University Mohamed Khider of Biskra
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Handout of cours

Module: Regulations and Standards in renewable energies

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Foreword

To the Master's students in Electrical Engineering, Option: Renewable Energies, This handout, for the module (Regulations and Standards in Renewable Energies), is designed to provide you, the future engineers and leaders of this sector, with the critical knowledge required to navigate this complex landscape. As you stand at the forefront of technological development, understanding the rules that govern its implementation is not an ancillary skill, it is a core competency. The journey through this module is structured to build your expertise systematically:

- Chapter 1: Standardization begins with first principles, exploring the very concept of standardization and the different types of standards. This foundational knowledge is essential for appreciating how consensus and technical rigor form the bedrock of safe and efficient electrical systems.

- Chapter 2: Standardization Organizations around the World maps the ecosystem of standards development. You will become familiar with the key international, regional, and national bodies-from the IEC and ISO to DIN and IGNOR-understanding their roles, influences, and the hierarchies of the standards they produce.

- Chapter 3: This chapter focuses standardization on the renewable energy field, from the global strategy of IRENA to Algeria's national program. It culminates in a practical analysis of essential international and corresponding Algerian photovoltaic standards, bridging global best practices with local application.

- Chapter 4:This module transitions from technical standards to binding legal frameworks, analyzing different regulation types and studying international examples from the EU and beyond. It culminates in a vital deep-dive into Algerian renewable energy regulations, providing the specific legal and procedural knowledge required to contribute to the national energy strategy.

This document is more than a collection of texts; it is a guide to the language of modern energy development. Mastery of this language will enable you to design systems that are not only technologically advanced but also compliant, safe, and commercially viable. It is our aim that this knowledge will empower you to be not just participants in Algeria's energy transition, but its active architects.

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Chapter I

Standardization

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I.1 Definition of standard

A standard is a set of established norms or criteria that serve as a model or benchmark for measuring quality, performance, or compliance . Here are a few key aspects of a standard (Figure I.1) :

- ☞ **Benchmark:** It acts as a reference point against which other things can be compared or assessed.
- ☞ **Consistency:** Ensures uniformity and consistency in processes, products, or services.
- ☞ **Authority:** Often established by authoritative bodies or organizations to ensure widespread acceptance and adherence.

For example, : in manufacturing, a standard might specify the dimensions and materials for a particular component to ensure compatibility and quality across different products.

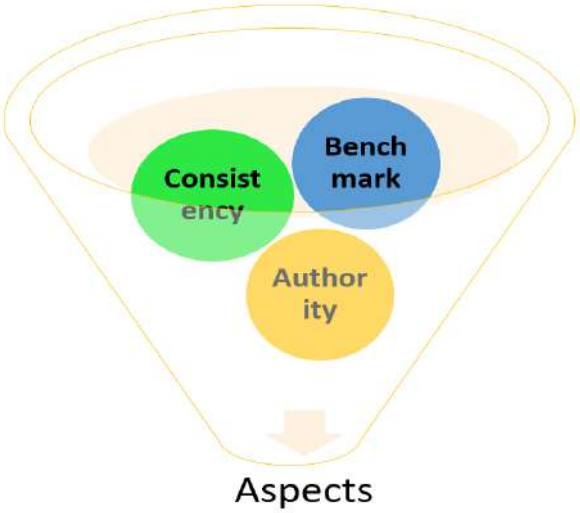

Figure I.1: Key aspects of a standard.

I.2 Role and objectives of the standards

The objectives of standards are multifaceted and aim to ensure quality, safety, and efficiency across various industries. Here are some key objectives :

- ✪ **Quality Assurance:** Standards help ensure that products and services meet consistent quality benchmarks, which enhances customer satisfaction and trust.
- ✪ **Safety:** They establish safety guidelines to protect consumers and workers, reducing the risk of accidents and injuries.

- ✪ **Regulatory Compliance:** Standards assist organizations in complying with local, national, and international regulations, avoiding legal issues and penalties.

- ✪ **Environmental Protection:** Many standards focus on minimizing environmental impact by promoting sustainable practices and reducing waste.
- ✪ **Interoperability:** Standards ensure that different systems, products, and services can work together seamlessly, which is crucial in fields like telecommunications and information technology.
- ✪ **Efficiency:** By providing clear guidelines and procedures, standards help organizations streamline their processes, reduce costs, and improve overall efficiency.
- ✪ **Innovation:** Standards provide a foundation upon which new technologies and innovations can be developed, ensuring they are compatible with existing systems .
- ✪ **Market Access:** Meeting international standards can open up new markets for products and services, as many countries and industries require compliance with specific standards.
- ✪ **Customer Confidence:** Consistent quality and safety standards enhance customer confidence and loyalty, as they know they can rely on the products and services provided.

I.3 Standardization challenges

Standardization can bring many benefits, but it also comes with its own set of challenges. Here are some common difficulties organizations might face:

I.3.1 Resistance to Change:

Employees and stakeholders may be resistant to new standards, especially if they are accustomed to existing processes.

I.3.2 Cost:

Implementing new standards can be expensive, involving costs for training, new equipment, and potential downtime during the transition.

I.3.3 Complexity:

Developing and maintaining standards can be complex, requiring significant time and expertise to ensure they are comprehensive and effective.

I.3.4 Flexibility:

Standardization can sometimes limit flexibility, making it harder for organizations to adapt quickly to changes in the market or industry.

I.3.5 Compliance:

Ensuring ongoing compliance with standards can be challenging, particularly in large organizations with diverse operations.

I.3.6 Cultural Differences

In multinational organizations, cultural differences can impact the acceptance and implementation of standardized processes.

I.3.7 Continuous Improvement

Standards need to be regularly reviewed and updated, which requires ongoing effort and resources.
Despite these challenges, the benefits of standardization, such as improved efficiency, consistency, and quality, often outweigh the difficulties. Addressing these challenges typically involves strong leadership, clear communication, and a commitment to continuous improvement.

I.4 Advantages and disadvantages of applying of standards

Applying standards in an organization can bring numerous benefits, but it also comes with some challenges. Here are the key advantages and disadvantages and :

I.4.1 Advantages

- ✓ **Quality Improvement:** Standards help ensure that products and services meet consistent quality criteria, which can enhance customer satisfaction and trust.
- ✓ **Efficiency:** By standardizing processes, organizations can reduce waste, streamline operations, and improve productivity.

- ✓ **Safety:** Standards often include safety guidelines that protect employees, consumers, and the environment, reducing the risk of accidents and harm.
- ✓ **Compliance:** Adhering to standards helps organizations comply with legal and regulatory requirements, avoiding fines and legal issues.
- ✓ **Interoperability:** In technology and manufacturing, standardization ensures that different systems and components can work together seamlessly.
- ✓ **Market Access:** Meeting international standards can open up new markets for products and services, as many countries and industries require compliance with specific standards.
- ✓ **Customer Confidence:** Consistent quality and safety standards enhance customer confidence and loyalty.

I.4.2 Disadvantages

- ✗ **Resistance to Change:** Employees and stakeholders may be resistant to new standards, especially if they are accustomed to existing processes.
- ✗ **Cost:** Implementing new standards can be expensive, involving costs for training, new equipment, and potential downtime during the transition.
- ✗ **Complexity:** Developing and maintaining standards can be complex, requiring significant time and expertise to ensure they are comprehensive and effective.
- ✗ **Flexibility:** Standardization can sometimes limit flexibility, making it harder for organizations to adapt quickly to changes in the market or industry.
- ✗ **Continuous Improvement:** Standards need to be regularly reviewed and updated, which requires ongoing effort and resources.

I.5 Types of standards

There are four main types of standard :

❶ **Fundamental standards:** concern terminology, symbols and metrology.

❷ **Test standards:** describe test and analysis methods and measure characteristics.

❸ **Specification standards:** set out the characteristics of a product or service, the performance thresholds to be achieved and the ability to meet them and fitness for use.

❹ **Organisational standards:** are concerned with the description of a function within a company, a way of operation.

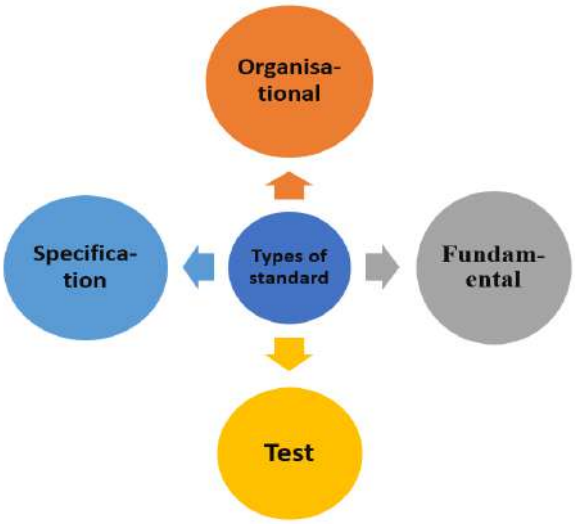

Figure I.2: Types of standards.

I.5.1 Fundamental standards

Fundamental standards are the basic requirements that organizations, particularly in health and social care, must meet to ensure quality and safety. These standards are designed to protect the rights of service users and ensure that care is delivered in a safe, effective, and respectful manner . The table I.1 shows some key aspects of fundamental standards :

Table I.1: Aspects of fundamental standards.

Person-Centered Care	Care and treatment must be tailored to meet the individual needs and preferences of each service user.
Dignity and Respect	Service users must be treated with dignity and respect at all times.
Consent	Care and treatment must only be provided with the informed consent of the service user.
Safety	Care must be provided in a way that ensures the safety of service users, minimizing risks and preventing harm.
Safeguarding from Abuse	Service users must be protected from abuse and improper treatment.
Nutrition and Hydration	Service users nutritional and hydration needs must be met to maintain their health.
Clean and Safe Environment	The premises and equipment used for care must be clean, secure, and properly maintained.
Complaints Handling	There must be a system in place to handle complaints effectively and take appropriate action when issues are identified.
Good Governance	Organizations must have effective governance systems to ensure they meet these standards and continuously improve.
Staffing	There must be sufficient numbers of suitably qualified, competent, and experienced staff to meet the needs of service users.
Fit and Proper Staff	Staff must be of good character, have the necessary qualifications, skills, and experience, and be able to perform their roles effectively.

I.5.1.1 Importance of Fundamental Standards

- Ensuring Quality: Fundamental standards help maintain a high level of quality in care and services.
- Protecting Rights: They safeguard the rights and dignity of service users.

- Promoting Safety: By setting clear safety guidelines, they help prevent harm and ensure a safe environment.
- Enhancing Trust: Adherence to these standards builds trust between service providers and users.

These standards are crucial for ensuring that care and services are delivered in a way that respects and protects the well-being of all individuals.

I.5.2 Test standards

Test standards are guidelines and specifications that ensure the quality, reliability, and consistency of testing processes across various fields. Here are some key types of test standards :

I.5.2.1 Software Testing Standards

These standards provide frameworks and guidelines for testing software to ensure it meets quality and performance requirements. Examples include in Table I.2:

Table I.2: Examples of software testing standards.

ISO/IEC/IEEE 29119	A set of international standards for software testing that covers concepts, processes, and documentation.
IEEE 829	Also known as the Standard for Software Test Documentation, it specifies the format for test plans, test designs, and test cases.

I.5.2.2 Laboratory Testing Standards

These standards ensure that laboratories operate competently and generate valid results. Examples include in Table I.3:

Table I.3: Examples of laboratory testing standards.

ISO/IEC 17025	Specifies the general requirements for the competence of testing and calibration laboratories.
ASTM Standards	Developed by ASTM International, these standards cover a wide range of materials, products, systems, and services.

I.5.2.3 Electrical and Electronic Testing Standards

These standards provide guidelines for testing electrical and electronic devices to ensure safety and performance. Examples include:
IEC Standards: Developed by the International Electrotechnical Commission (IEC), these standards cover the testing and certification of electrical and electronic devices.

I.5.2.4 Environmental Testing Standards

These standards ensure that products and systems can withstand environmental conditions such as temperature, humidity, and vibration. Examples include in Table I.4:

Table I.4: Examples of environmental testing standards.

MIL-STD-810	A U.S. military standard that specifies environmental test conditions for military equipment.
IEC 60068	A series of standards for environmental testing of electronic products.

I.5.2.5 Medical Testing Standards

These standards ensure the safety and efficacy of medical devices and procedures. Examples include in table I.5:

Table I.5: Examples of medical testing standards

ISO 13485:	Specifies requirements for a quality management system for medical devices.
CLSI Standards	Developed by the Clinical and Laboratory Standards Institute, these standards cover laboratory testing procedures and practices.

Importance of Test Standards.

- ***Quality Assurance:*** Ensures that products and services meet specified quality criteria.
- ***Safety:*** Helps prevent accidents and ensures the safety of users.
- ***Reliability:*** Ensures that products and systems perform consistently under specified conditions.
- ***Compliance:*** Helps organizations meet regulatory requirements and industry standards.

Test standards are essential for maintaining the quality, safety, and reliability of products and services across various industries. By adhering to these standards, organizations can ensure that their testing processes are robust and their results are valid.

I.5.3 Specification standards

Specification standards are detailed documents that outline the requirements, guidelines, or characteristics for materials, products, processes, or services. These standards ensure that items meet specific criteria for quality, safety, and performance. Here are some key points about specification standards:

I.5.3.1 Definition:

A specification standard is a precise requirement or set of requirements that a product, process, or service must meet. These requirements are documented and can be used as a reference for quality assurance.

I.5.3.2 Purpose:

The main purpose of specification standards is to ensure consistency, reliability, and safety. They provide a clear set of criteria that must be met, which helps in maintaining uniformity across different products and services.

I.5.3.3 Types of Specification Standards:

- ➔ **Material Specifications:** Define the properties and characteristics of materials used in manufacturing.
- ➔ **Product Specifications:** Detail the requirements for the design, function, and performance of a product.
- ➔ **Process Specifications:** Outline the steps and conditions necessary to produce a product or deliver a service.
- ➔ **Service Specifications:** Describe the standards for delivering services, including quality and performance criteria.

I.5.3.4 Development and Approval:

Specification standards are typically developed by industry experts and stakeholders. They may be approved by national or international standardization bodies, such as ISO (International Organization for Standardization) or ASTM International.

Table I.6: Examples of specification standards.

ISO 9001	Specifies requirements for a quality management system.
ASTM Standards	Provide specifications for materials, products, systems, and services in various industries.
IEEE Standards	Include specifications for electrical and electronic devices and systems.

I.5.3.5 Benefits:

- Quality Assurance: Ensures that products and services meet established quality criteria.
- Safety: Helps prevent accidents and ensures the safety of users.
- Interoperability: Ensures that different products and systems can work together seamlessly.
- Market Access: Facilitates entry into new markets by meeting international standards.

Specification standards play a crucial role in ensuring that products, processes, and services meet specific requirements for quality, safety, and performance. By adhering to these standards, organizations can improve their operations, enhance customer satisfaction, and gain a competitive edge in the market.

I.5.4 Organizational standards

Organizational standards are the principles, protocols, and procedures that guide how an organization operates. These standards ensure consistency, quality, and efficiency across various aspects of the organization. Here are some key points about organizational standards:

I.5.4.1 Purpose:

They help in achieving the organization's objectives by providing a clear framework for operations, ensuring that all employees understand their roles and responsibilities.

I.5.4.2 Types:

Organizational standards can cover a wide range of areas, including:

- **Quality Management:** Ensuring products and services meet certain quality criteria (e.g., ISO 9001) .

- ✷ **Environmental Management:** Reducing environmental impact (e.g., ISO 14001) .
- ✷ **Information Security:** Protecting data and information (e.g., ISO/IEC 27001) .

I.5.4.3 Benefits:

- ✿ **Efficiency:** Streamlined processes and reduced waste.
- ✿ **Consistency:** Uniformity in product and service delivery.
- ✿ **Compliance:** Meeting regulatory and legal requirements.
- ✿ **Customer Satisfaction:** Improved quality and reliability of products and services.

I.5.4.4 Implementation

Effective implementation involves:

- ➩ **Leadership Commitment:** Strong support from top management.
- ➩ **Employee Training:** Ensuring all employees are aware of and understand the standards.
- ➩ **Continuous Improvement:** Regularly reviewing and updating standards to adapt to changes and improve performance.

Chapter II

Standardization organizations around the world

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II.1 The History of Standards and Electrical Engineering

The history of electrical engineering is inextricably linked to the development of standards, a partnership that transformed a field of wild experimentation into the foundation of the modern technological world. This evolution began with a "War of the Currents" and progressed through foundational safety and measurement standards to the complex interoperability protocols that underpin today's global digital infrastructure. In the late 19th century, the lack of standards was starkly evident in the battle between Thomas Edison's Direct Current (DC) and Nikola Tesla/George Westinghouse's Alternating Current (AC). This was more than a technical debate; it was a commercial war fought over fundamental system standards for power generation and transmission, which was ultimately won by AC's superior efficiency over long distances. This conflict highlighted the critical need for uniformity, leading to the establishment of the world's first dedicated electrical standards body, the International Electrotechnical Commission (IEC), in 1906. National bodies like the American Institute of Electrical Engineers (a precursor to IEEE) and Germany's VDE soon followed, tackling the immediate and dangerous challenges of safety, measurement, and component ratings.

The 20th century was defined by the drive for interconnection and compatibility. The rapid expansion of the power grid required standards for voltage, frequency, and plug/socket designs to ensure that electricity from any power plant could safely power any device in any home. This era of standardization enabled mass production and consumer confidence. The invention of the transistor and the integrated circuit then shifted the frontier of standardization from power to information. New standards were needed for the "alphabet" of digital communication, leading to codes like ASCII (American Standard Code for Information Interchange). The need to connect different computer systems drove the creation of open, consensus-based standards for data networks, most famously the TCP/IP protocol suite, which became the universal language of the internet. This culminated in the development of foundational technologies like Ethernet (IEEE 802.3).

A brief history of electrical engineering standards evolved from the need for consistent units in the 19th century to the creation of international organizations like the IEC and IEEE for global safety and interoperability. Early standards focused on defining fundamental units like the ohm and volt, which were later formalized in 1893. As electrical technology grew, standards also emerged for safety regulations, particularly after industrial accidents, leading to the first wiring rules and later the creation of bodies like the IEE (now IET) and the IEEE Standards Association.

And today, the role of standards is more crucial than ever, governing the wireless and miniaturized world. The Institute of Electrical and Electronics Engineers (IEEE) has become a global powerhouse, producing thousands of standards that enable seamless interoperability,

from Wi-Fi (IEEE 802.11) and Bluetooth to USB and power management in microchips. Without this intricate, invisible framework of standards, the complex global ecosystem of devices, networks, and the Internet of Things (IoT) would be a chaotic mess of incompatible parts, making the progress of electrical engineering from a scientific curiosity to the backbone of modern society impossible .

II.2 Food and Agriculture Organization

The Food and Agriculture Organization of the United Nations (FAO) is a specialized agency of the United Nations that leads international efforts to defeat hunger and improve nutrition and food security. Its Latin motto, fiat panis, translates to "let there be bread". It was founded on 16 October 1945 .

The FAO comprises 195 members, including 194 countries and the European Union. Its headquarters is in Rome, Italy, and it maintains regional and field offices worldwide, operating in over 130 countries. It helps governments and development agencies coordinate their activities to improve and develop agriculture, forestry, fisheries, and land and water resources. It also conducts research, provides technical assistance to projects, operates educational and training programs, and collects agricultural output, production, and development data.

The FAO is governed by a biennial conference representing each member country and the European Union, which elects a 49-member executive council.

Figure II.1: Food and agriculture organization logo.

II.3 World Health Organization

The World Health Organization (WHO) is a specialized agency of the United Nations responsible for international public health. It is headquartered in Geneva, Switzerland, and has six regional offices and 150 field offices worldwide .

The WHO was established on April 7, 1948, and formally began its work on September 1, 1948. It incorporated the assets, personnel, and duties of the League of Nations' Health Organization and the Paris-based Office International d'Hygiène Publique, including the International Classification of Diseases (ICD). The agency's work began in earnest in 1951

after a significant infusion of financial and technical resources.
The WHO's official mandate is to promote health and safety while helping the vulnerable worldwide. It provides technical assistance to countries, sets international health standards, collects data on global health issues, and serves as a forum for scientific or policy discussions related to health. Its official publication, the World Health Report, provides assessments of worldwide health topics.
The WHO has played a leading role in several public health achievements, most notably the eradication of smallpox, the near-eradication of polio, and the development of an Ebola vaccine. Its current priorities include communicable diseases, such as HIV/AIDS, Ebola, malaria and tuberculosis; non-communicable diseases such as heart disease and cancer; healthy diet, nutrition, and food security; occupational health; and substance abuse. The agency advocates for universal health care coverage, engagement with the monitoring of public health risks, coordinating responses to health emergencies, and promoting health and well-being generally.
The WHO is governed by the World Health Assembly (WHA), which is composed of its 194 member states. The WHA elects and advises an executive board made up of 34 health specialists; selects the WHO's chief administrator.

Figure II.2: World health organization logo.

II.4 International Organization for Standardization

The International Organization for Standardization (ISO) is an independent, non-governmental, international standard development organization composed of representatives from the national standards organizations of member countries. Membership requirements are given in Article 3 of the ISO Statutes .
ISO was founded on 23 February 1947, and (as of July 2024) it has published over 25,000 international standards covering almost all aspects of technology and manufacturing. It has over 800 technical committees (TCs) and subcommittees (SCs) to take care of standards development.
The organization develops and publishes international standards in technical and nontechnical

fields, including everything from manufactured products and technology to food safety, transport, IT, agriculture, and healthcare. More specialized topics like electrical and electronic engineering are instead handled by the International Electrotechnical Commission. It is headquartered in Geneva, Switzerland. The three official languages of ISO are English, French, and Russian.

Figure II.3: International organization for standardization logo.

II.5 European Committee for Standardization

The European Committee for Standardization (CEN, French: Comité Européen de Normalisation) is a public standards organization whose mission is to foster the economy of the European Single Market and the wider European continent in global trading, the welfare of European citizens and the environment by providing an efficient infrastructure to interested parties for the development, maintenance and distribution of coherent sets of standards and specifications .

The CEN was founded in 1961. Its thirty-four national members work together to develop European Standards (ENs) in various sectors to build a European internal market for goods and services and to position Europe in the global economy. CEN is officially recognized as a European standards body by the European Union, European Free Trade Association and the United Kingdom; the other official European standards bodies are the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI).

More than 60,000 technical experts as well as business federations, consumer and other societal interest organizations are involved in the CEN network that reaches over 460 million people. CEN is the officially recognized standardization representative for sectors other than electrotechnical (CENELEC) and telecommunications (ETSI). On 12 February 1999, the European Parliament noted in a resolution that CEN, CENELEC and ETSI co-operate smoothly and that a merger of the three standardization bodies would not have clear advantages.

The standardization bodies of the thirty national members represent the twenty seven member states of the European Union, three countries of the European Free Trade Association (EFTA),

the United Kingdom and other countries that are highly integrated into the European economy. CEN is contributing to the objectives of the European Union and European Economic Area with technical standards (EN standards) which promote free trade, the safety of workers and consumers, interoperability of networks, environmental protection, exploitation of research and development programmes, and public procurement. An example of harmonized standards are those for materials and products used in construction and listed under the Construction Products Directive. The CE mark is a declaration by the manufacturer that a product complies with all relevant EU directives.
CEN (together with CENELEC) provide a CEN/CENELEC platform for the development of European Standards and other technical specifications across a wide range of sectors, also ensuring that standards correspond with any relevant EU legislation.
CEN (together with CENELEC) owns the Keymark, a voluntary quality mark for products and services. A product bearing the Keymark demonstrates conformity to European Standards.

Figure II.4: European committee for standardization logo.

II.6 French Standardization Association

Established in 1926, AFNOR is an association governed by the law of 1901, consisting of nearly 2500 member companies. Its aim is to lead and coordinate the standards development process and to promote the application of those standards .
Recognized by the public authorities (who entrusted the Ministry in charge of industry with the task of ensuring interministerial coordination and control functions), AFNOR is at the hub of the French standardization system. Bringing together all the major socio-economic players, AFNOR is alert to their needs and cooperates closely with the 25 standards bureaus and the other professional bodies in developing a set of standards that meet their strategic objectives. As a service provider, AFNOR has developed a variety of deliverables - for companies in particular - which, ranging from the distribution of standards to certification, including training, helps in a practical way to integrate standards into the company's development.
AFNOR has concentrated its commercial and competitive activities within specialised subsidiaries by creating AFNOR Certification and AFNOR Competences in the training area. The figures herewith refer to the group as a whole, which maintains strong synergy between its different activities.

Figure II.5: French standardization association logo.

II.7 Algerian Institute of Standardization

IANOR, or Algerian Institute of Standardization, is an industrial and commercial public institution (EPIC) founded on February 21, 1998, following Executive Decree 98-69 . This creation is part of a broader restructuring including INAPI (Algerian Institute of Standardization and Industrial Property). Under the supervision of the Ministry of Industry and Mines, IANOR represents Algeria within the International Organization for Standardization (ISO).
As a national standards body, IANOR's main objectives are to :

- Coordinate development of national standards with different sectors.
- Identify standardization needs at national level.
- Implement the national standardization plan.
- Disseminate information on standardization and related activities.
- Manage the national information point on technical barriers to trade for the World Trade Organization (WTO).
- Administer the conformity mark to Algerian standards

In addition, IANOR offers a range of services including training, consulting, auditing and certification for economic operators, public bodies and consumers. These services cover the areas of standardization, regulation and certification. The organisation has an information centre, various technical committees and a testing and calibration laboratory.

II.7.1 Which products need to be certified by an IANOR standard ?

IANOR offers companies the opportunity to certify their products according to its standards, thus ensuring their compliance with technical and regulatory criteria and highlighting their quality on the market. Certification is carried out via the TEDJ mark, a national quality label for voluntary certification, issued by IANOR. This label, once affixed to a product,

Figure II.6: Algerian institute of standardization logo.

certifies that it meets the applicable Algerian standards. EASD certification applies to a variety of products, including :

II.7.1.1 Industrial products

Concerning the products manufactured in various Algerian industrial sectors such as construction, energy, household appliances, metallurgy, plastics, etc. Among the examples of TEDJ certified industrial products are HDPE tubes for drinking water, cement, taps and manhole plugs.

II.7.1.2 Agri-food products

These are products of agriculture, livestock, fishing or food processing, intended for human or animal consumption. Examples of TEDJ-certified agri-food products include vegetable oils, dates, canned tomatoes, cheeses, and meats.

II.7.1.3 Halal products

These products meet the standards of the Islamic Sharia in terms of legality, purity, safety, and traceability. Meat, dairy, seafood, and bakery products are examples of TEDJ-certified halal products.
Obtaining TEDJ certification involves laboratory testing, evaluation of the manufacturer's quality system, and regular monitoring to ensure product compliance. The TEDJ certification is issued for three years and can be renewed, provided that the product-specific requirements are always met.

II.8 The International Electrotechnical Commission

(IEC; French: Commission électrotechnique internationale) is an international standards organization that prepares and publishes international standards for all electrical, electronic

and related technologies collectively known as (electrotechnology). IEC standards cover a vast range of technologies from power generation, transmission and distribution to home appliances and office equipment, semiconductors, fibre optics, batteries, solar energy, nanotechnology and marine energy as well as many others. The IEC also manages four global conformity assessment systems that certify whether equipment, system or components conform to its international standards .
All electrotechnologies are covered by IEC Standards, including energy production and distribution, electronics, magnetics and electromagnetics, electroacoustics, multimedia, telecommunications and medical technology, as well as associated general disciplines such as terminology and symbols, electromagnetic compatibility, measurement and performance, dependability, design and development, safety and the environment.

Figure II.7: International electrotechnical commission logo.

II.9 National Institute of Standards and Technology

The National Institute of Standards and Technology (NIST) is an agency of the United States Department of Commerce whose mission is to promote American innovation and industrial competitiveness. NIST's activities are organized into physical science laboratory programs that include nanoscale science and technology, engineering, information technology, neutron research, material measurement, and physical measurement. From 1901 to 1988, the agency was named the National Bureau of Standards .

Figure II.8: National institute of Standards and Technology logo.

Chapter III

Standardizing renewable energies

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III.1 Standardizing Renewable Energies Worldwide

Standardizing renewable energies worldwide is crucial for ensuring a consistent and efficient transition to clean energy. This involves creating uniform regulations, technical standards, and best practices that can be adopted globally [22].

III.1.1 Components of renewable energies Standardization

III.1.1.1 Regulations and policies

Governments need to establish clear and consistent policies that support renewable energy development. This includes incentives for renewable energy projects, subsidies, and tax benefits.

III.1.1.2 Technical standards:

Developing technical standards ensures that renewable energy systems are compatible and interoperable. This includes standards for solar panels, wind turbines, and energy storage systems.

III.1.1.3 Certification and testing:

Implementing certification and testing procedures ensures that renewable energy products meet specific quality and performance criteria. This helps to build trust and reliability in the market.

III.1.1.4 International cooperation:

Collaboration between countries is essential for sharing knowledge, resources, and best practices. International organizations like the International Renewable Energy Agency (IRENA) play a key role in facilitating this cooperation.

III.1.1.5 Education and training:

Providing education and training programs for professionals in the renewable energy sector ensures that they are equipped with the necessary skills and knowledge to implement and maintain renewable energy systems.

III.1.2 Benefits of standardization

Standardization benefits businesses through increased efficiency and market growth by creating economies of scale and brand consistency. Increased efficiency comes from simplified processes and reduced waste, while market growth is driven by easier entry into new global markets and consistent marketing. Standardization can also positively impact

the environment by promoting efficient resource use and can give companies a global reach through consistent, recognizable products and branding (see Figure III.1).

Figure III.1: Benefits of Standardization.

III.1.2.1 Increased efficiency

Standardization leads to more efficient production and installation processes, reducing costs and improving overall performance.

III.1.2.2 Market growth

Clear and consistent standards attract investment and promote market growth by providing a stable and predictable environment for businesses.

III.1.2.3 Environmental impact

Standardized renewable energy systems contribute to reducing greenhouse gas emissions and mitigating climate change.

III.1.2.4 Global reach

Standardization allows for the widespread adoption of renewable energy technologies, making clean energy accessible to more people around the world.

III.2 International Renewable Energy Agency (IRENA)

The International Renewable Energy Agency (IRENA) is a global intergovernmental organization dedicated to promoting the widespread and sustainable use of renewable energy. Here is an overview of its history, membership, and core objectives.
The International Renewable Energy Agency (IRENA) was officially established on January

26, 2009, in Bonn, Germany, following a long-standing vision for a dedicated global renewable energy body that dated back to the 1980s. The agency was founded by 75 founding member countries who signed its statute, which then entered into force on July 8, 2010, making it a formal legal entity. After a preparatory commission phase, IRENA became fully operational in 2011 with its permanent headquarters in Abu Dhabi, United Arab Emirates. Its creation marked a pivotal moment of global consensus on the critical need to promote the widespread and sustainable adoption of renewable energy to address energy security, climate change, and sustainable development. As of 2025, IRENA has a near-global membership of 170 members, which comprises 169 countries and the European Union. This broad membership underscores the international consensus on the importance of renewable energy. Any member state of the United Nations is eligible to join.

IRENA's core mission is to support countries in their transition to a sustainable energy future. It serves as the principal platform for international cooperation, a centre of excellence, and a repository of policy, technology, and financial knowledge on renewable energy. Its work is guided by the principles in its statute, which highlight the vast opportunities of renewable energy for :

- ✿ Sustainable Development and Energy Access,
- ✿ Energy Security and Price Stability,
- ✿ Climate Stabilization and Greenhouse Gas Reduction,
- ✿ Economic Growth and Job Creation.

III.3 Renewable Energies in Algeria

Algeria is starting a green energy dynamic by launching an ambitious renewable energy development (EnR) and energy efficiency program. This vision of the Algerian government is based on a strategy focused on the development of inexhaustible resources such as solar and their use to diversify energy sources and prepare the Algeria of tomorrow. Thanks to the combination of initiatives and intelligence, Algeria is embarking on a new sustainable energy era.

The updated renewable energy program consists of installing a renewable power source of around 22,000 MW by 2030 for the national market, with the maintenance of the export option as a strategic objective, if market conditions allow it.

The updated energy efficiency program aims to achieve energy savings by 2030 of the order of 63 million Tons of oil equivalent(TOE), for all sectors (building and public lighting, transport, industry) by introducing high-performance lighting, thermal insulation and solar water heaters, clean fuels (Liquefied Petroleum Gas and Compressed Naturel Gas) (LPG and CNg), and

high-performance industrial equipment.
The energy efficiency program will reduce CO2 emissions by 193 million tons.
Algeria is committed to the path of renewable energies in order to provide global and sustainable solutions to environmental challenges and issues of conservation of energy resources of fossil origin by launching an ambitious renewable energy development program adopted by the government in February 2011, revised in May 2015 and made a national priority in February 2016.

III.4 Renewable Energy Development Program

Through this renewable energies program, Algeria intends to position itself as a major player in the production of electricity from photovoltaic and wind power, as well as biomass, cogeneration, geothermal energy and, beyond 2021, solar thermal energy. These energy sources will drive sustainable economic development, providing the impetus for a new model of economic growth.
37% of installed capacity by 2030, and 27% of electricity production for national consumption, will be of renewable origin. As the country's renewable energy potential is strongly dominated by solar energy, Algeria sees this as an opportunity and a lever for economic and social development, particularly through the establishment of industries that create wealth and jobs.
However, this does not rule out the launch of numerous wind farm projects and the implementation of experimental biomass, geothermal and cogeneration projects.
Renewable energy projects to produce electricity for the domestic market will be carried out in two stages:
First phase 2015 - 2020: This phase will see the construction of 4010 MW of photovoltaic and wind power, and 515 MW of biomass, cogeneration and geothermal power.
Second phase 2021 - 2030: The development of the electrical interconnection between the North and the Sahara (Adrar), will enable the installation of large-scale renewable energy plants in the regions of In Salah, Adrar, Timimoune and Bechar, and their integration into the national energy system. By this time, solar thermal energy could be economically viable.
Algeria's strategy in this area is to develop a genuine renewable energies industry, combined with a training and knowledge capitalization program that will eventually make it possible to employ local Algerian engineering and project management talent. The renewable energy program will create several thousand direct and indirect jobs to meet the electricity needs of the national market.
N.B: (CSP) is a Concentrated Solar Power.

Unité : MW	â€‹ 1ère phase 2015-2020	2ème phase 2021-2030	TOTAL
Photovoltaïque	3 000	10 575	13 575
Eolien	1 010	4 000	5 010
CSP	-	2000	2 000
Cogénération	150	250	400
Biomasse	360	640	1 000
Géothermie	05	10	15
TOTAL	**4 525**	**17 475**	**22 000**

Figure III.2: Renewable Energy Development Program.

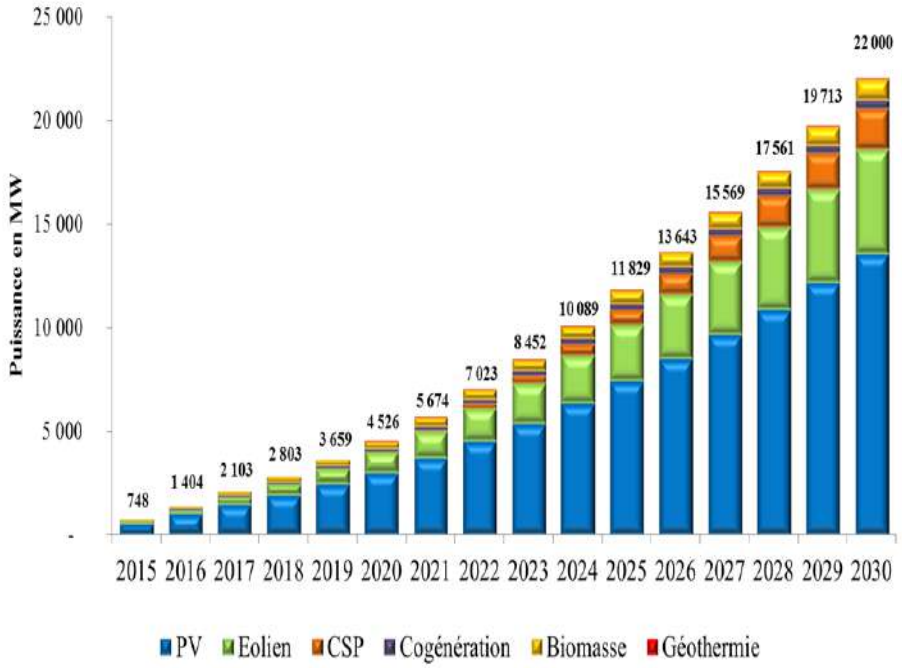

Figure III.3: The national market of RE over the 2015-2030 period is 22,000 MW.

III.5 The essential international standards for photovoltaic energy

The essential standards for photovoltaic may vary from country to country and region to region, but there are a number of internationally recognized standards. These standards aim to ensure the quality, safety and interoperability of photovoltaic systems. Here are just a few of the essential standards for photovoltaic:

III.5.1 IEC 61215 (photovoltaic modules)

This standard specifies performance and qualification requirements for photovoltaic modules. It covers aspects such as mechanical strength, durability and manufacturing quality, and includes tests to assess module performance under different environmental conditions. Classification of photovoltaic modules: The standard defines different classes of modules according to their electrical, thermal and mechanical characteristics (see Table III.1).

Table III.1: Standards specifies performance of photovoltaic modules.

Performance requirements	It specifies the performance criteria that solar modules must meet, such as energy yield, long-term stability, and resistance to environmental conditions.
Mechanical tests	The standard details the mechanical tests that modules must undergo to ensure their robustness in the face of the mechanical and climatic stresses to which they may be exposed.
Electrical testing	Establishes procedures for evaluating the electrical performance of modules, including voltage and current characteristics, resistance to electrostatic discharge, etc.
Environmental testing	The standard defines climatic tests to evaluate the resistance of modules to environmental conditions such as exposure to heat, humidity, frost, etc.

III.5.2 IEC 61730 (Photovoltaic installations)

As safety is a major concern in photovoltaic installations, this standard establishes safety requirements for photovoltaic modules intended for use in fixed installations. It covers aspects such as resistance to fire, mechanical shock and weathering.

Table III.2: Standards of photovoltaic installations.

Safety requirements	The standard establishes safety criteria for photovoltaic modules to minimize potential risks to people, animals and property.
Construction tests	It specifies tests to assess module construction, particularly with regard to electrical insulation, protection against electric shock, and weather resistance.
Mechanical tests	The standard includes mechanical tests to assess the resistance of modules to mechanical stresses, such as snow loads, wind loads and mechanical shocks.
Durability testing	It defines tests to assess the durability of modules over time, including resistance to thermal cycles, humidity and other environmental conditions.
Electrical tests	The standard includes electrical tests to assess the electrical safety of modules, including resistance to overvoltage and electrostatic discharge.

III.5.3 IEC 62109 (Inverters for PV system)

This standard covers the safety of inverters for photovoltaic systems.

Table III.3: Standards of inverters for photovoltaic systems.

Safety requirements	The standard establishes safety criteria for inverters, including protection against electric shock, overcurrent, overvoltage and other electrical hazards.
Safety testing	This specifies tests designed to assess inverter compliance with safety requirements. These tests may include overvoltage resistance tests, fault protection tests, thermal stability tests, etc.
Overvoltage protection	The standard defines requirements for the protection of inverters against overvoltage, in order to minimize risk to the user and ensure equipment reliability.
Insulation	This includes specifications for the electrical insulation of inverters to ensure adequate protection against electric shock.
Mechanical tests	The standard may also include mechanical tests to assess the physical robustness of inverters.

III.5.4 IEC 61724 (Monitoring)

deals with the characteristics of photovoltaic systems in terms of monitoring, maintenance and diagnostics. This includes recommendations on performance monitoring, preventive maintenance and fault detection.

Table III.4: Standards of monitoring.

Monitoring parameters	The standard lists the essential parameters to be monitored in a photovoltaic plant, such as energy production, module temperature, weather conditions, etc.
Measurement methods	It provides recommendations on the appropriate measurement methods for each parameter, ensuring accurate assessment of system performance.
Performance reports	Provides guidelines on how to generate performance reports based on monitoring data, facilitating analysis and understanding of system performance.
Maintenance and calibration	The standard includes recommendations on the regular maintenance of measurement equipment to ensure its accuracy over time.

III.5.5 IEC 61646 (solar panels)

this standard concerns photovoltaic modules (solar panels) and specifies test methods for assessing their performance. However, it is important to note that standards may be updated, and it is advisable to check with standards bodies or official sources to obtain the most recent version of the standard.

III.6 Algerian standards for photovoltaic energy

Algeria has adopted a number of standards concerning photovoltaic energy, with the aim of guaranteeing the safety and efficiency of installations. These standards are developed by the Renewable Energy Development Center (CDER), in collaboration with international standards bodies.
The main Algerian standards for photovoltaic energy are as follows:

Table III.5: Standard photovoltaic modules.

Performance testing	The standard establishes test methods for evaluating the performance of photovoltaic modules, including criteria such as energy yield, long-term stability, and resistance to environmental conditions.
Electrical testing	It specifies procedures for evaluating the electrical performance of modules, including voltage and current characteristics.
Mechanical tests	The standard may include mechanical tests to assess module resistance to mechanical stresses, such as snow and wind loads.
Environmental tests	The standard defines climatic tests to assess the resistance of modules to environmental conditions such as exposure to heat, humidity, frost, etc.
Module classification	The standard may also include criteria for classifying modules according to their characteristics.

III.6.1 NA 02-004-14

Is an Algerian standard that defines the technical requirements and test procedures for photovoltaic systems. It was published by the National Agency for Renewable Energy and Energy Efficiency (ANRE) in 2014.
This standard is mandatory for all photovoltaic systems installed in Algeria. It is important to ensure the safety and performance of photovoltaic systems.
NA 02-004-14 covers the following aspects of photovoltaic systems:

Table III.6: Aspects of photovoltaic systems.

Materials and components	The standard defines requirements for materials and components used in photovoltaic systems, such as photovoltaic cells, photovoltaic modules, inverters and brackets.
Design and Installation	The standard defines requirements for the design and installation of photovoltaic systems, such as component selection, module layout, and installation procedures.
Testing	The standard defines the test procedures for photovoltaic systems, such as performance testing, safety testing and durability testing.

III.6.2 NA 02-005-14

Is an Algerian standard that defines the technical requirements and test procedures for roof photovoltaic systems. It was published by the National Agency for Renewable Energy and Energy Efficiency (ANRE) in 2014.

NA 02-005-14 covers the following aspects of roof photovoltaic systems:

Table III.7: Aspects of roof photovoltaic systems.

Materials and components	The standard defines the requirements for materials and components used in photovoltaic roofing systems, such as photovoltaic cells, photovoltaic modules, inverters and brackets. Photovoltaic modules used in roof photovoltaic systems must be designed to withstand corrosion and extreme weather conditions.
Design and installation	The standard defines requirements for the design and installation of roof photovoltaic systems, such as component selection, module layout, and installation procedures.
Testing	The standard defines test procedures for roof photovoltaic systems, such as performance testing, safety testing, and durability testing.

III.6.3 NA 02-007-14

This standard defines the technical requirements applicable to stand-alone photovoltaic installations. It specifies the electrical, mechanical and thermal characteristics of the installations, as well as the tests they must undergo to comply.

Example: A farmer in Algeria wants to install an autonomous photovoltaic installation to power his farm. He must choose photovoltaic modules that are designed to withstand extreme weather conditions. He must also install the installation in such a way as to meet the energy needs of the farm. Finally, he must subject the installation to performance tests to ensure that it produces the expected amount of energy.

Algeria has also adopted a number of European standards relating to PV energy. These standards are similar to IEC standards, but they are often more stringent.

III.6.4 EN 61215 (PV Modules)

This is a European standard that is part of the harmonized standards for photovoltaic modules (solar panels) and specifies the design and performance requirements of these modules. Specifically, EN 61215 covers crystalline modules used in solar installations.

III.6.5 EN 60253 (PV Controllers)

Defines safety and performance requirements photovoltaic (PV) controllers. It applies to PV controllers used to convert the DC voltage of PV modules into AC voltage compatible with the power grid.

III.6.6 EN 60364 (PV Cables)

This is an international standard that defines the electrical installation requirements for buildings. It is applicable to all types of electrical installations, including photovoltaic (PV) installations.
It defines the following requirements for PV cables:

Table III.8: Standard of electrical installation requirements(PV cables).

Insulation	The insulation of PV cables must be resistant to high temperatures and ultraviolet radiation.
Conductors	The conductors of PV cables must be made of copper or aluminum.
Cross section	The cross section of PV cables must be sufficient to carry the required electrical power.
Marking	PV cables should be marked with information such as rated voltage, frequency, cross section, and type of insulation. In Algeria, the EN 60364 standard is transposed into the CNE 60364 standard. This standard is mandatory for all electrical installations in Algeria.

III.6.7 EN 62548 (PV Installations)

It is an international standard that defines the safety and performance requirements for photovoltaic (PV) installations. It applies to all PV installations, whether connected to the network or not. The standard covers the following aspects of PV installations:

In addition to Algerian standards, photovoltaic installations must also comply with the provisions of the Electricity Code. This code defines the safety rules applicable to all electrical installations, including photovoltaic installations.
The adoption of these standards has contributed to the development of the photovoltaic energy sector in Algeria. Standards ensure the quality and safety of facilities, which contributes to investor and consumer confidence.

III.6.8 Renewable Energy Development Center CDER

The company that adopts these standards is the Renewable Energy Development Center (CDER)(Centre de Développement des Energies Renouvelables).

Table III.9: International standard photovoltaic (PV) installations.

Safety	The standard defines safety requirements to protect people, property and the environment. These requirements include protection against electric shock, over voltage, fire and explosion.
Performance	The standard defines performance requirements to ensure that PV installations operate efficiently and reliably. These requirements include output power, energy efficiency, service life and maintenance. The application of these standards is mandatory for all photovoltaic products and installations marketed in Algeria. Products and installations that do not comply with the standards may not be placed on the market or put into service.

The CDER is a public scientific and technical institution under the supervision of the Ministry of Energy. The CDER is responsible for the promotion of renewable energies in Algeria. One of its tasks is to develop standards and regulations in this area.
Algerian standards for photovoltaic energy are developed by the CDER in collaboration with international standards bodies. This collaboration ensures that Algerian standards are harmonized with international standards. This facilitates trade in photovoltaic products and installations between Algeria and other countries.

Chapter IV

Renewable energy regulations

Table of Contents

IV.1 Introduction

Regulations are authoritative rules or directives created and maintained by an authority, such as government agencies, to manage the behavior of industries, individuals, and organizations. They ensure the safety, efficiency, and fairness of various systems within society.

The components of the regulation

The regulations are composed of the following standards :

- The order
- The regulations
- Decree

Moreover, there are two kinds of regulations :

- The regulations implementing the laws
- Autonomous regulations .

What is regulation mean ?

To regulate: to control, especially by rules, administer, conduct, direct, govern, manage, monitor, order, organize, oversee, restrict, and supervise.
Regulation: rule, in accordance with rules or conventions, by law, commandment, decree, dictate, directive, edict, law order, requirement, restriction, rule, and statute.

Why regulation ?

Regulation in industries like energy aims to fix "market failures" to safeguard consumers, society, and the environment. It primarily ensures fair competition and prevents one dominant player from raising prices. In regulated markets, the level of control is a political decision tied to policy goals. While competition can reduce regulation, it doesn't eliminate the need entirely.

1. Ensure Fair Play: Prevents companies from abusing their market power, promoting competition.
2. Protect Consumers: Keeps prices reasonable and prevents exploitation.
3. Safeguard the Environment: Imposes rules to reduce harmful emissions like CO_2.
4. Ensure Social Equity: Guarantees universal access to essential services.
5. Maintain Supply Security: Prevents disruptions to critical services like electricity.

In essence, regulation in competitive markets aims for economic efficiency, protects consumers, the environment, and promotes social justice by ensuring necessary goods and services

are provided reliably.

Who regulates ?

Regulating energy industries involves different models globally. The independent or semi-independent specialist regulator is common, especially post-privatization. However, in some cases, a central government department retains regulatory functions. Three common models include regulation through a government department, a ministerial agency, or a fully independent regulator.

In general, renewable energy regulation may involve:

- Central government departments: Setting overarching policies.
- Specialist utility or energy regulators: Focusing on industry-specific oversight, including renewables.
-Competition regulators: Ensuring fair practices in the energy market.
- Environmental regulators: Addressing environmental concerns related to energy production.
- Local authorities: Managing regional aspects of energy projects.
-Courts and tribunals: Resolving legal matters in the energy sector.

Regulation of **solar photovoltaic (PV) energy** and renewable energies, in general, is typically managed by multiple entities at various levels. Here are the key regulators:

International Level:

- International Electrotechnical Commission (IEC): Sets global standards for electrical and electronic technologies, including PV systems.

International Renewable Energy Agency (IRENA): Promotes the adoption and sustainable use of renewable energy worldwide.

Regional Level:

European Union (EU): The European Commission implements directives like the Renewable Energy Directive (RED) to set targets and policies for member states.

North American Electric Reliability Corporation (NERC): Ensures the reliability of the power grid in North America, including renewable energy integration.

National Level:

Government Ministries and Departments: Various countries have specific ministries or departments, such as the U.S. Department of Energy (DOE) or China's National Energy Administration (NEA), responsible for energy policy and regulation.

National Regulatory Authorities: Bodies like the Federal Energy Regulatory Commission (FERC) in the U.S. oversee electricity markets, including renewables.

Local Level:

State and Provincial Governments: In federal systems, individual states or provinces often have their own regulations and incentives for renewable energy.

Municipal Governments: Local governments may have additional regulations and incentives to promote the use of renewable energy within their jurisdictions.

IV.2 Types of Regulations

1- Economic Regulations: Control prices, competition, and market entry within industries. Example: antitrust laws .
2- Social Regulations: Protect public welfare by setting standards for health, safety, and the environment. Example: environmental protection laws.
3- Administrative Regulations: Govern the internal procedures of organizations, particularly within the public sector. Example: procurement regulations.

IV.3 Agreement and regulations relating to renewable energies in the European Union

IV.3.1 United Nations Framework Convention

An international environmental treaty to combat "dangerous human interference with the climate system", in part by stabilizing atmospheric concentrations of greenhouse gases. It was signed by 154 countries at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, which was held in Rio de Janeiro from June 3 to 14, 1992. It has established a secretariat headquartered in Bonn and has entered into force. Implemented in March 1994. The Treaty called for continued scientific research, regular meetings, negotiations and future political agreements designed to allow ecosystems to adapt naturally to climate change .

IV.3.2 Kyoto Protocol

The Kyoto Protocol is an international treaty linked to the United Nations Framework Convention on Climate Change (UNFCCC), adopted in Kyoto, Japan, in December 1997. It commits its Parties by setting internationally binding emission reduction targets.
The Protocol's main goal is to reduce greenhouse gas (GHG) emissions to mitigate climate change .
Relationship to Renewable Energy:
1- Promotion of Renewable Energy: The Kyoto Protocol encourages the use of renewable energy sources as a means to reduce GHG emissions. It includes mechanisms like the Clean Development Mechanism (CDM) that support projects using renewable energy technologies, such as solar and wind power.

2- Emission Reduction Targets: By setting binding targets for GHG emissions, the Protocol incentivizes countries to invest in renewable energy to meet these targets.
3- Sustainable Development: The Protocol promotes sustainable development, which includes the development and deployment of renewable energy technologies.
The Kyoto Protocol has played a significant role in advancing renewable energy by creating financial and regulatory incentives for countries to transition away from fossil fuels and towards cleaner energy sources.

IV.3.3 Paris Agreement

The Paris Agreement is a landmark international treaty adopted in 2015 under the United Nations Framework Convention on Climate Change (UNFCCC). Its primary goal is to limit global warming to well below $2°C$ above pre-industrial levels, with efforts to limit the increase to $1.5°C$. The Agreement works on a five-year cycle of increasingly ambitious climate action plans known as Nationally Determined Contributions (NDCs) .
1- Relationship with Renewable Energy: Emission Reduction Targets: The Paris Agreement encourages countries to set ambitious targets for reducing greenhouse gas emissions. Renewable energy plays a crucial role in achieving these targets by replacing fossil fuels with cleaner energy sources.
2- NDCs and Renewable Energy: Many countries include renewable energy targets in their NDCs. For example, 134 out of 188 submitted NDCs mention renewable energy targets, with a significant focus on electricity generation.
3- Financial and Technical Support: The Agreement provides a framework for financial, technical, and capacity-building support to help countries transition to renewable energy.
4- Long-Term Strategies: Countries are encouraged to develop long-term low greenhouse gas emission development strategies (LT-LEDS) that include renewable energy as a key component.
By promoting the adoption of renewable energy, the Paris Agreement aims to reduce energy-related CO_2 emissions and contribute to global efforts to combat climate change.

IV.4 Universal Regulations

1. Renewable Energy Targets: Many countries have set ambitious targets for renewable energy deployment, such as the EU's target of at least 40% renewable energy share by 2030. These targets often drive policy and regulation .
2. Feed-in Tariffs (FiTs): FiTs provide guaranteed payments per unit of renewable energy produced, encouraging investment and project development.
3. Renewable Portfolio Standards (RPS): RPS mandate electricity suppliers or utilities to

source a certain percentage of their energy from renewable sources.

4. Net Metering: Allows small-scale renewable energy producers to sell excess electricity back to the grid, offsetting their own consumption costs.

5. Permitting and Licensing: Streamlined permitting processes and clear licensing requirements are crucial for efficient project development.

6. Grid Integration: Regulations ensure efficient and reliable integration of variable renewable energy sources like solar and wind into the grid.

7. Environmental Impact Assessment (EIA): EIAs assess the potential environmental impacts of renewable energy projects and guide mitigation measures.

8. Land Use Planning: Regulations ensure the responsible siting of renewable energy projects to minimize land-use conflicts and environmental impacts.

9. Social Impact Assessment (SIA): SIAs assess the social impacts of renewable energy projects on communities and guide community engagement and benefit-sharing strategies.

10. Community Engagement: Regulations encourage open communication and engagement with local communities affected by renewable energy projects.

11. Carbon Pricing: Mechanisms like carbon taxes or emissions trading schemes can incentivize the reduction of greenhouse gas emissions, indirectly supporting renewable energy development.

12. Energy Efficiency: Regulations promoting energy efficiency can reduce overall energy demand, making it easier to meet targets with renewable energy sources.

13. Research and Development (R&D): Investing in R&D for new and more efficient renewable energy technologies is crucial for long-term sustainability and cost reduction.

14. Technology Transfer and Capacity Building: Sharing knowledge and expertise with developing countries can accelerate their transition to renewable energy.

15. Intellectual Property (IP) Rights: Clear and fair IP regulations are essential to incentivize innovation and attract investment in renewable energy technologies.

16. Renewable Energy Certificates (RECs): Tradable certificates that represent the environmental attributes of one megawatt-hour of electricity generated from renewable sources.

17. Emission Standards: Regulations setting limits on the amount of pollutants that can be released from industrial processes and power plants.

18. International Climate Agreements: Agreements like the Paris Agreement that set global targets for reducing greenhouse gas emissions.

19. Smart Grid Standards: Technical standards for modernizing power systems to integrate renewable energy and improve efficiency.

IV.5 Algerian renewable energy regulations

Influenced by the widespread interest in renewable energy in the world, Algeria has decided to develop a national policy to promote it by trying to establish a legal framework to regulate this sector as an alternative to traditional energy in order to achieve sustainable development. Below are the regulations and laws adopted by Algeria in the field of renewable energy:

Law No. 98-11 of August 22, 1998 :

Which includes the orientation law and the five-year program for scientific research and technological development, was one of the first laws to give concrete expression to the Algerian government's interest in renewable energies .

Law No. 99-09 on energy management was promulgated:

It aims to consolidate energy efficiency and promote the use of renewable energies. As part of environmental protection against greenhouse gases, this law also includes various measures and procedures taken with the aim of rationalizing energy and developing renewable energies.

Order No. 02-01 of 2002 relating to the distribution of electricity and gas by Canals:

This was the first legislative framework dealing with the marketing of electrical energy. The law also enabled the private sector to exploit energy from renewable sources, as well as allowing self-generation of energy from these sources.

Law No. 01-02 of 2002:

Has also adopted support policies represented by the conduct of calls for tenders for the development of large projects for the private sector, which guarantee the purchase of energy produced from renewable sources.

Law No. 04.09 of 2004 relating to the promotion of renewable energies in the context of sustainable development :

It aims to strike a balance between energy sources and the need to achieve sustainable development by preserving traditional energies and gradually replacing them with clean, sustainable energies.

La loi No. 04-09 :

The aforementioned stipulates the need to create a national renewable energy observatory to contribute to their development.

Executive Decrees No. 06-428, 06-429 of November 26, 2006 And Order of February 21, 2008:

On guaranteeing the connection of renewable energy plants to the grid.

Law No. 09-09 and Executive Decision No. 11423 of December 20, 2011:

which creates the (National Fund for Renewable Energy and Cogeneration).

Executive Decree No. - 13 - 218 of June 18, 2013:

Determines the conditions for granting bonuses to cover the costs of diversifying electricity

production.

Executive Decree No. 17-98 of February 26, 2017 :

Determines the procedure for requesting tenders for the production of renewable energies from co-production and their integration into the electrical energy supply system.

The decision establishing the ministry in application of Executive Decree No. 20-322 of 11/22/2020:

Which defines the responsibilities of the Minister of Energy Transition and Renewable Energies. It aims to implement a national renewable energy development program focused on solar energy (3,000 hours of sunshine per year) and wind energy, with export. prospects

Figure IV.1: National institute of Standards and Technology logo.

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