



TÜV NORD NUCLEAR CAPABILITY: SERVICE PROVIDER IN THE FIELD OF CLEAN ENERGY SOLUTIONS

TÜV NORD EnSys GmbH & Co. KG
TÜV UK Ltd.

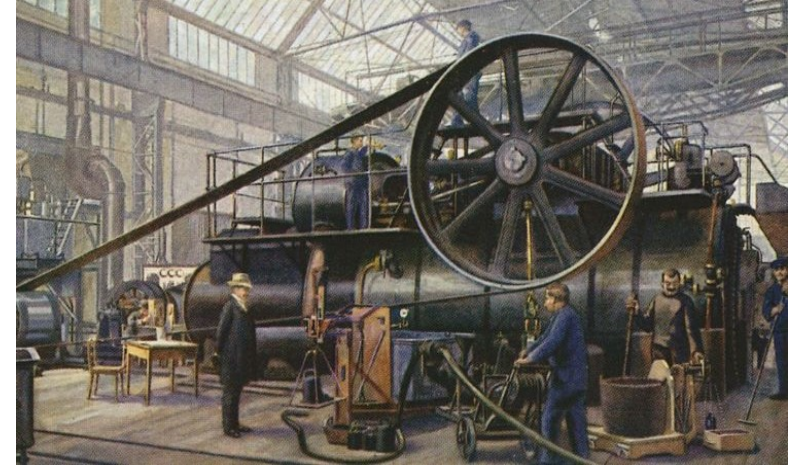


TÜV NORD GROUP

150 YEARS OF CONTINUOUS EVOLUTION

PRODUCTS & SERVICES FOR SAFETY & SECURITY

- 19th century: Foundation of various TÜV associations
- 1869 **TÜV NORD**: first steam boiler inspections
- 1903 First inspection of **motor vehicles** in Schleswig-Holstein & Hannover and first driver's license exam
- 1908 First inspection of **elevator installations**
- 1911 First **mining industry** inspection of electrical installations
- 1927 First recurring **motor vehicle** inspections (voluntary)
- 1948 Foundation of the **materials engineering** and **manufacturing control** departments in Hamburg
- 1957 Start of work in nuclear safety - Geesthacht 1 research reactor



Today, TÜV NORD GROUP is one of the largest principle TSOs in Germany and an international network of TÜV NORD entities operating worldwide

MORE THAN 150 YEARS OF EVOLUTION WITH NEW SERVICE AREAS EVERY YEAR

1869

• Pipes • **1900** • Steam Boilers • Pressure Vessels • Materials • Tanks •

Systems • **1950** • Power Generation • Electrical Systems •

• Motor Vehicles • Driving Licence Examinations •

• Railway • **1980** • Technology • Nuclear Energy •

• Education • Occupational • Safety • Occupational Health •

• Radiation Protection • **1990** • Microelectronics • Water

Protection • Medical Devices • • Biotechnology •

• Quality Assurance • Certification • **2000** • Environmental

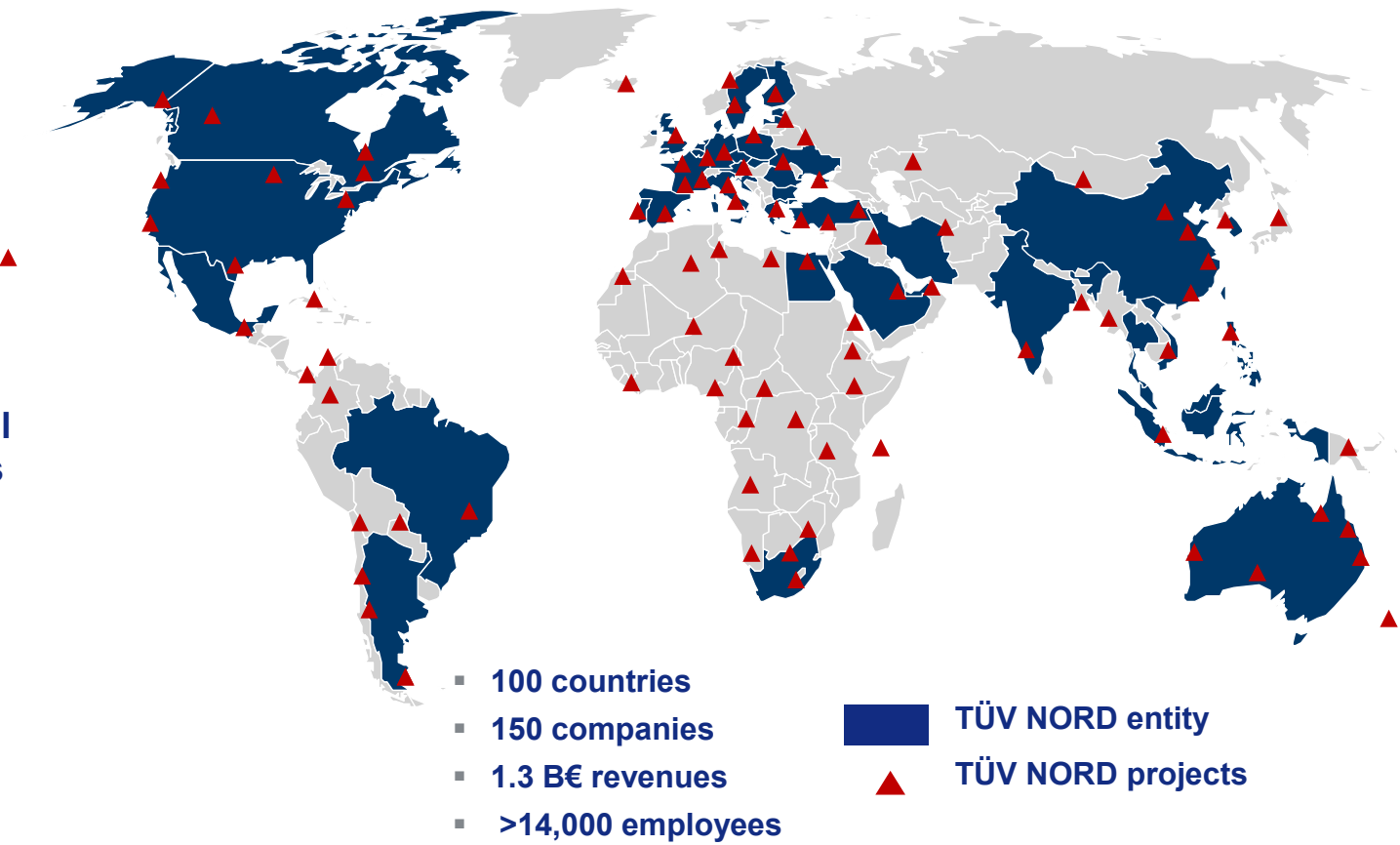
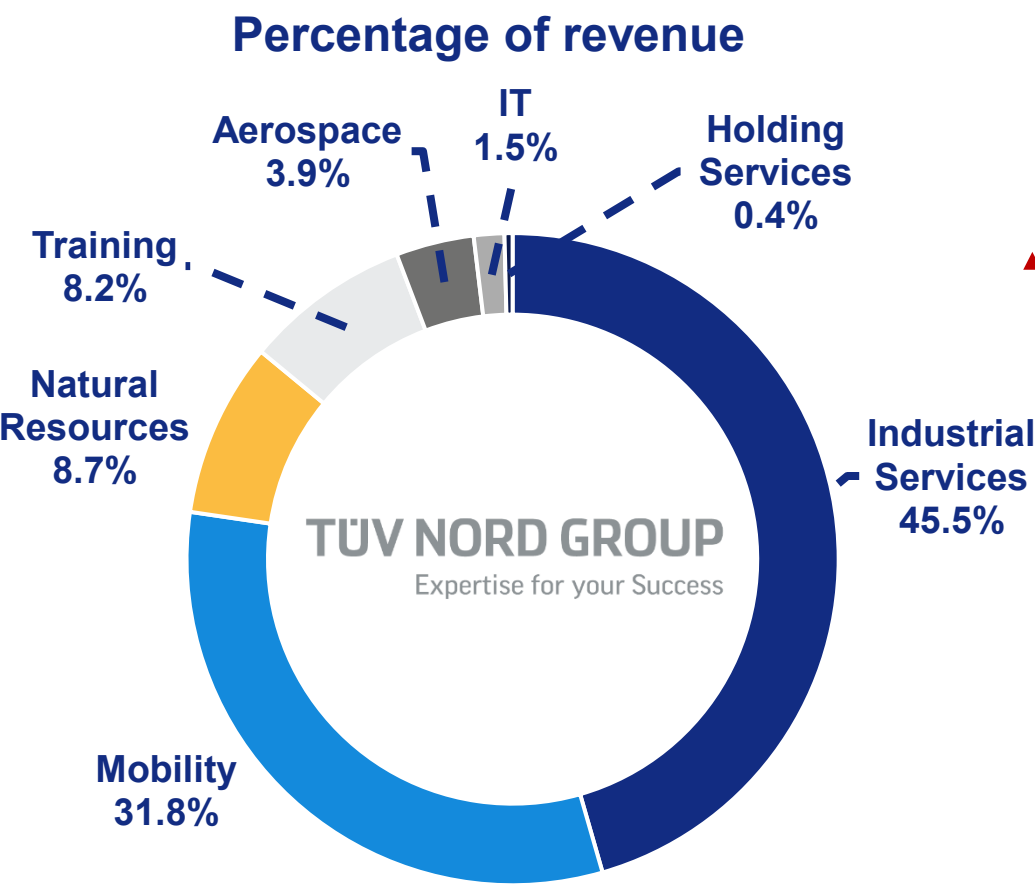
Impact Assessment • Noise Control • Renewable Energies • Natural

Resources • Information Technology • IT Security • New Energy Business

• Data Protection • Telecommunications • Aviation • **2023** • Hydrogen •

TÜV NORD GROUP

A GROWING BUSINESS - WORLDWIDE



TÜV NORD GROUP

AN ANSWER TO ALMOST ANY TECHNICAL QUESTION - WORLDWIDE

TÜV NORD AG						
Business Unit Industrial Services	Business Unit Mobility	Business Unit Natural Resources	Business Unit Training	Business Unit Aerospace	Business Unit IT	Group Services
TÜV NORD Systems, TÜV NORD EnSys	TÜV NORD Mobilität	DMT	TÜV NORD Bildung	ATN	TÜViT	TÜV NORD Service



TÜV NORD Nuclear:

*Embedded within TÜV NORD GROUP,
TÜV NORD Nuclear now rebranded as*

Clean Energy Solutions consists of TÜV NORD EnSys, TÜV NORD Energy Engineers, TÜV UK Ltd. as well as several other international subsidiaries

TÜV NORD NUCLEAR CAPABILITY: A PARTNER FOR OPERATORS, REGULATORS & MANUFACTURERS



Services and products bespoke to meet **international market** needs.

Independent inspections and consultancy to **operators, regulators & manufacturers.**

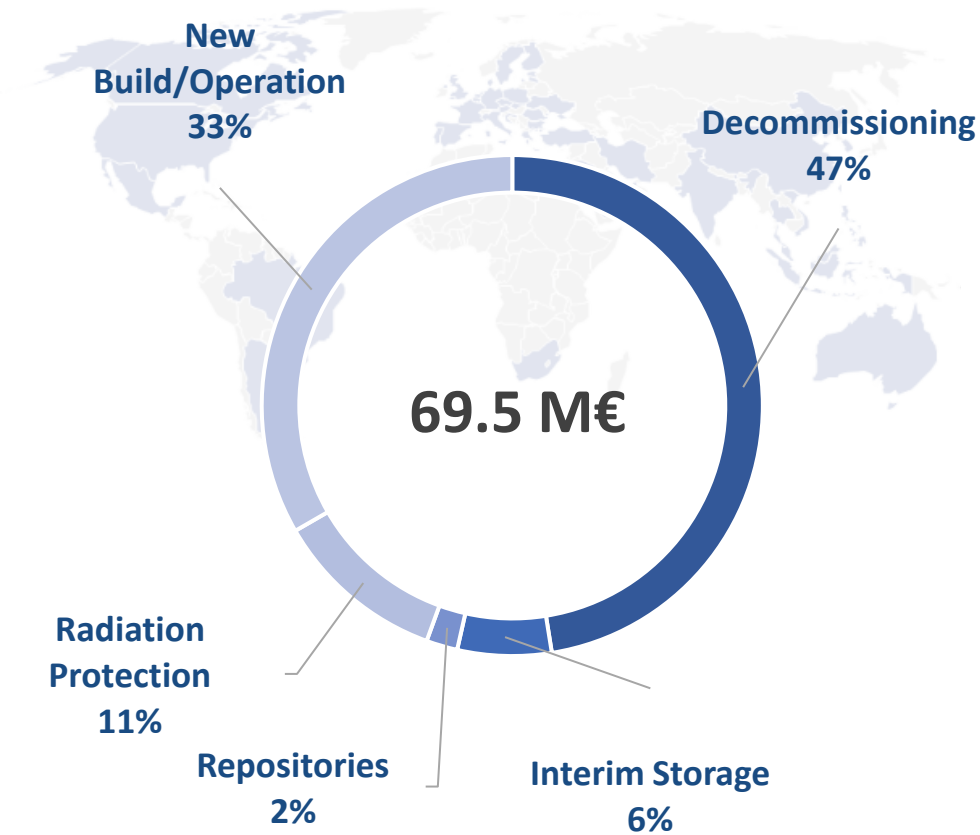
Strategic alliances & innovative partnerships.

Continuous expansion of **capacity & competence** to execute orders for international clients.

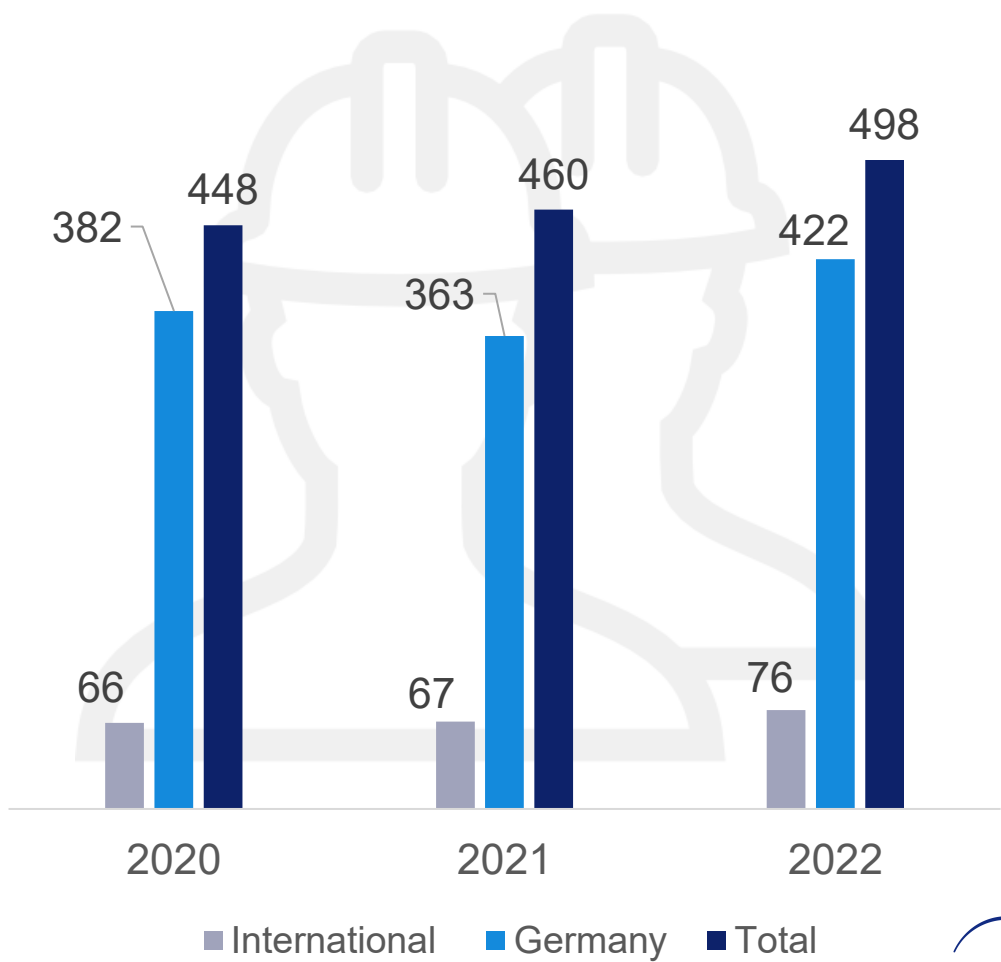


TÜV NORD NUCLEAR FACTS AND FIGURES

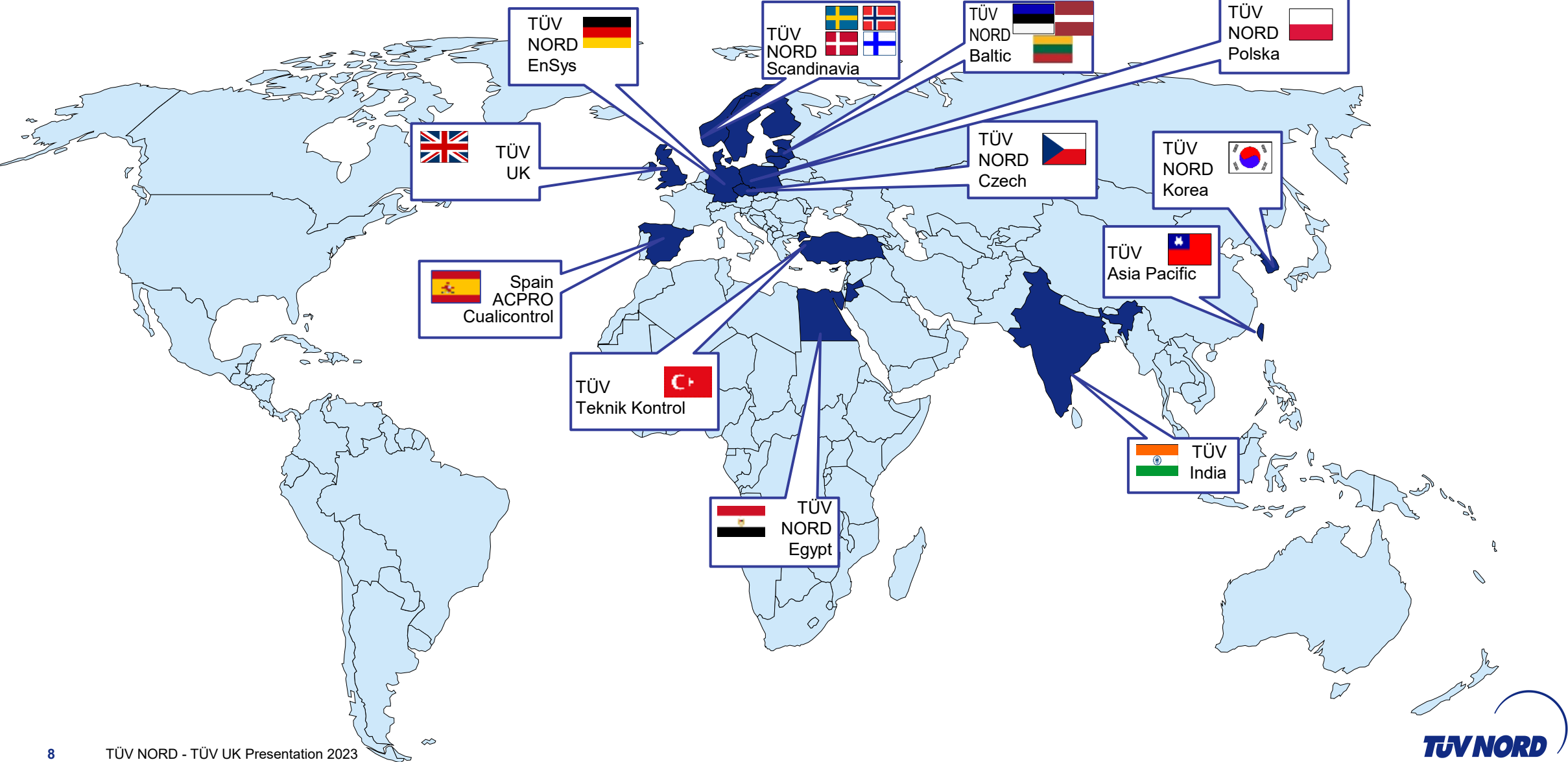
REVENUE DISTRIBUTION



NUMBER OF EMPLOYEES



TÜV NORD NUCLEAR INTERNATIONAL ENTITIES

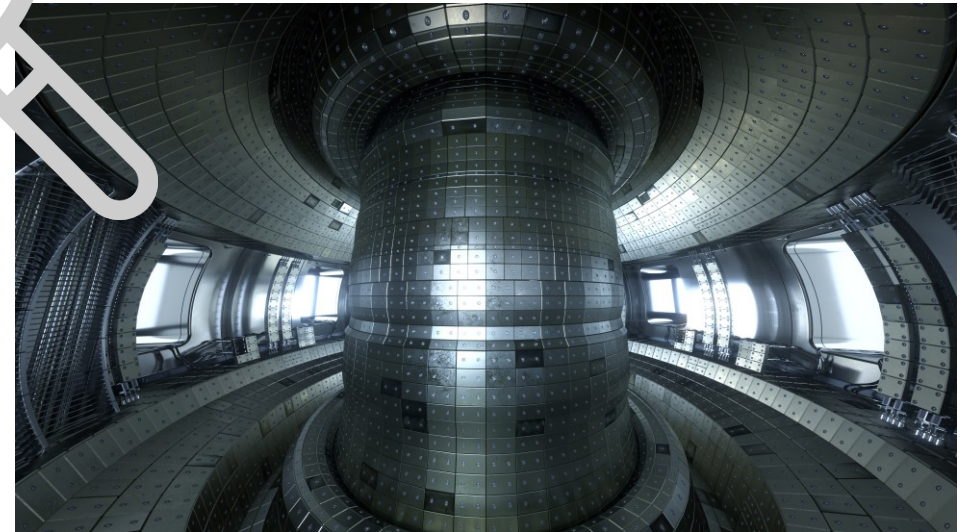
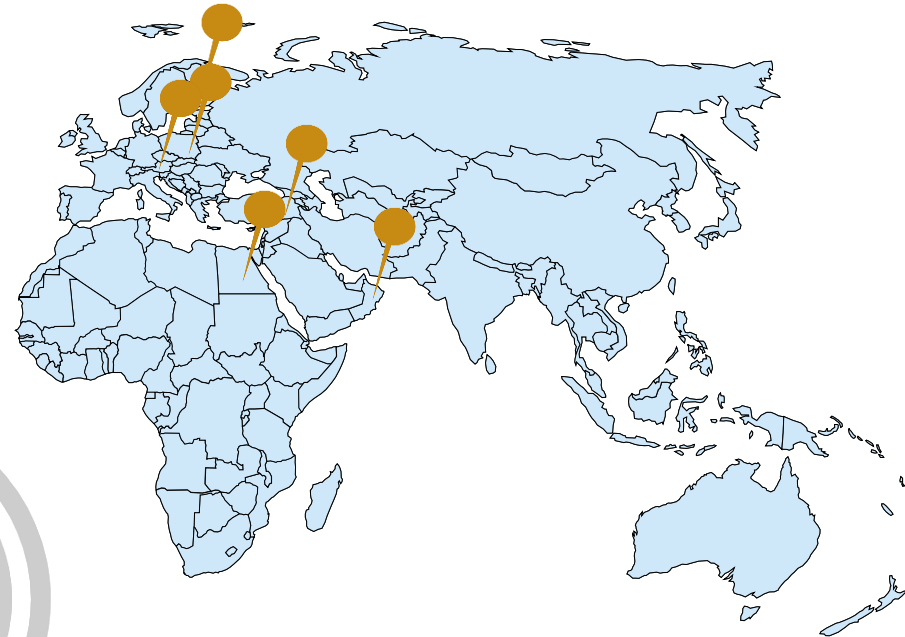


TÜV NORD NUCLEAR INTERNATIONAL FOCUS

NUCLEAR NEW BUILDS

SMR/AMR

FUSION



TÜV NORD NUCLEAR

A FULL-SCOPE SERVICE PROVIDER

TÜV NORD Nuclear

A competent and interdisciplinary expert organisation in nuclear energy projects

- Neutrality
- Independence
- Competence



TÜV NORD NUCLEAR

A FULL-SCOPE SERVICE PROVIDER

Our general nuclear scope

- Safety assessment, design review, documentation review
- Consultancy, engineering and inspection services for utilities, suppliers, manufacturers.
- Adapted to the respective stages of the life cycle of nuclear facilities: new build and refitting, operation, decommissioning.
- Certified and accredited according to international standards:

ISO 9001:2015

ISO 17020:2012

ISO 14001:2015

ISO 17025:2018

ISO 45001:2018

ASME-AIA III Div. 1&3



TÜV NORD NUCLEAR COVERING THE ENTIRE LIFE CYCLE



New Build

- Concept & Planning
- Licensing Support
- Construction & Erection
- Manufacturing
- Commissioning



Operation

- Start-up
- Power Operation
- Outage Support
- Life Time Extension



Decommissioning & Dismantling

- Planning & Licensing
- Post Operation Clean Out
- Decontamination & Dismantling
- Site Remediation, Release & Store



Waste Management

- Waste Concepts
- Properties, Handling and Conditioning
- Interim Storage & Disposal

TÜV NORD NUCLEAR COVERING THE ENTIRE LIFE CYCLE



New Build

- Concept & Planning
- Licensing Support
- Construction & Erection
- Manufacturing
- Commissioning

Concept & Planning

- Safety assessment of concepts and designs
- Safety related co-engineering of structures, systems and components
- Assessment of Safety Case and supporting documentation
- All siting issues like Environmental Impact Assessment

Construction & Erection

- Reviews and inspections of design and manufacturing documents
- Inspections during manufacture and erection on site
- Work and safety aspects

Commissioning

- Testing, qualification and commissioning
 - systems & components; cold tests
 - nuclear commissioning

TÜV NORD NUCLEAR COVERING THE ENTIRE LIFE CYCLE



Operation

- Start-up
- Power Operation
- Outage Support
- Life Time Extension

Operational Supervision

- Periodic in-service inspections
- Operation (conduct and occurrences)
- Plant and document modifications
- Assessment of events and occurrences in nuclear installations

Lifetime Extension

- Reviews and inspections of design and manufacturing documents
- Inspections during manufacture and erection on site
- Work and safety aspects

Revision and Outage

- Safety re-assessments
- Safety evaluations during maintenance, repair and outages

TÜV NORD NUCLEAR COVERING THE ENTIRE LIFE CYCLE



Decommissioning & Dismantling

- Planning & Licensing
- Post Operation Clean Out
- Decontamination & Dismantling
- Site Remediation, Release & Store

D&D

- Safety assessment of decommissioning concepts and review of safety cases
- On site inspection and surveillance
- Radiation protection

Clearance & Release

- Clearance concept
- Measurement strategies
- Application of clearance and exposure scenarios
- Clearance-driven D&D-concept
- Economics of clearance vs. radwaste

Site Remediation

- Decommissioning goal (green or brown field, reuse as nuclear site)
- Decontamination concepts
- Measurement strategies
- Renaturalisation concepts

TÜV NORD NUCLEAR COVERING THE ENTIRE LIFE CYCLE



Waste Management

- Waste Concept
- Properties, Handling and Conditioning
- Interim Storage & Disposal

Waste Concept

- Definition of waste-streams
- Evolution of waste composition during the course of decommissioning
- Concepts for problematic waste
- Storage space, logistics, etc.

Properties, Handling and Conditioning

- Assessment of properties of radioactive waste
- Assessment and qualification of waste treatment and storage concepts
- Assessment of conditioning facilities
- Inspection during waste processing
- Evaluation of documentation

Interim Storage and Disposal

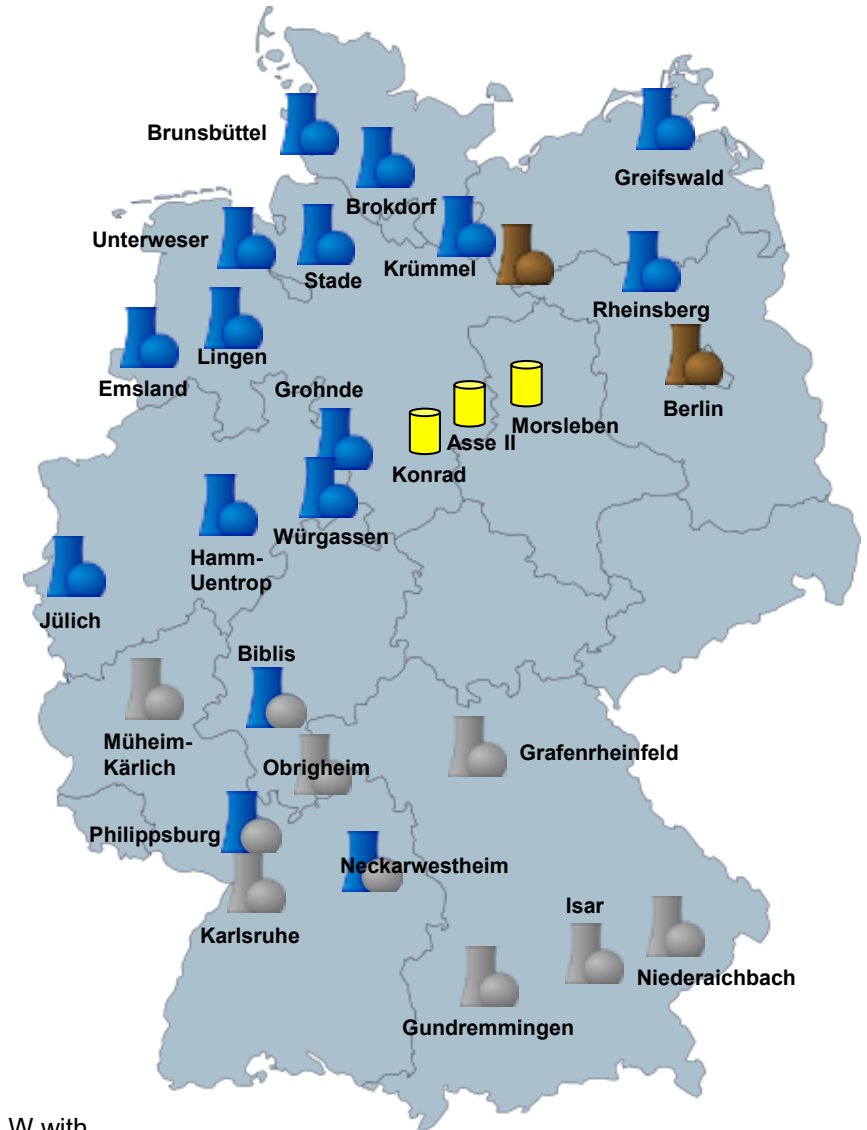
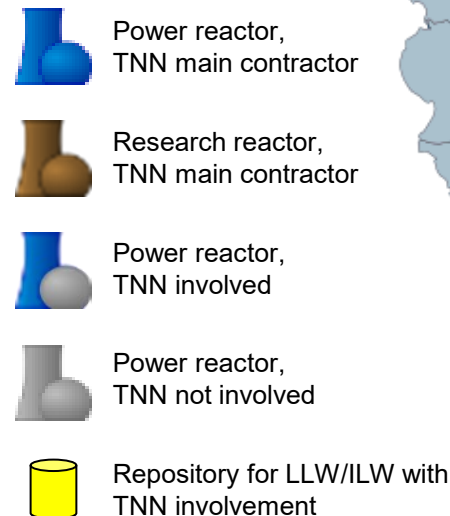
- Assessment of interim storage and disposal concepts and facilities
- Verification of compliance with regulatory requirements and acceptance criteria
- Evaluation of documentation

TÜV NORD NUCLEAR OUR REFERENCES AND EXPERIENCE

GERMANY
EUROPE
WORLDWIDE
INTERNATIONAL STANDARDS

TÜV NORD NUCLEAR REFERENCES IN GERMANY

- TÜV NORD Nuclear with 300+ years of operational experience with NPP and a variety of reactor types is appointed technical support organisation for German regulators. As such TN is involved in the majority of German nuclear power plants, with 18 large power reactors, plus a number of research reactors and other facilities of the new nuclear fuel circle.
- TÜV NORD Nuclear's work comprises:
 - Licensing Support.
 - Concept evaluation.
 - Radiological measurements.
 - On site inspections.
 - Training & consulting.



TÜV NORD NUCLEAR REACTOR TYPES IN TÜV NORD ENSYS' TRACK RECORD

- Siemens KWU PWR (Stade, Biblis A, Unterweser, Trillo Almaraz (Esp), Angra, Grohnde, Brokdorf, Philippsburg, Neckarwestheim, Emsland)
- Framatome/AREVA EPR (Olkiluoto 3, HPC)
- Westinghouse PWR (Ringhals, Koeberg, Yeongwang/Hanbit)
- Combustion Engineering PWR (Yeongwang/Hanbit)
- Korean PWR APR1400 (Barakah)
- ABB BWR (Oskarshamn, Forsmark)



TÜV NORD NUCLEAR

REACTOR TYPES IN TÜV NORD ENSYS' TRACK RECORD

- AEG BWR (Würgassen, Krümmel)
- BWR with fossile fuel superheater (Lingen)
- Gas cooled HTR (Jülich, Hamm Uentrop, PBMR (RSA))
- Russian Design PWR VVER 440 (Greifswald) VVER 1000 (Stendal), VVER 1200 (Hanhikivi, Akkuyu)
- Heavy-Water moderated PWR (Atucha II)
- Heavy Water moderated PWR Candu type (Embalse)
- Various MTR/research reactors



TÜV NORD NUCLEAR EXPERIENCES IN GERMANY WITH DIFFERENT REACTOR TYPES

NS Otto Hahn

Small PWR,
dismantled in 1978.



NPP Greifswald (PWR)

Europe's major D&D project:
5 reactors (VVER 440).
Ongoing since 1995, large
components removed.



NPP Würgassen (BWR)

D&D 1996 - 2014,
components removed,
buildings left.



NPP Rheinsberg (PWR)

Dismantling of the activated
parts from 1999 to 2011,
early VVER.



NPP Stade (PWR)

In D&D since 2005,
dismantling completed,
buildings left.



NPP Lingen (BWR)

Safe enclosure 1988 to
2013, entering D&D,
Oil fired super heater.



TÜV NORD NUCLEAR

SELECTED REFERENCES IN EUROPE



Finland

- **NPP Olkiluoto 3 (EPR):** Design reviews and inspections
- **NPP Hanhikivi-1 (VVER):** Assessment of systems important to safety



Sweden NPP Barsebaeck, Forsmark, Ringhals

- Third party review of operation and plant modifications



Switzerland

- Assessment of FDP for all Swiss nuclear installations



Spain NPP Trillo

- Assessment of neutron noise measurements



United Kingdom

- Studies for STEP (Spherical Tokamak for Energy Production)

TÜV NORD NUCLEAR

SELECTED REFERENCES WORLDWIDE



Argentina NPP Atucha 2

- Review of safety-related documents
- On-site inspections during erection
- Support in Commissioning Preparation

NPP Embalse (CANDU)

- Review of documentation of PLEX



Brazil NPP Angra 2 & 3

- Review of specifications and pre-approval of manufacturing documents
- Supplier qualification



Korea NPP Hanbit 2 & 3

- Safety assessment of RPV Maintenance
- Independent evaluation of in-service inspection by automated ultrasonic testing of RPV welds



South Africa NPP Koeberg

- Risk Based Maintenance concept
- Client office of Eskom utility in new PBMR project
- Assessment and inspection of RPV head replacement
- Developing classification system for SSC



UAE NPP Barakah

Safety Assessment in licensing as TSO to FANR (UAE regulator)

- Digital I&C
- Probabilistic Safety Analysis
- Safety Case documents for nuclear core design

TÜV NORD NUCLEAR INTERNATIONAL STANDARDS

- IAEA Safety Guides and Standards
- NEA Publications
- German KTA codes, DIN standards, RSK Guidelines
- European PED
- French RCC-M, RCC-E
- US NRC Reg. Guides, SRP 10 CFR ASME Codes III,VIII
- Korean KEPIC codes
- Russian GOST, TGL
- Swedish SSMFS
- Finnish YVL codes
- Argentinean Regulatory Standards

