

Water Demand Projections for Power Generation in Texas

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1. Report Document File (no subfolder)

ThermoelectricWaterProjection_FINAL.pdf: Full text of final report including Appendices.

ThermoelectricWaterProjection_FINAL.doc: Full text of final report, in editable format, not including full Appendices.

2. Description of ArcGIS Files (in subfolder “GIS”)

The ArcGIS files included in the CD-ROM are described as follows:

There are three geodatabase files in subfolder “\GIS\GDBs”:

1. ElecGenAndWaterUse – This is 2006 data for electricity generation (historical from the EIA) and the official estimate of water consumption (ac-ft) for 2006.

2. TWDB_FutureProjectionFinalData_Total – This database contains all electricity and water projections for every scenario and all years when *considering all electricity generation in Texas*.
3. TWDB_FutureProjectionFinalData_Nonindus - This database contains all electricity and water projections for every scenario and all years when *neglecting on-site industrial electricity generation in Texas*.

The columns in the geodatabases are labeled and described here **for years 2020-2060:**

Column Heading	Description
County	The county for which the data are valid.
RWPA	The regional water planning area that governs the county of interest.
AC_FT_NL	This is the acre-feet of water consumed for the <i>N</i> th low scenario “NL”.
PCWATER_NL	This is the percentage of water consumed for power generation in Texas for the <i>N</i> th low scenario “NL”.
MWH_NL	This is the electricity generated (in MWh) for the <i>N</i> th low scenario “NL”.
PCMWH_NL	This is the percentage of electricity generated in Texas for the <i>N</i> th low scenario “NL”.
AC_FT_NBAU	This is the acre-feet of water consumed for the <i>N</i> th business-as-usual scenario “NBAU”.
PCWATER_NB	This is the percentage of water consumed for power generation in Texas for the <i>N</i> th business-as-usual scenario “NBAU”.
MWH_NBAU	This is the electricity generated (in MWh) for the <i>N</i> th business-as-usual scenario “NBAU”.
PCMWH_NBAU	This is the percentage of electricity generated in Texas for the <i>N</i> th business-as-usual scenario “NBAU”.

The columns in the geodatabases are labeled and described here **for years 2006-2010 and all scenarios for 2015:**

Column Heading	Description
County	The county for which the data are valid.
RWPA	The regional water planning area that governs the county of interest.
AC_FT	This is the acre-feet of water consumed for the <i>N</i> th scenario as indicated by the shapefile name itself. For example, shapefile name “TWDBFutureProjectionFinalData_Total_2015_1BAU” is the file for the Scenario 1 business-as-usual case in year 2015 when considering all generation units in Texas.
PERCWATER	This is the percentage of water consumed for power generation in Texas for the <i>N</i> th scenario as indicated by the shapefile name itself.
MWH	This is the electricity generated (in MWh) for the <i>N</i> th scenario as indicated by the shapefile name itself.
PERCMWH	This is the percentage of electricity generated in Texas for the <i>N</i> th scenario as indicated by the shapefile name itself.

There are GIS shapefiles files in subfolder “\GIS\shapefiles”. For each filename there is the associated .dbf, .prj, .sbn, .sbx, .shp, and .shx file for loading into ArcGIS. The shapefiles were used to generate the geodatabases. The years of the data are designated in the filenames. For example “TWDBFutureProjectionFinalData_Nonindus_2010.dbf” contains the water consumption projection data for the year 2010 when concerning only the non-industrial electricity generation sources.

3. Description of Excel Files used for final calculations (no subfolder)

TWDBDataCalculations_FINAL.xls: This Excel file is composed of worksheets (e.g. “*MatlabInput-2008*” for year 2008 power plant generation and water consumption data) that include each power plant that is considered in each projection year (2007, 2008, 2009, 2010, and 2015 for each scenario). Assumed capacity factors for each fuel type are based upon the total electricity projection and number of power plants. Finally the total MWh of electricity generation and ac-ft of water consumption is calculated for each power plant in the projected year.

Worksheet “NewPlants_2007-2018” lists all new plants that were added for years after 2006.

Worksheet “ElecGenAndWaterUse-2006-WORKING” has the raw data for 2006 power plant generation and water consumption information that is the basis for all future projections.

Worksheet “ElecGenAndWaterUse-2006-FINAL” is a simplified version for printing purposes that also neglects spurious information. This worksheet is the exact same information as exists in Appendix C.1 of the final report.

TWDBFutureProjectionFinalData_Total.xls: This file houses all results for water consumption projections for each year and scenario analyzed. The results for each year are indicated by the worksheet names (2006, 2007, 2008, 2009, 2010, 2015-1L, 2015-1BAU, 2015-2L, 2015-2BAU, 2015-3L, 2015-3BAU, 2015-4L, 2015-4BAU, 2020, 2030, 2040, 2050, and 2060). The worksheet “*TX Summary*” has all of the results aggregated by year and Regional Water Planning Group. The worksheets “*RWPG Ac-ft*” and “*RWPG MWh*” show county level data for each year and scenario analyzed.

TWDBFutureProjectionFinalData_nonindus.xls: Same information as in “TWDBFutureProjectionFinalData_Total.xls” but while neglecting the electricity and water consumption contribution from all industrial facilities that are classified by the North American Industrial Classification System as industrial.

TWDBProjections_Scenario1.xls: For projection Scenarios 1L and 1BAU, this file performs all of the calculations for the amount of electricity generated from

each generation technology as well as the carbon dioxide emissions. The worksheets of this file are shown in Appendix A.

TWDBProjections_Scenario2.xls: For projection Scenarios 2L and 2BAU, this file performs all of the calculations for the amount of electricity generated from each generation technology as well as the carbon dioxide emissions. The worksheets of this file are shown in Appendix A.

TWDBProjections_Scenario3.xls: For projection Scenarios 3L and 3BAU, this file performs all of the calculations for the amount of electricity generated from each generation technology as well as the carbon dioxide emissions. The worksheets of this file are shown in Appendix A.

TWDBProjections_Scenario4.xls: For projection Scenarios 4L and 4BAU, this file performs all of the calculations for the amount of electricity generated from each generation technology as well as the carbon dioxide emissions. The worksheets of this file are shown in Appendix A.

4. Description of Matlab File (no subfolder)

TWDB_MatlabCalculator.m: This file is coded and run using Matlab version 7.4.0, release 2007a.

This file takes the input from the Excel file “TWDBDataCalculations_FINAL.xls” for each year projected in the near term (2007, 2008, 2009, 2010, and 2015 for each scenario). This file IS NOT used for projections for years after 2015 as the input electricity generation is from the files *TWDBProjections_Scenario1.xls*, *TWDBProjections_Scenario2.xls*, *TWDBProjections_Scenario3.xls*, and *TWDBProjections_Scenario4.xls*.

The output from this file is put into the appropriate worksheets of the Excel files *TWDBFutureProjectionFinalData_Total.xls* and *TWDBFutureProjectionFinalData_nonindus.xls*.

NOTE: The use of the file can be bypassed. A major reason for the existence of this Matlab file is to easily accommodate changes and additions to the power plants and capacity factors. One can directly input desired quantities of MWh generated for each power plant into the results Excel files and calculate the ac-ft consumed.

5. Description of ERCOT data and files (in subfolder “ERCOT”)

2008 Planning Long-Term Hourly Demand Energy Forecast Final.doc

– ERCOT document that discusses the 10 year projections for electricity demand

ERCOT2008CapacityDemandReserveReportFinal.xls – ERCOT document discussing existing power plant capacity and 5-year future capacity projections

6. Description of TCEQ data and files (in subfolder “TCEQ”)

SteamElectric-WaterRightsAndUse-TCEQ.xls – Spreadsheet document that reports the water diversion, consumption, and return as reported to the TCEQ for a large number of electric power facilities for the years 2001-2006. These data were provided to the authors upon request.

SteamElectricWaterUse_RioGrandeWM Area-TCEQ.xls - Spreadsheet document that reports the water diversion, consumption, and return as reported to the TCEQ for specific electric power facilities residing in the Rio Grande Watermaster area for the years 1996-2006. These data were provided to the authors upon request.

South Texas Watermaster (TCEQ) water use data:

For a few power plant facilities residing within the South Texas Watermaster area, the following documents listing water usage data were provided by the TCEQ:

2161.doc – City Public Service of San Antonio, Arroyo Seco

2162.doc – City Public Service of San Antonio, Calaveras Creek

3859.doc – South Texas Electric Coop, Inc., San Marcos River

3861.doc – E. I. DuPont de Nemours & Co., Guadalupe River

4505.doc – Nueces Bay WLE, L. P., Tule Lake Channel

5145.doc – San Miguel Electric Cooperative Inc., Hog Creek

5485.doc – Victoria WLE, L. P., Guadalupe River

5486.doc – Coletto Creek power facility

7. Description of TWDB data and files (in subfolder “TWDB”)

SteamElectricGroundwater-TWDB.xls – Spreadsheet document that reports the groundwater intake for various power plant facilities that report groundwater intake to the Texas Water Development Board

0704830756_commentlt(c)r_TWDBOfficialCommentsOnDraft.doc – This is the letter sent by the TWDB to the Bureau of Economic Geology detailing comments regarding the first draft of the report on Water Demand for Power Generation.

8. Description of EIA data and files (in subfolder “EIA”)

Because the “end goal” calculation for the water demand projection for electric power generation in Texas is largely based upon the factor of ‘gallons per kWh generated’, data from the Energy Information Administration (EIA) were used to obtain the amount of kWhs generated during various years. The EIA data files used are designated here.

Subfolder “EIA-860”:

EIA-860_2006 – Application file that runs to produce a set of Excel spreadsheets that describe the electric power generating units of the United States and from which the units in Texas can be extracted. The data are from the 2006 file.

Subfolder “EIA-906920”:

This subfolder contains .zip and application files that expand to produce the electrical generation data, in MWh, for all electric generation in the United States. Texas-based units can be extracted.

f906920_2001.zip – Generation data from 2001.

f906920_2002.zip – Generation data from 2002.

f906920_2003.zip – Generation data from 2003.

f906920_2004.zip – Generation data from 2004.

f906920_2005.zip – Generation data from 2005.

f906920_2006 – Application file with generation data from 2006.

Subfolder “EIA-767”:

EIAForm767_2005.zip – Raw data from the EIA form 767 that includes water withdrawal, consumption, and discharge from power plants.

F767_COOLING_SYSTEM_2005-and-SIU2003Data-TXOnly.xls –

Spreadsheets that compile data from EIA Form 767 of 2005 (water usage and electricity generation) and create many of the plots used in Chapter 1 of the Final report. These data and results are not used for the water projections in the final report, but are provided for reference to data that exists and must be reported to a federal agency.

9. Description of Consultant Report to Bureau of Economic Geology (no subfolder)

ConsultantReport_BaierAndWalden.doc – This report describes the results of efforts by consultants Steve Walden and Russ Baier. Mr. Baier and Mr. Walden contacted several power generation facility owners via phone and e-mail questionnaire in an attempt to verify water use data that was reported to the Energy

Information Administration on form 767. This report describes the results of their inquiries.