

South Africa - Domestic Electrical Load Survey 1994-2014

Eskom, University of Cape Town, University of Stellenbosch

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Identification

SURVEY ID NUMBER

zaf-eskom-su-uct-dels-1994-2014-v1

TITLE

Domestic Electrical Load Survey 1994-2014

COUNTRY

Name	Country code
South Africa	zaf

STUDY TYPE

Household Survey [hh]

SERIES INFORMATION

Eskom, Stellenbosch University & University of Cape Town. Domestic Electrical Load Survey 1994-2014 [dataset]. Version 1. Johannesburg: Eskom, Cape Town: UCT, Stellenbosch: SU [producers], 2014. Cape Town: DataFirst [distributor], 2019. DOI: <https://doi.org/10.25828/kzer-gd88>

ABSTRACT

This dataset contains the survey data collected as a component of the National Rationalised Specification Load Research (NRSLR) Programme. The NRSLR Programme is a joint academic-public-private research effort to collect electricity consumption data to inform South Africa's electrification strategy. The survey, initially known as the National Load Research Tracking Study, was undertaken from 1994 to 2014 and covered South Africa and Namibia. Two questionnaires were used for survey data collection, one from 1994 - 1999 and one from 2000 - 2014.

The NRS Load Research Programme was started in 1994 to provide inputs towards policy development and technical design guidelines for the domestic electricity distribution business in South Africa. The programme was overseen by the National Rationalised Specification (NRS) 034 Working Group at Eskom. Under this programme the Domestic Electrical Load (DEL) Study (also referred to as the Domestic Load Research Project) was designed and managed to collect electricity meter readings and conduct an annual socio-demographic survey of metered households. The resulting DEL data collection and research outputs present a collaborative, multi-party public-academic-private collaboration.

Initiated by Dr Ron Herman (Stellenbosch University) and Prof. Trevor Gaunt (University of Cape Town), the study was promoted by the NRS 034 Working Group established within Eskom for this purpose. Early funders and collaborators included the Department of Minerals and Energy Affairs (now Department of Energy), the Council for Scientific and Industrial Research, as well as Stellenbosch, eThekweni and Nelson Mandela Bay Municipalities. From 1994 to 2009 eight municipalities contributed to data collection. Eskom Research, Testing and Development became actively involved in the study in 1997. Eskom survey data is only available from 2000. From 2001 onwards Eskom was the major data contributor and funder of the study. Prior to 1994, the National Energy Council and Development Bank of Southern Africa funded the development of the data loggers used in the study, as well as early research efforts by Dr Ron Herman and J.J. Kritzinger that influenced the study.

This study made a major contribution to the electrification of South African households and enabled Eskom and municipalities to accurately forecast and right-size new power transmission and distribution infrastructure. The research outputs in power engineering that emerged from the data collected in this study, such as the Hermann-Beta distribution and the Geo-based Load Forecasting Standard, informed the design of South Africa's power system and have been used in the design of power grids in other developing countries.

KIND OF DATA

Sample survey data

UNIT OF ANALYSIS

Households and individuals

Version

VERSION DESCRIPTION

v1: edited, anonymised data for licensed distribution

VERSION DATE

2019-05-13

VERSION NOTES

Version 1

Scope

NOTES

The scope of the South African Domestic Electrical Load Survey data includes:

Households: Household characteristics, occupant demographics of gender and age, education, employment, income, income sources, number of household occupants with income, dwelling ownership, gender of head of household,

Dwelling: Dwelling characteristics, wall material, roof material, floor area, ceiling, insulation, rooms, water source, out-buildings, circuit breaker, business use

Appliances: Appliance characteristics, stove, hotplate, kettle, heater, iron, geyser, washing machine, TV, HiFi radio, lights, fridge, freezer, microwave, tumble dryer, broken appliances, appliance usage

Behaviours: Cooking, heating, alternative fuels, paraffin, gas, wood, charcoal, coal,

Electricity: Time electrified, power quality, lights dimming, power outages, power trips

KEYWORDS

Keyword
electrical
household
load data
domestic
electrification
power quality
electricity
consumption
energy
rural
residential
appliance

Coverage

GEOGRAPHIC COVERAGE

The study had national coverage.

GEOGRAPHIC UNIT

The lowest unit of geographic aggregation is suburb/settlement.

UNIVERSE

The survey covers electrified households that received electricity either directly from Eskom or from their local municipality. Particular attention was devoted to rural and low income households, as well as surveying households electrified over a

range of years, thus having had access to electricity from recent times to several decades.

Producers and sponsors

PRIMARY INVESTIGATORS

Name	Affiliation
Eskom	Government of South Africa
University of Cape Town	
University of Stellenbosch	

PRODUCERS

Name	Affiliation	Role
Schalk Heunis	Enerweb	[Technical assistance in] sampling methodology/selection, data processing, data quality control, statistical analysis, data analysis (1995 - 2014)
Wiebke Toussaint	University of Cape Town	[Technical assistance in] data science, data stewardship, data archiving, data publishing (2017 - 2019)
Council for Scientific and Industrial Research	University of Cape Town	Technical assistance
Marcus Dekenah Consulting	University of Cape Town	Data collection, Technical assistance

FUNDING AGENCY/SPONSOR

Name	Abbreviation	Role
Department of Minerals and Energy Affairs (now: Department of Energy)	DMEA	Funder from 1994 - 1997
Eskom Research	Eskom	Funder from 1998 - 2014
South African National Energy Development Initiative	SANEDI	Funder in 2019 for data archiving

OTHER IDENTIFICATIONS/ACKNOWLEDGMENTS

Name	Affiliation	Role
City of Cape Town	Government of South Africa	provided data loggers and human resources for data collection (1997 - 2006)
City of Johannesburg	Government of South Africa	provided data loggers and human resources for data collection (1996 - 2000)
City of Tshwane	Government of South Africa	provided data loggers and human resources for data collection (2001 - 2003, 2005 - 2009)
eThekweni Municipality	Government of South Africa	provided data loggers and human resources for data collection (1995, 1997 - 2002, 2005, 2006)
Msunduzi Municipality	Government of South Africa	provided data loggers and human resources for data collection (1996, 1997)
Mantsopa Municipality	Government of South Africa	provided data loggers and human resources for data collection (1996, 1997)
Nelson Mandela Bay Municipality	Government of South Africa	provided data loggers and human resources for data collection (1995, 1997 - 2006)
Stellenbosch Municipality	Government of South Africa	provided data loggers and human resources for data collection (1994)

Sampling

SAMPLING PROCEDURE

The household surveys were performed in addition to electrical metering to provide socio-demographic, dwelling, and economic information on the households. The household survey was thus guided by the physical requirements and constraints of domestic electrical load metering. An overview of the sampling methodology for the load metering is described in the metadata for the DELMS dataset. The annual sample design is detailed in project reports (external resources of the DELMS dataset).

DEVIATIONS FROM THE SAMPLE DESIGN

Every year before the winter survey collection period, site referencing was done to ensure that data loggers were metering the correct households. In the case where errors were encountered (for example if a logger or wire had been moved and reconnected incorrectly after a routine municipal maintenance procedure), the household to be surveyed was updated to correspond with the household that had been metered. Thus the target list for the household surveys was established and validated every year.

RESPONSE RATE

Survey enumerators were instructed to obtain at least an 80% response rate within a particular location (suburb or settlement). Revisits would be done until this target was reached and individual homes were revisited up to 3 times.

WEIGHTING

Data is provided as is and no weightings have been applied.

Data Collection

DATES OF DATA COLLECTION

Start	End	Cycle
1995-05-01	1995-08-31	G1994
1995-08-31	1996-05-01	G1995
1996-08-31	1997-05-01	G1996
1997-08-31	1998-05-01	G1997
1998-08-31	1999-05-01	G1998
1999-08-31	2000-05-01	G1999
2000-08-31	2001-05-01	G2000
2001-08-31	2002-05-01	G2001
2002-08-31	2003-05-01	G2002
2003-08-31	2004-05-01	G2003
2004-08-31	2005-05-01	G2004
2005-08-31	2006-05-01	G2005
2006-08-31	2008-05-01	G2006
2008-08-31	2009-05-01	G2008
2009-08-31	2010-05-01	G2009
2010-08-31	2012-05-01	G2010
2012-08-31	2013-05-01	G2012
2013-08-31	2014	G2013
2014	2014-05-01	Final data collection

2014-08-31

G2014

DATA COLLECTION MODE

Face-to-face [f2f]

DATA COLLECTION NOTES

Surveys were done every May to August (inclusive). When access was difficult, briefings with a body corporate, estate managers or the traditional leaders in the area were facilitated to smoothen access to households. The survey was done with a representative household member who provided information about the household. Where possible, this was the head of the family living in the house. Where the family head was not available, this was a resident or visiting family member.

TRAINING of enumerators

A briefing session was conducted prior to field surveys every year. Municipal enumerators did not receive special training , as surveys were usually done on the job.

INTERVIEW LANGUAGE and LENGTH

Interviews were conducted in the language of the household and translated to English by the enumerator during the survey interaction. Interview length depended on the type of customers and typically took 15 minutes.

FEEDBACK of field teams

Feedback was received after data was captured at every site. The field data collection team was responsible for data capturing and bug fixing based on the output of an automated quality checking process.

PILOT SURVEY

No official pilot survey was done, but as the study underwent continuous improvement over its entire duration, early surveys can be viewed as pilots.

CORRECTIVE ACTIONS

At the end of the winter collection period problems and improvements for the following year were discussed and where possible incorporated. Resampling was not done, but households were visited up to 3 times to service 'not at home' households.

DATA COLLECTORS

Name	Abbreviation
van der Bank Research and Training	vdBRT

Questionnaires

QUESTIONNAIRES

The questionnaires were updated once in 1999 to incorporate lessons learned from the early study years. This data thus contains two subsets of survey responses - surveys from 1994 to 1999 capture responses to the first questionnaire. Some of the existing questions in the questionnaires used from the 2000 were rephrased. Additional questions were also added to the original questionnaire. Data collection was thus consistent from 1994 to 1999, and again from 2000 to 2014.

Data Processing

DATA EDITING

This dataset has been produced by extracting all tables other than the Profiletable from the original NRS Load Research SQL database using the saveTables and saveAnswers functions from the delretrieve python package (<https://github.com/wiebket/delretrieve>: release v1.0). Full instructions on how to use delretrieve to extract data are in the README file contained in the package.

De-identification:

De-identification was done in the process of extracting the data from the SQL database with the delretrieve package. Personal information has been removed from the survey responses by replacing responses with an 'a' in the dataset. De-identified variables are names of survey respondents and household owners, all street and postal addresses, erf numbers and all telephone numbers. Documents with full details of the variables that have been anonymised are included as external

resources.

Group Table:

The parent-child hierarchy of the groups table was deconstructed into levels and reconstructed as a 4-level multi-index table with the following levels:

Level 1 - domestic / non-domestic

Level 2 - Survey type : Eskom LR, NRS LR, Namibia [domestic] / Clinics, Shops, Schools [non-domestic]

Level 3 - Years

Level 4 - Locations

Missing Values:

Other than de-identification and reshaping the groups table no post-processing was done and all database records, including missing values, are stored exactly as retrieved.

Data Appraisal

DATA APPRAISAL

Throughout the study during the course of the data collection process data editing of survey responses was done in a number of stages before data entry into the database.

Site referencing:

Every year the site references were gathered at each site, captured and verified (February - May). This was used to produce the target list for the socio-demographic surveys. Once socio-demographics from surveys were returned, they were used together with the target list to link them to instruments. The link between survey responses and observational profiles in the links table was validated annually.

Quality control during data collection:

Surveys were collected one site at a time, typically with 4 enumerators and one controller. The supervisor ensured standardisation of data collection, manage logistics and liaison and to visually verify all returned surveys on the day of data collection, thus identifying any 'illegal' data entries. Typically the work at each site would take 2 - 3 days to collect up to 60 surveys. Upper management visited every site over a number of years. Thus a portion of sites was visited annually. These visits were planned to coincide with survey collection.

Missing surveys:

Eskom got involved in the study in 1997, but Eskom survey data is only available from 2000 onwards. No survey data was collected in 2007 and 2011. Some anecdotal events were recorded in Eskom Annual Reports.

Access policy

CONTACTS

Name	Affiliation	Email	URL
DataFirst	University of Cape Town	support@data1st.org	support.data1st.org

ACCESS CONDITIONS

Licensed use files, available for non-commercial use only

CITATION REQUIREMENTS

Eskom, Stellenbosch University & University of Cape Town. Domestic Electrical Load Survey 1994-2014 [dataset]. Version 1. Johannesburg: Eskom, Cape Town: UCT, Stellenbosch: SU [producers], 2014. Cape Town: DataFirst [distributor], 2019. DOI: <https://doi.org/10.25828/kzer-gd88>

ACCESS AUTHORITY

Name	Affiliation	Email	URL
DataFirst	University of Cape Town	support@data1st.org	support.data1st.org

Metadata production

PRODUCERS

Name	Abbreviation	Affiliation	Role
Energy Research Centre	ERC	University of Cape Town	Metadata producer

DATE OF METADATA PRODUCTION

2020-04-10

DDI DOCUMENT VERSION

Version 4

Data Description

Data file	Cases	Variables
answers	0	4
answers_blob_anonymised	0	52
answers_char_anonymised	0	52
answers_number_anonymised	0	250
groups	0	7
links	0	5
profiles	0	8
profilessummary	0	9
qconstraints	0	8
questionnaires	0	4
questions	0	7
recorderinstall	0	7