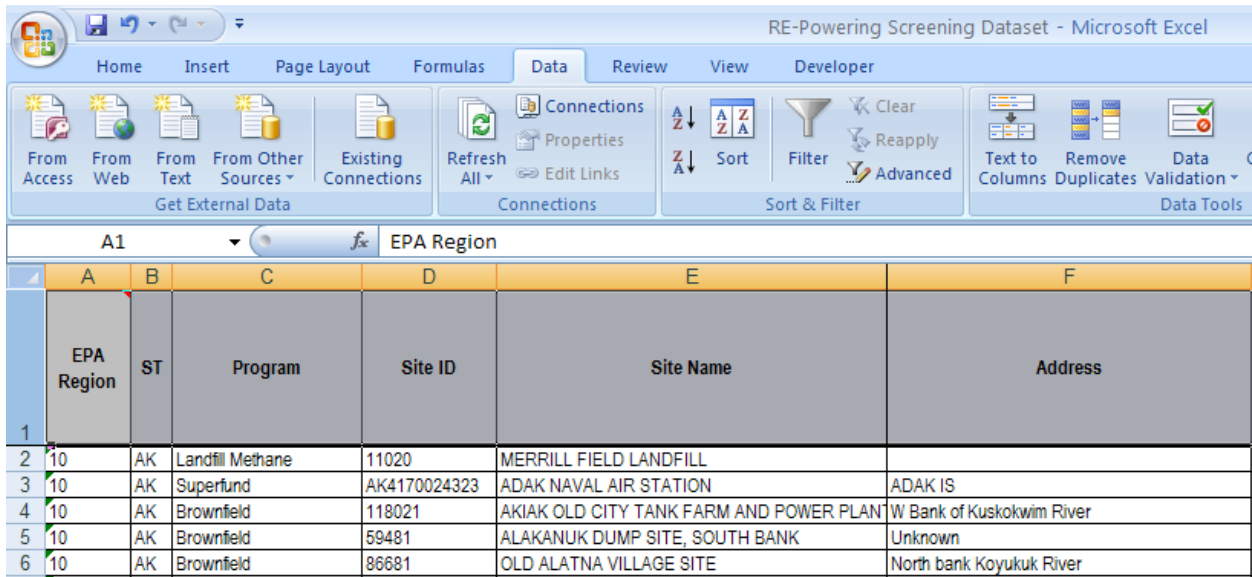
The instructions below will walk you through turning on the "Filter" function and provide brief exercises to familiarize you with its use.

How to turn on the Filter function
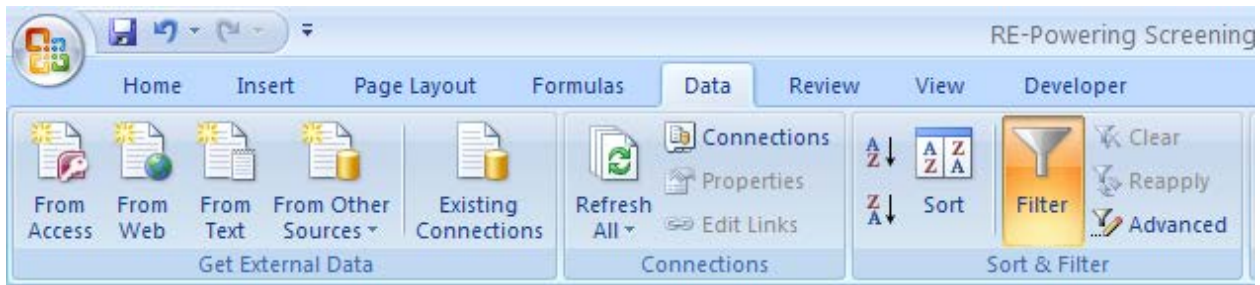
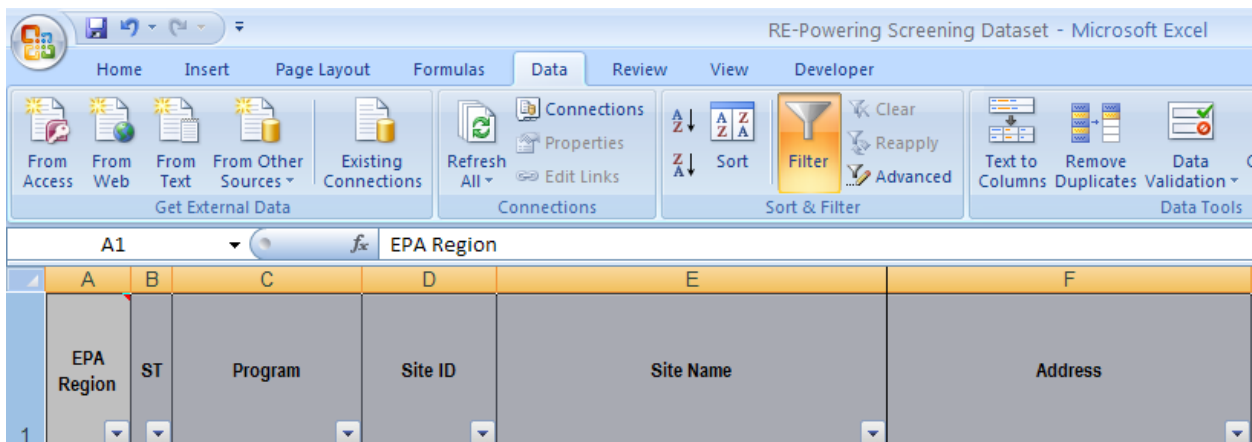1. Select Row 1 in the spreadsheet by clicking on the "1" in the row. The complete row will be highlighted.

2. On the tool ribbon, go to the "Data" tab, in Sort & Filter group, click "Filter."

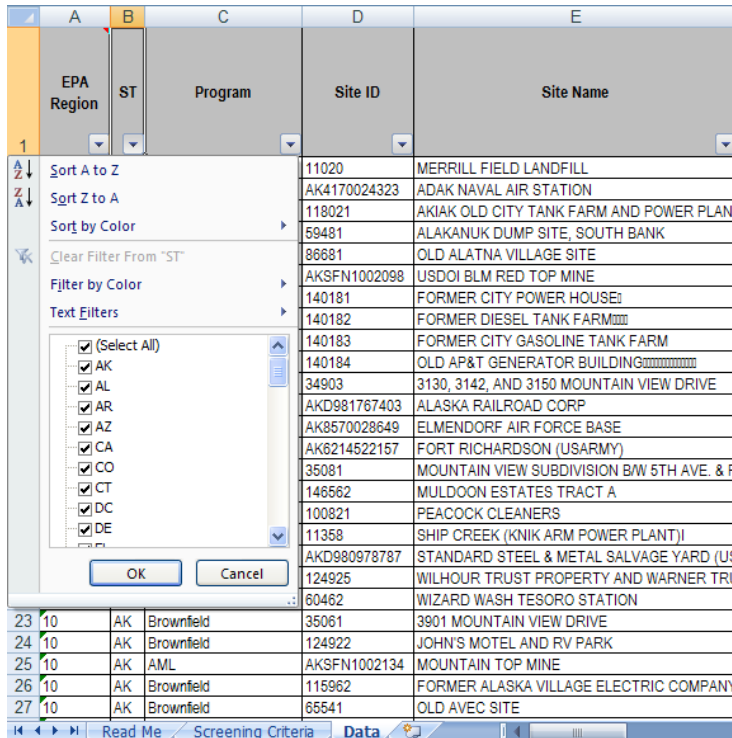3. Once enabled, an arrow will appear in Row 1 for each column.
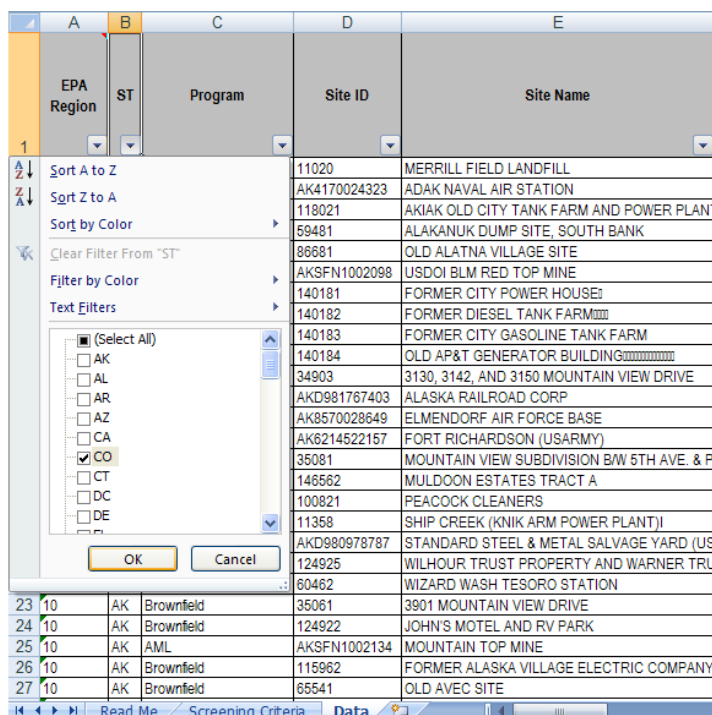
Exercise 1: How to filter for sites in your State

1. Locate *the State column labeled "ST."*
2. Click on the arrow ▼ to display the complete list of states and territories included in the dataset.

3. Uncheck the "(Select All)" default option. Scroll down and select the state(s) of interest. For this example, the filter is applied to identify sites in Colorado (CO).

4. Click "OK" to apply the filter. You will now see only sites located in the State of Colorado. In the current dataset, there are 582 Colorado sites.

EPA Region	ST	Program	Site ID	Site Name
08	CO	AML	CON000802791	GENEVA CREEK WATERSHED AREA
08	CO	Brownfield	12135	MORRISON ROAD CLEANUP
08	CO	Brownfield	12132	MOUSE TRAP STORAGE
08	CO	Brownfield	12133	WASHINGTON STREET CORRIDOR
08	CO	Brownfield	11133	HELLER
08	CO	Superfund	CO5210020769	ROCKY MOUNTAIN ARSENAL (USARMY)
08	CO	Brownfield	136964	PINK ELEPHANT

Note: Once the filter is applied, the arrow ▼ will change to a new icon with a filter and arrow ⊾ to indicate that a filter has been applied to that particular column. Highlighting in the filtered column is shown for demonstration purposes only.
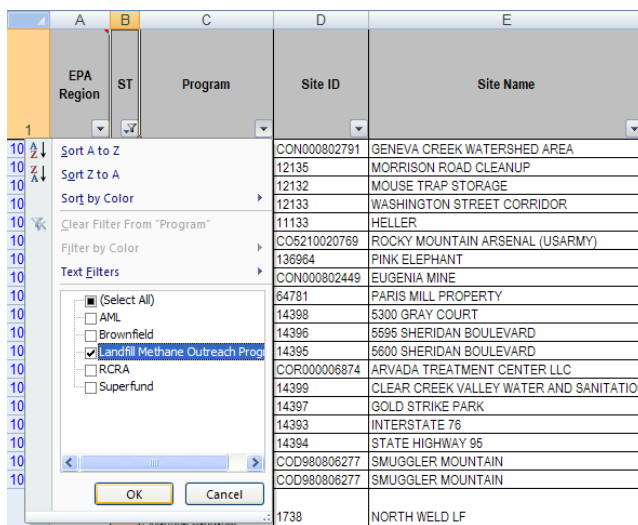
Exercise 2: How to apply multiple filters

Now that you have successfully applied a filter to show sites in a single state, add three more filters to the dataset to identify sites with the following characteristics:

- Located in the State of Colorado (CO) (Completed in Exercise 1)
- Landfills tracked through EPA's Landfill Methane Outreach Program (LMOP)
- Positive screening result for "Solar PV: Large-scale"
- Landfill status of "Closed"

Apply each filter as follows:

1. Locate the EPA/State Program column labeled, "Program" (Column B).
2. Click on the arrow ▼ to display the dropdown list. Select "Landfill Methane Outreach Program" and click "OK."

	A	B	C	D	E
1	EPA Region	ST	Program	Site ID	Site Name

Sort A to Z		CON000802791	GENEVA CREEK WATERSHED AREA
Sort Z to A		12135	MORRISON ROAD CLEANUP
Sort by Color ▶		12132	MOUSE TRAP STORAGE
Clear Filter From "Program"		12133	WASHINGTON STREET CORRIDOR
Filter by Color ▶		11133	HELLER
Text Filters ▶		CO5210020769	ROCKY MOUNTAIN ARSENAL (USARMY)
		136964	PINK ELEPHANT
■ (Select All)		CON000802449	EUGENIA MINE
☐ AML		64781	PARIS MILL PROPERTY
☐ Brownfield		14398	5300 GRAY COURT
☑ Landfill Methane Outreach Prog		14396	5595 SHERIDAN BOULEVARD
☐ RCRA		14395	5600 SHERIDAN BOULEVARD
☐ Superfund		COR000006874	ARVADA TREATMENT CENTER LLC
		14399	CLEAR CREEK VALLEY WATER AND SANITATION
		14397	GOLD STRIKE PARK
		14393	INTERSTATE 76
		14394	STATE HIGHWAY 95
OK Cancel		COD980806277	SMUGGLER MOUNTAIN
		COD980806277	SMUGGLER MOUNTAIN
		1738	NORTH WELD LF

Note: This dropdown list reflects only those options available after the application of the first filter in Exercise 1. In this example, it will show only EPA programs associated with sites in Colorado, e.g., AML, Brownfield, LMOP, RCRA, and Superfund.

3. Repeat the filtering process using the "Solar PV: Large-scale" column and by selecting "X" for positive screening results.

4. Repeat the filtering process for *Landfill Status* by selecting "Closed."

After applying these four filters, you should have narrowed the dataset from over 60,000 sites to four:

EPA Region	ST	Program	Site ID	Site Name	Solar PV: Large scale	Landfill Status
08	CO	Landfill Methane Outreach Program	1723	TEMPLETON GAP LANDFILL, INC.	X	Closed
08	CO	Landfill Methane Outreach Program	1739	DENVER REGIONAL LANDFILL (NORTH)	X	Closed
08	CO	Landfill Methane Outreach Program	1737	DENVER REGIONAL LANDFILL (SOUTH)	X	Closed
08	CO	Landfill Methane Outreach Program	1736	CENTRAL WELD COUNTY LANDFILL	X	Closed

In general, most filter-based searches will yield a greater number of sites. This exercise demonstrates the ability to use this large dataset to target a set of sites, which could be used for planning or development purposes.

Exercise 3: How to remove filters

If you would like to change your filter-based search, you may clear the filters two ways.

To remove an individual filter

1. Click on the filter icon [icon] in the lower right of the desired column header.
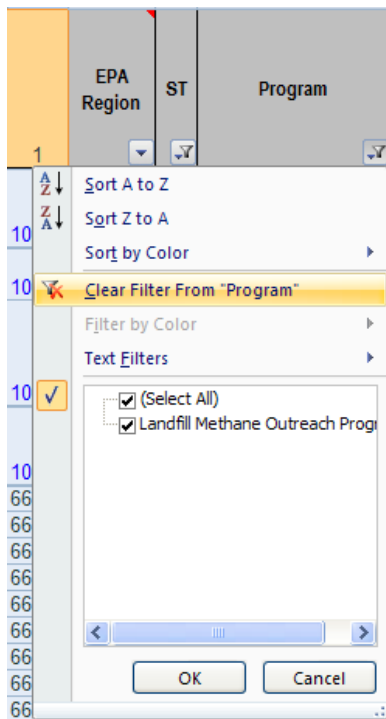
2. Click "Clear Filter from "<attribute name>," e.g., "Program" in this example. Once the filter has been removed, the arrow [icon] will reappear in that single column.

To remove all filters

1. On the tool ribbon, go to the "Data" tab, in Sort & Filter group, click "Clear."

2. Once the filters have been removed, the arrow ▼ will reappear in all affected columns. The complete dataset will once again be visible.

Creating Summary Reports with PivotTables

Pivot tables are a convenient way to view and summarize large datasets. The RE-Powering Screening Dataset spreadsheet offers many opportunities for data mining the renewable energy potential on contaminated lands, landfills, and mine sites.

The instructions below will walk you through creating a pivot table and provide brief exercises to familiarize you with their use.

How to create a PivotTable

1. On the "Data" worksheet, select the complete dataset.

   TIP: To select the complete dataset, click in Cell A1. Then, holding down the SHIFT and CTRL keys, hit the right arrow, followed by the down arrow. This will select the full data set. In this case, Cells A1 to CM66306 will be selected.

   On the tool ribbon, go to the "Insert" tab. In the Tables group, click "Pivot Table."
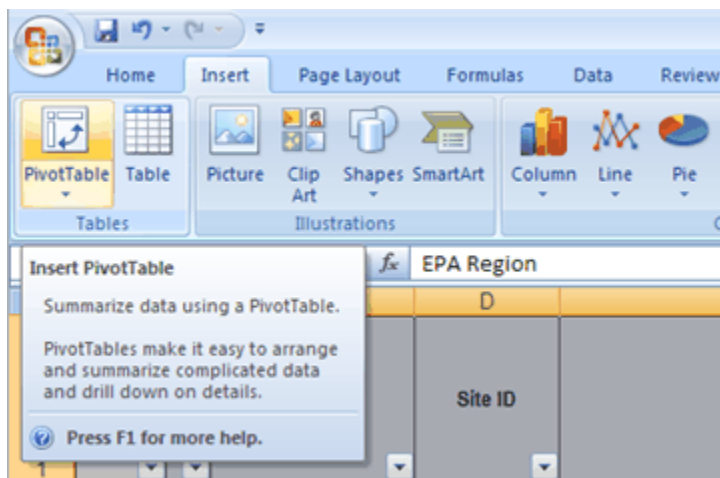
2. To create the PivotTable in a new worksheet, click "OK."
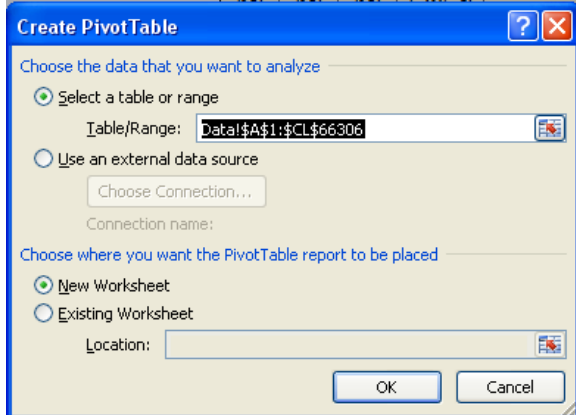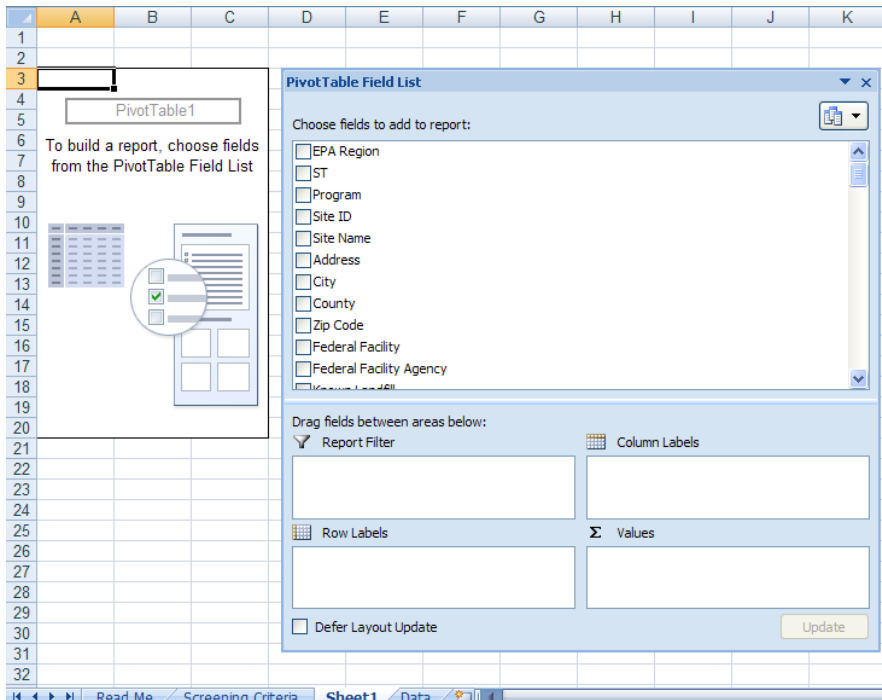

3. On a new worksheet, you will now see an empty PivotTable and a PivotTable Field List pop-up window.

TIP: The PivotTable Field List is a pop-up window that is only available when the cell or range of cells selected is within the bounds of the PivotTable. If you click outside of the PivotTable, the Field List pop-up will disappear. If you close the Field List and wish to reopen it, click in the PivotTable in order to show the PivotTable Tools in the ribbon. On the "Options" tab, in the "Show/Hide" group, click "Field List."
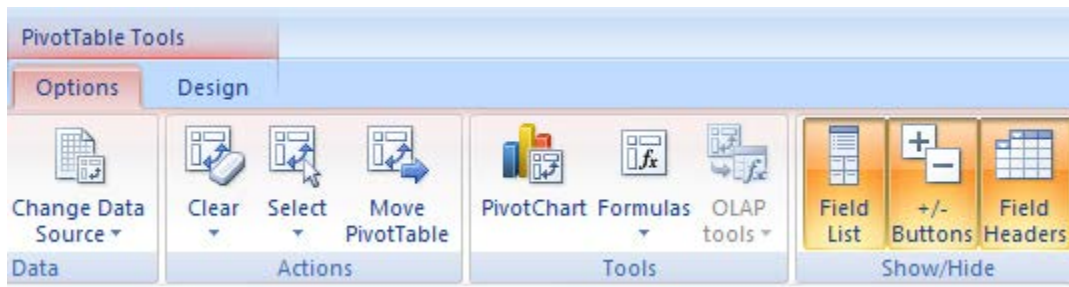
Exercise 4: How to create a summary table for Utility-Scale Solar Potential by EPA Region

1. In the PivotTable Field List, click on "EPA Region" and drag it to "Row Labels" in the bottom left corner. Once complete, the PivotTable will list all ten EPA regions in the column to the left.

2. For this example, scroll down the field list and select "Solar PV: Utility Scale." Drag and drop it into "Values" in the bottom right corner of the PivotTable Field List.

Once complete, the PivotTable will show a second column labeled "Count of Solar PV: Utility scale." This value represents the number of sites in each region with Utility-Scale Solar PV potential.

Row Labels ▼	Count of Solar PV: Utility scale
01	
02	19
03	
04	1
05	
06	116
07	21
08	175
09	1079
10	169
Grand Total	**1580**

Exercise 5: How to add additional attributes to the PivotTable

While it is useful to know the number of sites with utility-scale solar PV potential, you may also want to see the estimated solar capacity or how much solar could be installed on these sites.

1. Because you want to show values only associated with sites that screened positively for "Solar PV: Utility scale," you will need to add this attribute as a filter. Scroll down the field list and select "Solar PV: Utility scale". Drag and drop it into "Report Filter" in the top left corner of the PivotTable Field List.

Once complete, a new row will now show above the PivotTable, indicating a filter for "Solar PV: Utility scale" is available, but not yet applied as indicated by the "(All)" designation and the arrow dropdown.

Solar PV: Utility scale	(All)
Row Labels	Count of Solar PV: Utility scale
01	
02	19
03	
04	1
05	
06	116
07	21
08	175
09	1079
10	169
Grand Total	1580

To apply the filter, click on the arrow and select "X". Click Ok to apply the filter.

Once the filter is applied, the PivotTable will no longer show EPA Regions where sites did not meet the screening criteria for Utility-Scale Solar PV. You will now see that Regions 1, 3 and, 5 are no longer listed.

Solar PV: Utility scale	X
Row Labels	Count of Solar PV: Utility scale
02	19
04	1
06	116
07	21
08	175
09	1079
10	169
Grand Total	1580

2. Scroll down the field list and select "Estimated Solar PV Capacity Potential." Drag and drop it into "Value" in the bottom right corner of the PivotTable Field List below "Count of Solar PV: Utility scale."

Once complete, a new column will now show in the PivotTable, titled "Count of Estimated Solar PV Capacity Potential (MW)." Because it is displaying the count, the values will match those shown in "Count of Solar PV: Utility scale."

Solar PV: Utility scale X		
	Values	
Row Labels	**Count of Solar PV: Utility scale**	**Count of Estimated Solar PV Capacity Potential (MW)**
02	19	19
04	1	1
06	116	116
07	21	21
08	175	175
09	1079	1079
10	169	169
Grand Total	**1580**	**1580**

3. To display the cumulative "Estimated Solar PV Capacity Potential (MW)," the PivotTable Value needs to be changed from "Count" to "Sum." Begin by clicking on the arrow on the field description.
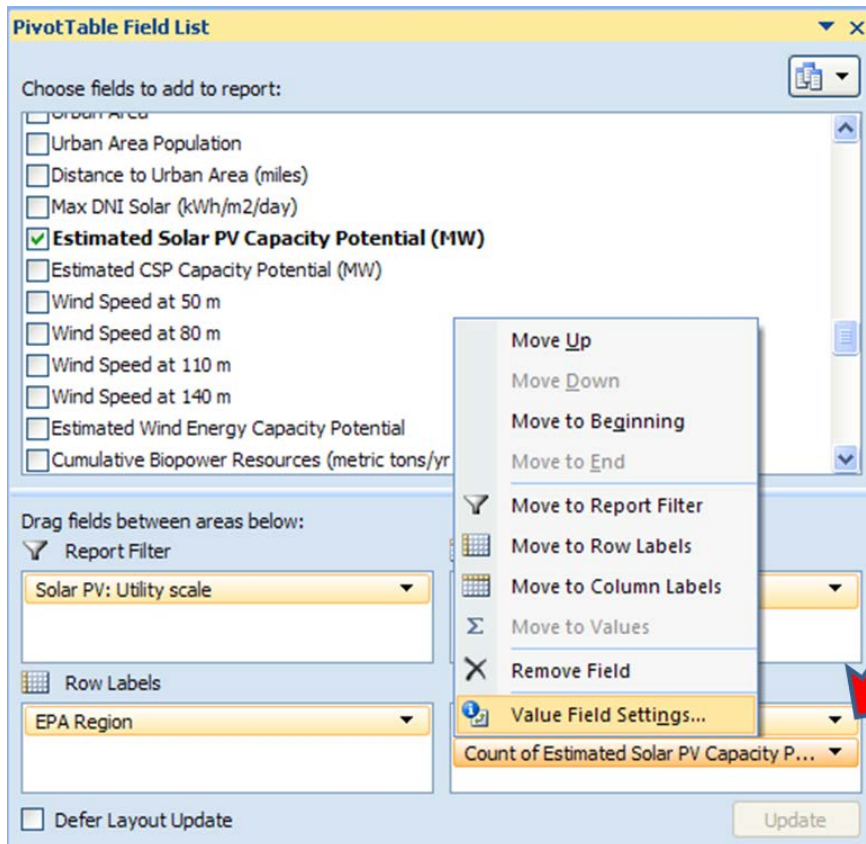
4. On the pop-up menu, click the "Value Field Settings…" option, which is at the bottom of the menu.
5. Select "Sum" from the "Summarize value field by" options in the pop-up window. Click OK.
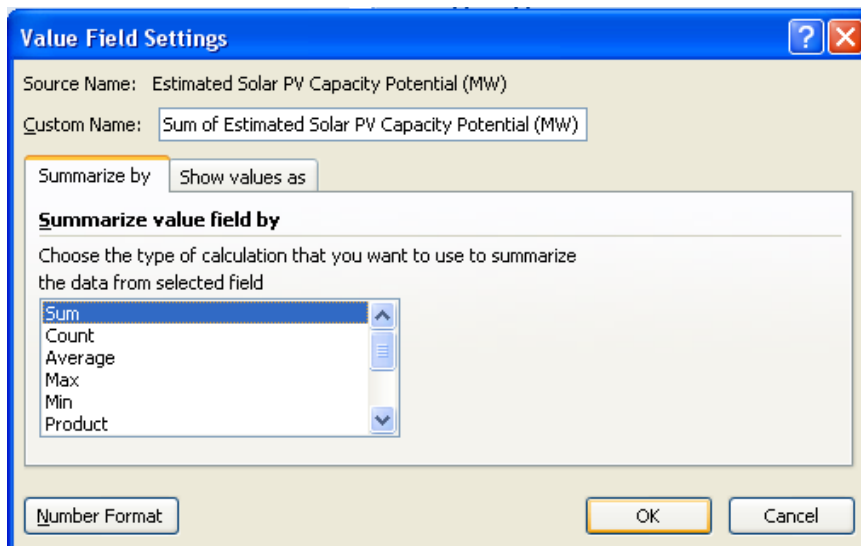
Once complete, the PivotTable will update to show the cumulative "Estimated Solar PV Capacity." With the "Solar PV: Utility scale" filter applied, this represents the estimated capacity only at sites that met the associated screening criteria.

Solar PV: Utility scale	X	
	Values	
Row Labels	**Count of Solar PV: Utility scale**	**Sum of Estimated Solar PV Capacity Potential (MW)**
02	19	575
04	1	778
06	116	599,844
07	21	5,792
08	175	354,369
09	1079	2,696,631
10	169	252,054
Grand Total	**1580**	**3,910,044**

Exercise 6: How to add details within a PivotTable

From the summary level, having the ability to view more specific data is often helpful to gain a better understanding of the main drivers in the data. In this example, you will now add two layers below the EPA Region: (i) State; (ii) Site Name.

1. Select "ST" from the field list. Drag and drop it into "Row Labels" in the bottom right corner of the PivotTable Field List below "EPA Region."

PivotTable Field List

Choose fields to add to report:

- ☑ EPA Region
- ☑ ST
- ☐ Program
- ☐ Site ID
- ☐ Site Name
- ☐ Address
- ☐ City
- ☐ County
- ☐ Zip Code
- ☐ Federal Facility
- ☐ Federal Facility Agency
- ☐ Known Landfill

Drag fields between areas below:

▽ Report Filter
- Solar PV: Utility scale

▦ Column Labels
- Σ Values

▦ Row Labels
- EPA Region
- ST

Σ Values
- Count of Solar PV: Utility scale
- Sum of Estimated Solar PV Capacity Pot...

☐ Defer Layout Update   Update

Once complete, the PivotTable will display the data by EPA Region, then by State.

Row Labels	Values Count of Solar PV: Utility scale	Sum of Estimated Solar PV Capacity Potential (MW)
02	19	575
PR	19	575
04	1	778
FL	1	778
06	116	599,844
NM	40	552,609
OK	36	17,805
TX	40	29,431
07	21	5,792
KS	15	2,699
NE	6	3,094
08	175	354,369
CO	89	137,994
MT	7	54,518
SD	8	1,751
UT	53	157,867
WY	18	2,238
09	1079	2,696,631
AZ	69	720,733
CA	789	1,722,991
HI	192	88,509
NV	29	164,398
10	169	252,054
ID	34	8,256
OR	131	183,874
WA	4	59,924
Grand Total	1580	3,910,044

2. To add the site level information, select "Site Name" from the field list. Drag and drop it into "Row Labels" in the bottom right corner of the PivotTable Field List below "EPA Region" and "ST."

Once complete, the PivotTable will now show each Site Name below the EPA Region and State. For illustration purposes, only a subset of results for Region 6 in New Mexico are shown, while results for other regions can be viewed using by clicking on the "+" mark to expand the information in the table under each EPA Region.

Solar PV: Utility scale		X	▾▾

		Values	
Row Labels	▾	Count of Solar PV: Utility scale	Sum of Estimated Solar PV Capacity Potential (MW)
⊞ 02		19	575
⊞ 04		1	778
⊟ 06		116	599,844
⊟ NM		40	552,609
27 SOW AFSOC USAF CANNON AFB NM		1	750
AT&SF (ALBUQUERQUE)		1	15
BOSTON HILL		1	83
CAMINO REAL LANDFILL		1	21
CERRILLOS GRAVEL PITS		1	33
CERRILLOS HILLS MINING DISTRICT		1	72
CERRO COLORADO LF		1	60
CHEVRON QUESTA MINE		1	1,460
DEL NORTE GUN CLUB		1	9
FORMER (OR SOUTH) EUBANK LANDFILL		1	14
FORMER MUNICIPAL LANDFILL		1	50
FORT WINGATE DEPOT ACTIVITY		1	3,635
GANDY MARLEY INC TRIASSIC PARK		1	80
HOLLOMAN AIR FORCE BASE		1	9,940
KIRTLAND AFB		1	8,593
LEE ACRES LANDFILL (USDOI)		1	10
LOS ANGELES LANDFILL		1	13
NASA JSC WHITE SANDS TEST FACILITY		1	10,000
NAVAJO REFINING COMPANY LLC		1	123
NORTHEASTERN NEW MEXICO REGIONAL LANDFILL		1	72

RE-Powering America's Land Initiative: Additional Tools & Resources

RE-Powering Mapper

The spreadsheet discussed in this reference guide is one component of the RE-Powering Mapper tool. The components and associated documentation include:

- RE-Powering Mapper
  - o RE-Powering Mapper: Google Earth overlay with RE-Powering Screened Sites
  - o RE-Powering Screening Dataset
  - o Data Documentation for Mapping and Screening Criteria for Renewable Energy Generation Potential on EPA and State Tracked Sites
  - o RE-Powering Screening Results: National Maps by Technology
  - o Fact Sheets
    - ▪ RE-Powering Mapper
    - ▪ RE-Powering Solar Technologies
    - ▪ RE-Powering Wind Technologies
    - ▪ RE-Powering Biomass Technologies
    - ▪ RE-Powering Geothermal Technologies

Other Site Screening & Feasibility Assessment Tools

- Site Screening
  - o RE-Powering Solar Decision Tree
  - o RE-Powering Wind Decision Tree
- EPA-NREL Feasibility Studies