



REVIEW ON MICROGRID STANDARD AND INTRODUCTION TO IEC MICROGRID ACTIVITIES

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MY SINCERE GRATITUDE GOES TO

- Shandong University
 - My hometown
 - My alma mater





CONTENTS

Introduction to IEC

Review on microgrid standards

Introduction to IEC microgrid activities

INTRODUCTION TO IEC

- The **International Electrotechnical Commission** is a non-profit, non-governmental international standards organization.
- Responsibility: prepares and publishes International Standards for all electrical, electronic and related technologies – collectively known as **electrotechnology**".
- Participants: **National Committees**



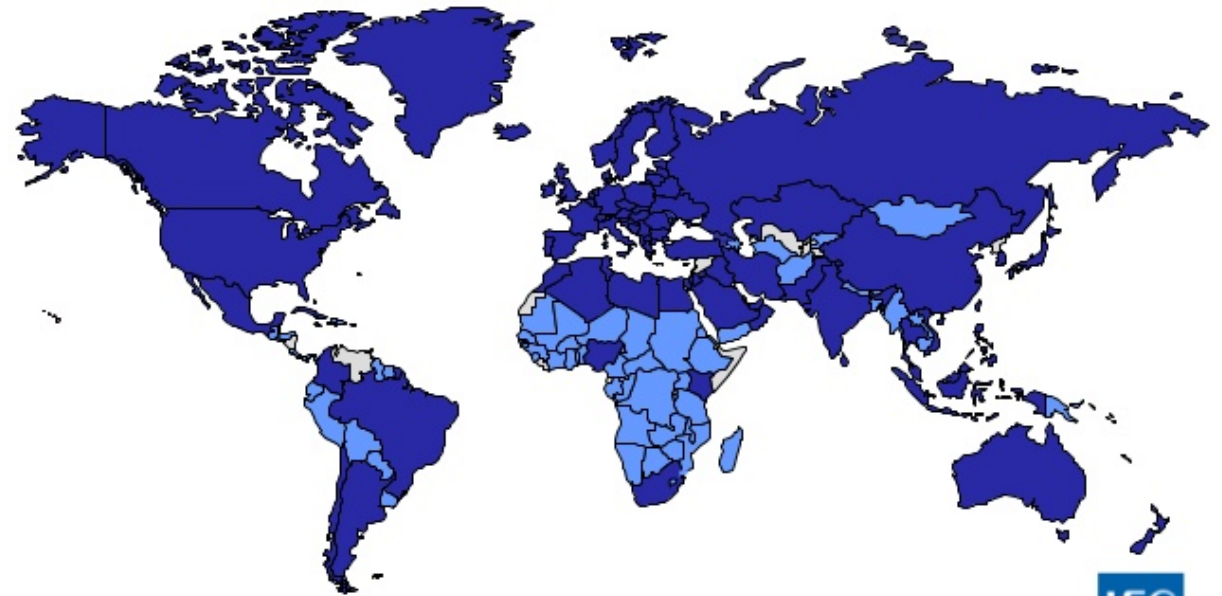
INTRODUCTION TO IEC

- Encourage national adoption of international standard
- BY 2014, there are almost 10000 IEC publications
- **China joined IEC in 1957**

IEC Family : 164 countries

82 Members

82 Affiliates



IEC PUBLICATION: NORMATIVE

approved by two-thirds of the Participating Members (P-Member) of an IEC Technical Committee (TC) or Subcommittee (SC).

International standard (IS)

Technical Specifications (TS)



IEC/TS 62257-7-3

Edition 1.0 2008-04

TECHNICAL SPECIFICATION

Recommendations for small renewable energy and hybrid systems for rural electrification –
Part 7-3: Generator set – Selection of generator sets for rural electrification systems

IEC PUBLICATION: INFORMATIVE

approved by simple majority of Participating Members of an IEC Technical Committee (TC) or Subcommittee (SC).

Publicly Available Specifications (PAS)

Technical Reports (TR)



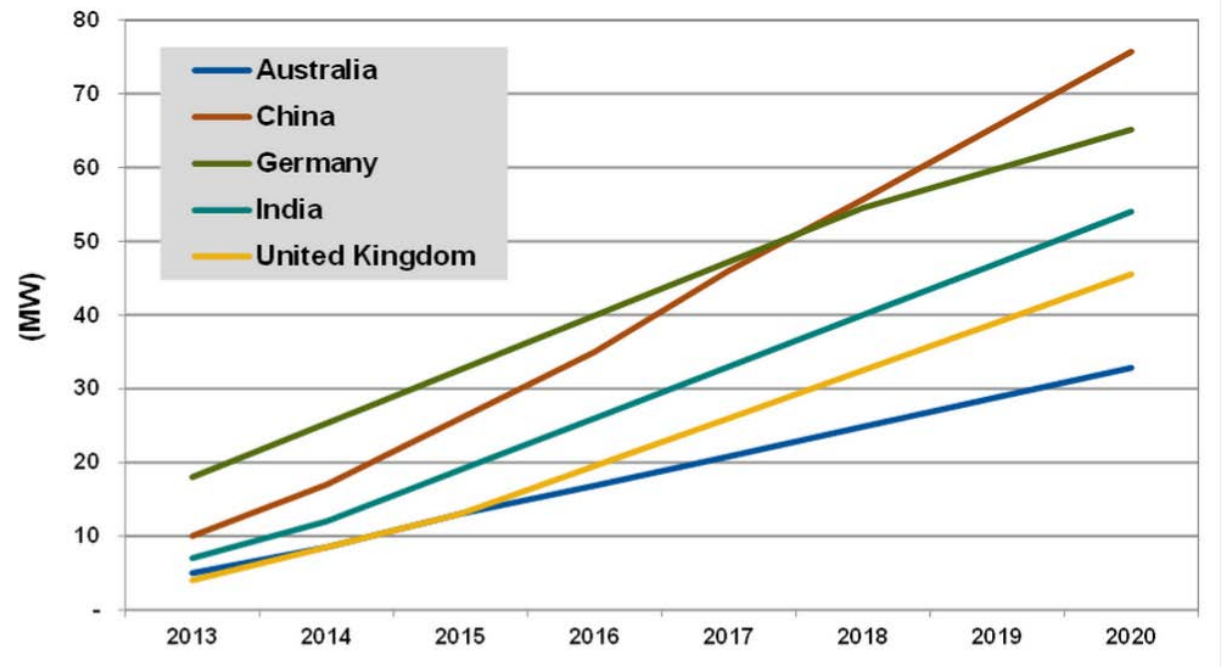


REVIEW ON MICROGRID STANDARDS

NAVIGANT MICROGRID RESEARCH

- **Rapid growth period**
- **China** expected to be ranked as the **top 1** microgrid market by 2020.
- Even more interesting is that three of the top five markets (**China, Australia, and India**) will be led by remote off-grid systems.

Annual Total Microgrid Capacity by Top Five Export Markets, Conservative Scenario, World Markets: 2013-2020



(Source: Navigant Research)

MICROGRID RELATED INTERNATIONAL STANDARDS

Organization Standard title

IEC	IEC 62257-1 Introduction to Rural Electrification
	IEC 62257-9-1 Micropower Plants
	IEC 62257-9-2 Microgrids
	IEC 61272 Photovoltaic(PV) Systems: Characteristics of the Utility Interface
	IEC 61400 Wind Turbine Generator Classes
IEEE	1547-2003, Standard for Interconnecting Distributed Resources with Electric Power Systems
	1547.4-2011, Guide for Design, Operation, and Integration of Distributed Resource Island Systems with Electric Power Systems
CENELEC	EN 50438:2013, Requirements for the Connection of Micro-generators in Parallel with Public Low-voltage Distribution Networks
CIGRE	WG C6.22 Microgrids Evolution Roadmap

IEC 62257 SERIES

IEC

Recommendations for small renewable energy and hybrid systems for rural electrification

IEC 62257-9-1 Micropower Plants

IEC 62257-9-2 Microgrids

- IEC 62257 series = 30 technical specifications addressing
 - Introduction to **rural electrification**
- 62257-9-2 Microgrid: **first time IEC defined microgrid.**
- But the microgrid in 62257 is defined as
 - subsystem of DERS intended for power distribution of which the capacity does not exceed 100 kVA, the prefix "micro" being intended to express the low level of transmitting capacity
 - **IEC 62257-9 is proper for small microgrid in rural electrification, but not suitable for the new development**

IEEE 1547.4

- IEEE 1547 is published by IEEE Fuel Cells, Photovoltaic, Dispersed Generation and Energy Storage Standards Coordinating Committee21。
- 2011 July, 1547.4-2011 ***IEEE Guide for Design, Operation, and Integration of Distributed Resources Island Systems with Electric Power Systems*** is published.
- IEEE 1547.4 provides alternative approaches and good practices for the design, operation, and integration of distributed resource (DR) island systems with electric power systems (EPS). This guide includes the distributed resources, interconnection systems, and participating electric power systems.

SUMMARY OF CURRENT STANDARDS

- 1) There are **only two published international microgrid standards (IEEE 1547.4 and IEC 62257 series)**, and their content is limited and not systematic.
- 2) **Microgrid cannot use the current DER integration standard** : DER standards require automatic and rapid disconnection of all DER during grid outages. Such standards limit the fault ride ability of DER in microgrids
- 3) **Microgrid is an essential part of the smart grid** at the distribution system level. Intentional islanding ability of microgrid is similar to the self-healing characters. Standardization of microgrid should be coordinated with that of smart grid.



IEC MICROGRID ACTIVITIES

STANDARD MANAGEMENT BOARD(SMB)

TC8

WG1 TERMINOLOGY

WG6 Generic smart grid requirement

WG7 general planning, design, operation and control of microgrids

OTHER TC

TC57 Power systems management and associated information exchange

TC64 Electrical installations and protection against electric shock

TC 82 Solar photovoltaic energy systems

TC88 Wind turbines

System Work

SEG1 Smart cities

SEG4 Systems Evaluation Group - Low Voltage Direct Current Applications,

SEG5 Electrotechnology for mobility

SEG6 Non-traditional Distribution Networks / Microgrids

System Committee Smart Energy (coordinate Smart Grid related standards)

PROPOSAL TO ESTABLISH TC8/WG7



2012

First proposed to construct international standards on microgrid in Oslo IEC General Meeting.

VOTING RESULT ON NEW PROPOSAL(NP)

- 8/1326/NP, 8/1327/np, 2013

Approval				
P-Members Voting	P-Members Approving	Approval %	Criteria	Result
20	17	85	>50%	APPROVED
Participation				
Number of P-Members	P-Members approving and participating	Criteria		Result
31	6	>=4 (if <= 16) >= 5 (if >= 17)		APPROVED

INTRODUCTION TO TC8/WG7

TC 8 Systems aspects for electrical energy supply

WG 7 General Planning, Design, Operation and Control of Microgrids

- To develop guidelines for General Planning and Design of Microgrids and develop Technical Requirements for Operation and Control of Microgrids

IEC/TS 62898-1	Guidelines for General Planning and Design of Microgrids
IEC/TS 62898-2	Technical requirements for Operation and Control of Microgrids

EXPERTS IN WG TC8/WG7

- **Convenors**

- Prof BIE Zhaohong

Xi'an Jiaotong University, (

- Prof ZHANG Jianhua

North China Electric Power University, China

Function	↕ Last Name	↕ First Name	↕ NC	↕ E-mail address
Convenor	Bie	Zhaohong	CN	
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Member	Khatri	Amal	ZA	
Member	Komarnicki	Przemyslaw	DE	
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Member	Zhang	Ping	CN	
Member	ZHENG	DEHUA	CN	

• Right now in 2015
24 members from 12 countries

Total number of experts : 24
Total number of records : 24

PUBLICATION PROCESS OF IEC STANDARDS

Usually takes around 5 years

Stage	documents
Preliminary	
Proposal	New Work Item Proposal (NP)
Preparatory	Working Draft (WD)
Committee	Committee Draft for comments (CD)
Enquiry	Committee Draft for vote (CDV)
Approval	Final Draft International Standard (FDIS) Only for International Standard
Publication	

A new work item proposal is approved after a 3 months commenting and voting period.

document is submitted to the National Committees as a committee draft (CD) for comment.

WD i
team
201

2015

January, 1CD submitted

17,18th April , Nanjing Meeting, discuss

response to 1CD comments

27,28
9th Nov

general meeting (Tokyo Japan)

CDV is submitted for circulated for three-month voting period. Approved if: 2/3 majority of P-members

FDIS is circulated for a two-month period. Approved if: 2/3 majority of P-members

FIRST INTERNATIONAL WG7 MEETING IN XI'AN JUNE,2014



INTERNATIONAL WG7 MEETING IN TOKYO, NOVEMBER, 2014





INTERNATIONAL WG7 MEETING IN TOKYO, NOVEMBER, 2014



INTERNATIONAL WG7 MEETING IN NANJING, APRIL,2015



CONTENTS

• TS62898-1 Guidelines for General Planning and Design of Microgrids

• INTRODUCTION / Scope

• Normative reference

• Definitions

Every standard contains these four clauses

• Purpose and application

• Resources analysis and generation forecast

• Load forecast

Resource and load analysis

• Distributed energy resources planning

• Microgrid power system planning

Microgrid planning

• Requirements for microgrid connection to distribution system

• Requirements for control, protection and communication system

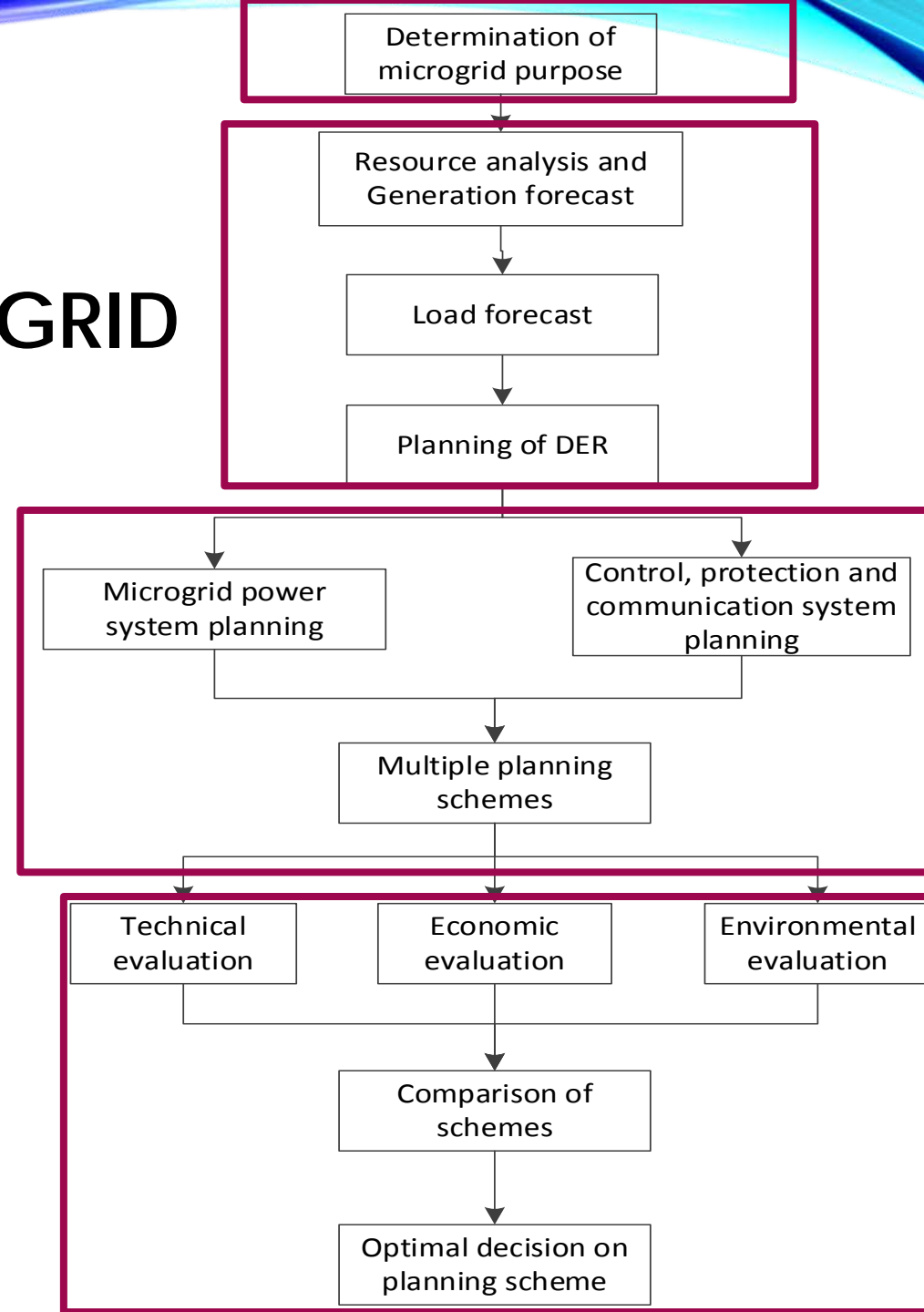
Technical requirement

• Evaluation of the general planning of microgrids

Evaluation

THE OVERALL PLANNING OF MICROGRID

- Determination of the **purpose** for building the microgrid
- **Resource analysis** of intermittent and dispatchable resources in the local area, while predicting the maximum available generating capacity from them.
- **load forecast**
- **DER planning**, including determining the ratio of renewable energy and types of DER.
- **Planning** of microgrid power system
 - **Technical requirements** for control/protection/communication system.
- Forming multiple feasible microgrid planning proposals based on the above steps.
 - Technical, economic, and environmental evaluation of the different proposals.
 - Forming the optimal decision on microgrid planning



MAJOR ISSUES

2014.6@xian

- introduction
- scope

2014.11@Tokyo

- Definition of microgrids
- Liaison with other TC

2015.4@Nanjing

- DER requirement

MAJOR ISSUES: INTRODUCTION

- INTRODUCTION-give a description of microgrid
- Microgrids are usually seen as means to increase resistance to a **grid contingency**.
- It has other potential effects such as **local optimization** of energy supply by **managing the use of distributed energy resources (DER)**.
- Microgrids also present a way to provide electricity supply in **remote areas**, to use clean and renewable energy and a systemic approach for rural electrification.

Major discussion in 2014.6 Xi'an meeting

MAJOR ISSUES: SCOPE

- The purpose of this document is to provide technical guidelines for microgrid **planning and design**.
- Microgrids considered in this TS are **AC electrical** systems combining loads and distributed resources at low or medium voltage level.
- They can satisfy customer needs for power quality and reliability.
- Microgrids are classified into **connected microgrids and isolated microgrids**. Connected microgrids may act as controllable units to the electrical network and can operate in grid-connected mode or island mode. Isolated microgrids have no electrical connection to a distribution system.
- This TS **does not cover direct current microgrids**.

Major discussion in 2014.6 Xi'an meeting

PURPOSE AND APPLICATION OF MICROGRIDS

- **purpose: improved reliability, economy, disaster preparedness, or a hybrid of several.**
- **Application(example):**
 - **For improving reliability**, and securing the uninterrupted energy supply in contingency to critical load, e.g. in military base, hospital, mining industry, customer installation.
 - Microgrid that aims at **providing power to remote areas** with lower cost, e.g. isolated microgrid in rural electrification oceanic island.
 - **Microgrids in community/utility.**

- Connected microgrid
 - Energy Management System
 - Mode transfer
- Isolated microgrid
 - Storage
 - load management

Major discussion in 2014.11 Tokyo meeting

MAJOR ISSUES: LIAISON

- Power quality at POC(microgrid Point of Connection)
 - reference to **IEC TS 62749**
- Microgrid voltage level
 - Reference to **IEC 60038**
- Distribution Line selection
 - Reference to IEC **TC64 and TC 99**
- Communication between microgrid and distribution system
 - reference to **IEC61968 and IEC61970.**

Major discussion in 2014.11 Tokyo meeting

MAJOR ISSUES: TECHNICAL REQUIREMENT FOR DER

■General

- The principles and technical requirements for DER connected to the distribution system have been specified in PT 62786. Different country can also choose to abide their national grid codes that provide specification for DER

■Connected microgrid

- In principle, aligned with **IEC/PT62786**

■Isolated microgrid and island mode of connected microgrid

- Specific microgrid requirement only

Major discussion in 2015.4 Nanjing meeting

TIME TABLE FOR TC8/WG7

Date	Tasks
24 th April, 2015	Send back CC with resolution of comments to the secretary in parallel upload CC and minutes to the collaboration tools.
End of April, 2015	Send out the drafts with change tracks
End of May, 2015	Collect Feedback to TS62898-1, -2
During the period	Coordinate between TS62898-1, -2
12 June, 2015	Submit 2CD of TS62898-1, -2
End of August, 2015	Receive comments of 2CD
29 th September, 2015	TC8 Plenary Meeting in Italy Discuss the comments to 2CD



- Thank you for your support!