

Capacidades de I+D en Energía Eólica

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CIEMAT

WEBINAR AEE - REOLTEC: PERTE de Energías Renovables, Hidrógeno Renovable
y Almacenamiento. Análisis para el sector eólico“
22/12/2021

CIEMAT: Algunos datos

**Centro de Investigaciones Energéticas,
Medioambientales y Tecnológicas**

Organismo Publico de Investigación

Secretaria de Estado de Investigación Desarrollo e Innovación

Ministerio de Economía, Industria y Competitividad

Personal : 1.336 trabajadores

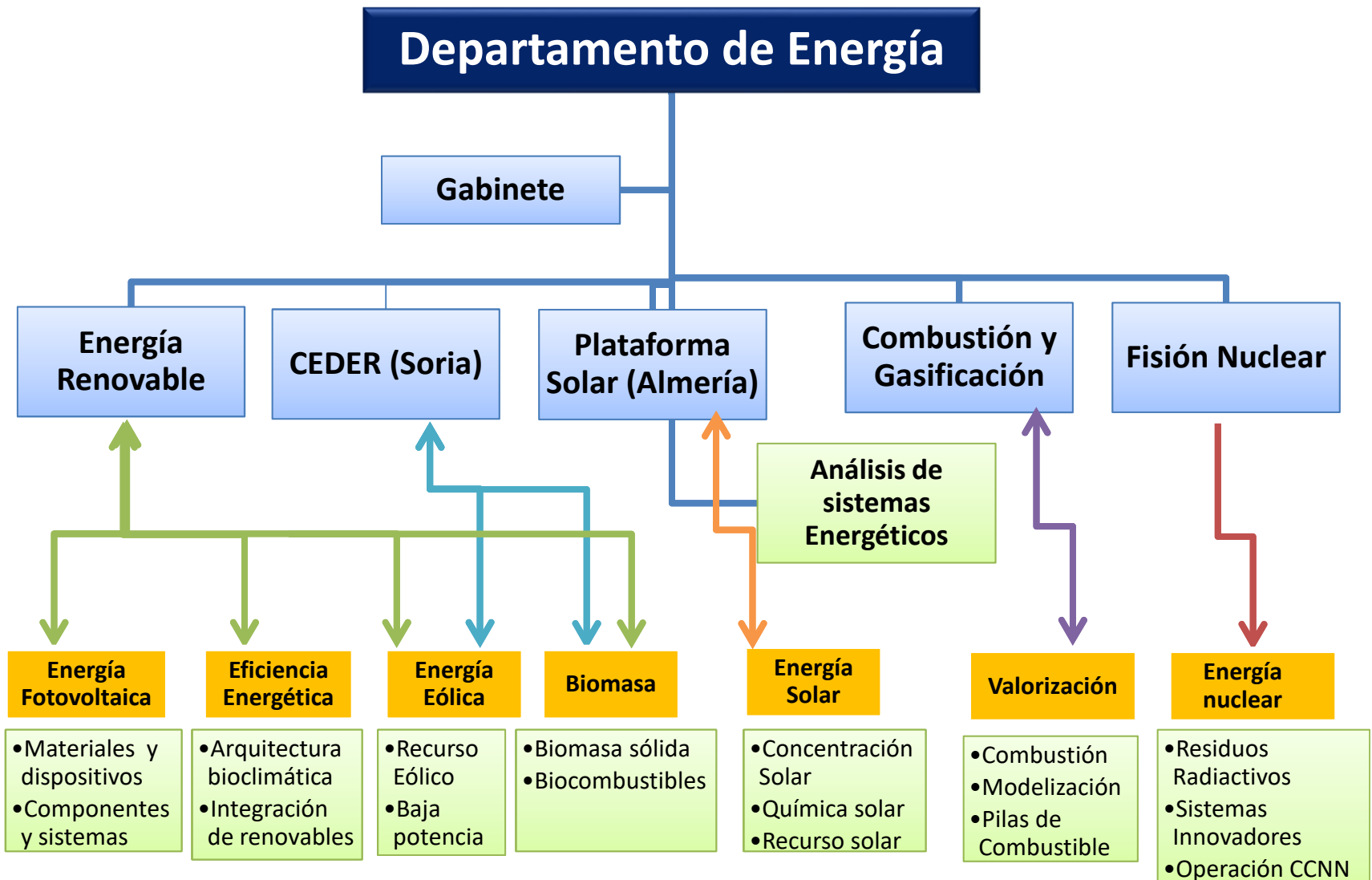
- 260 Doctores
- 478 Titulados Superiores
- 115 Técnicos Medios
- 336 Ayudantes técnicos
- 147 Administrativos y servicios generales

Presupuesto TOTAL: 101 M€
Ingresos exteriores : 38 M€

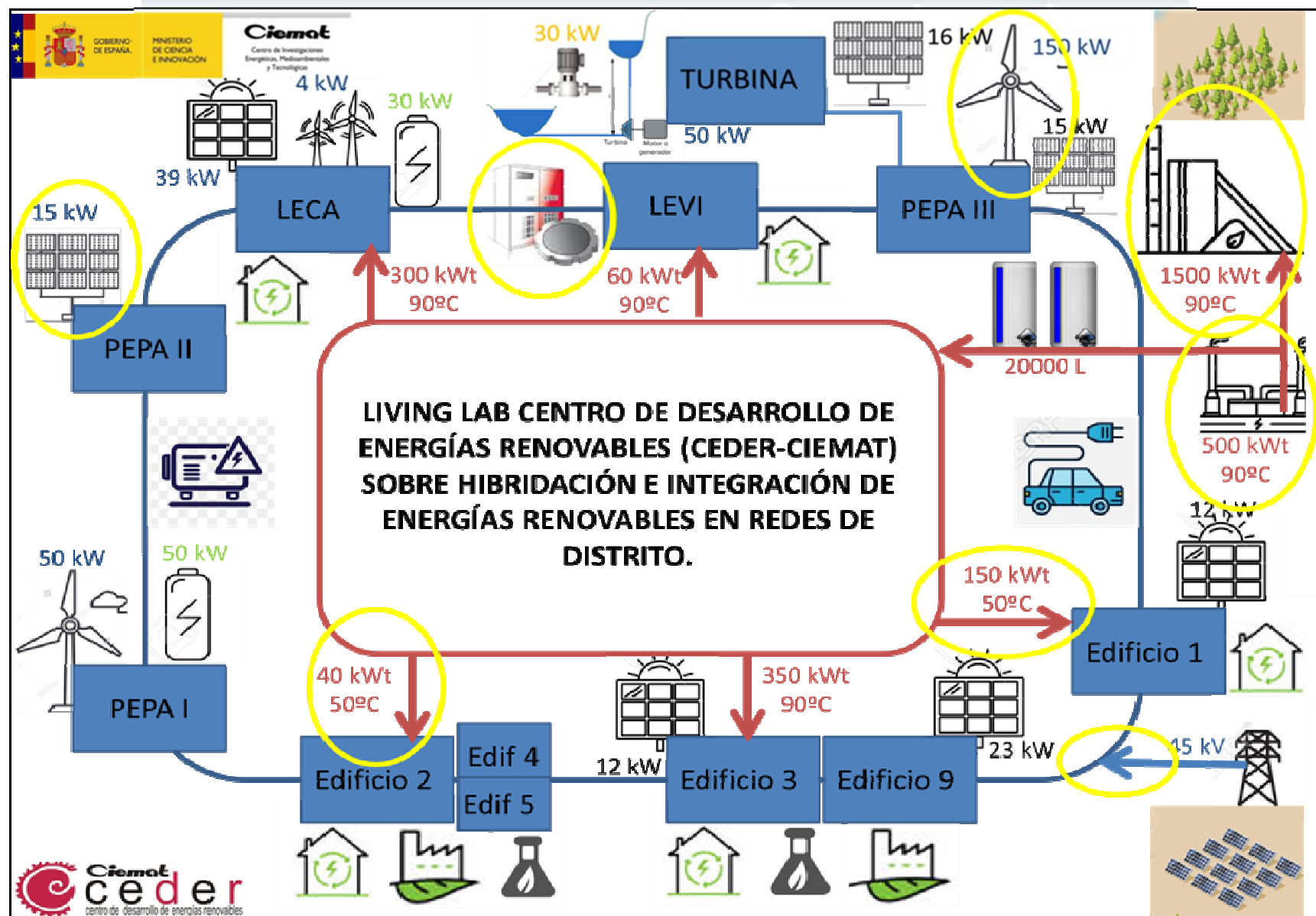
CIEMAT: Centros



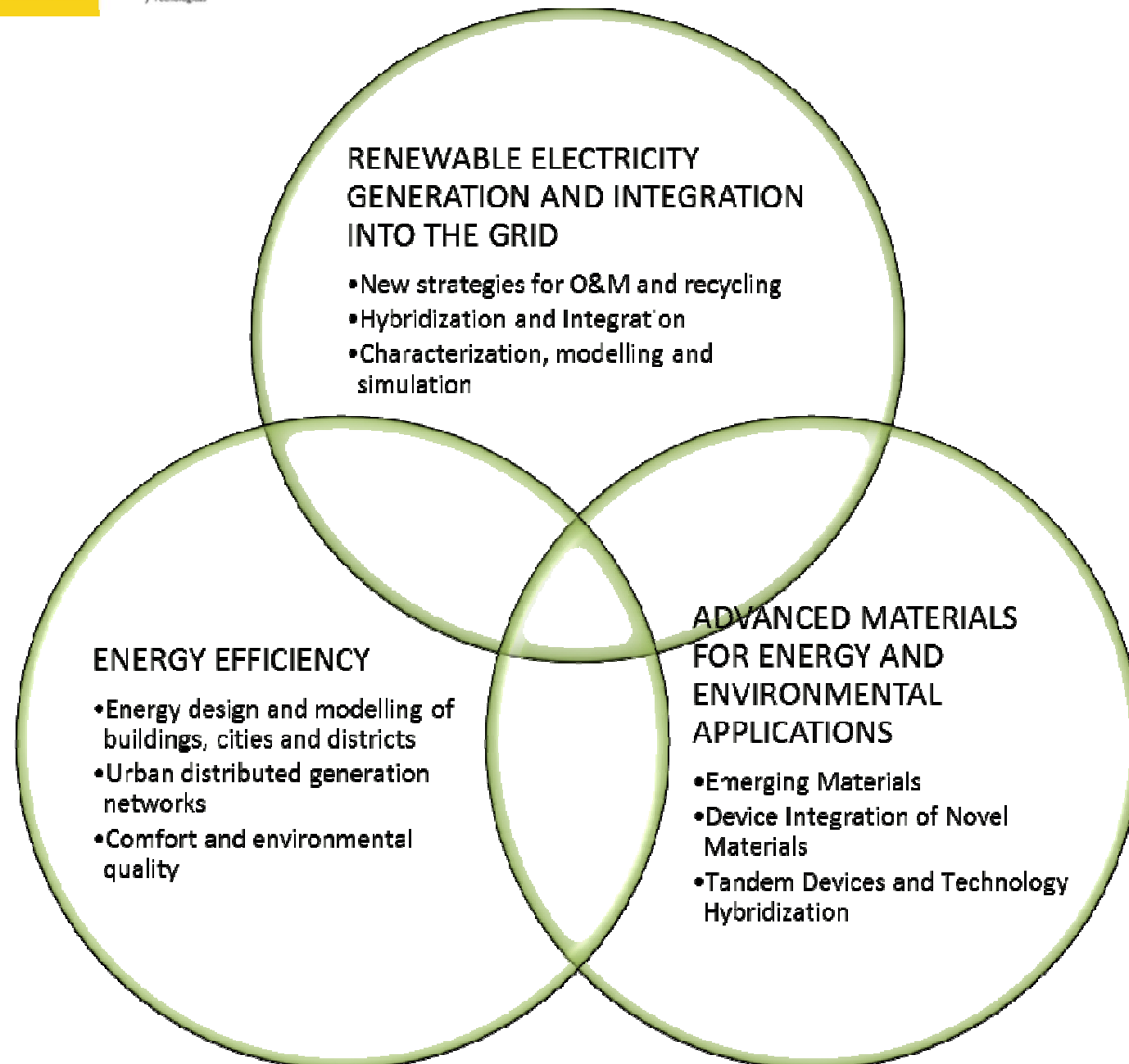
Departamento de Energía



CEDER –CIEMAT Living Lab (Soria)



RENEWABLE ELECTRICITY GENERATION AND ENERGY EFFICIENCY



RENEWABLE ELECTRICITY GENERATION AND INTEGRATION INTO THE GRID

R&D Activities



Advanced VREs O&M and components recycling

Recyclability
NDT field inspection solutions
Defects



VREs Systems hybridization and grid Integration

National VRES Hybridization Map
System sizing and topology
System optimization
System operation and control
Grid integration and service
Off-grid direct H2 generation

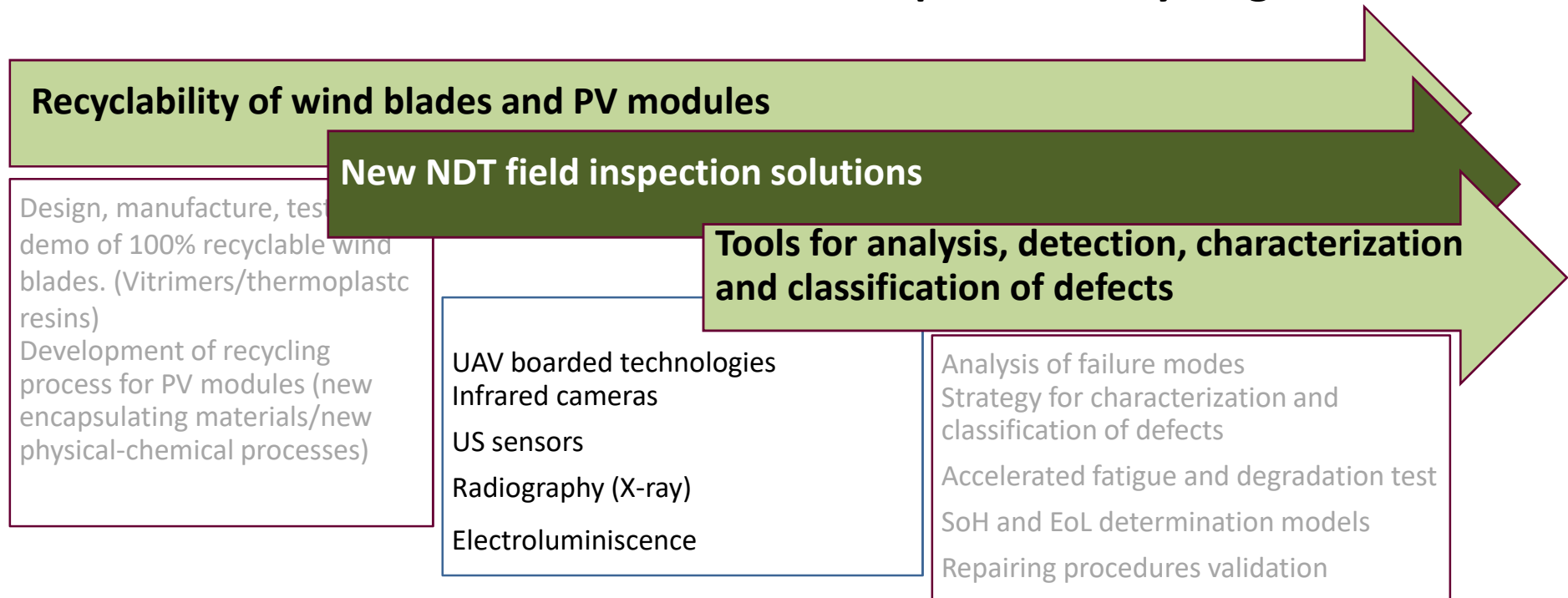


Characterization, modelling and simulation for VRE technologies

Evaluation and development of simulation models and tools
Strategies to increase the reliability of models
Characterization of PV and Wind devices
Evaluation, development and improvement of models for specific systems and complete power plants



Advanced VREs O&M and components recycling

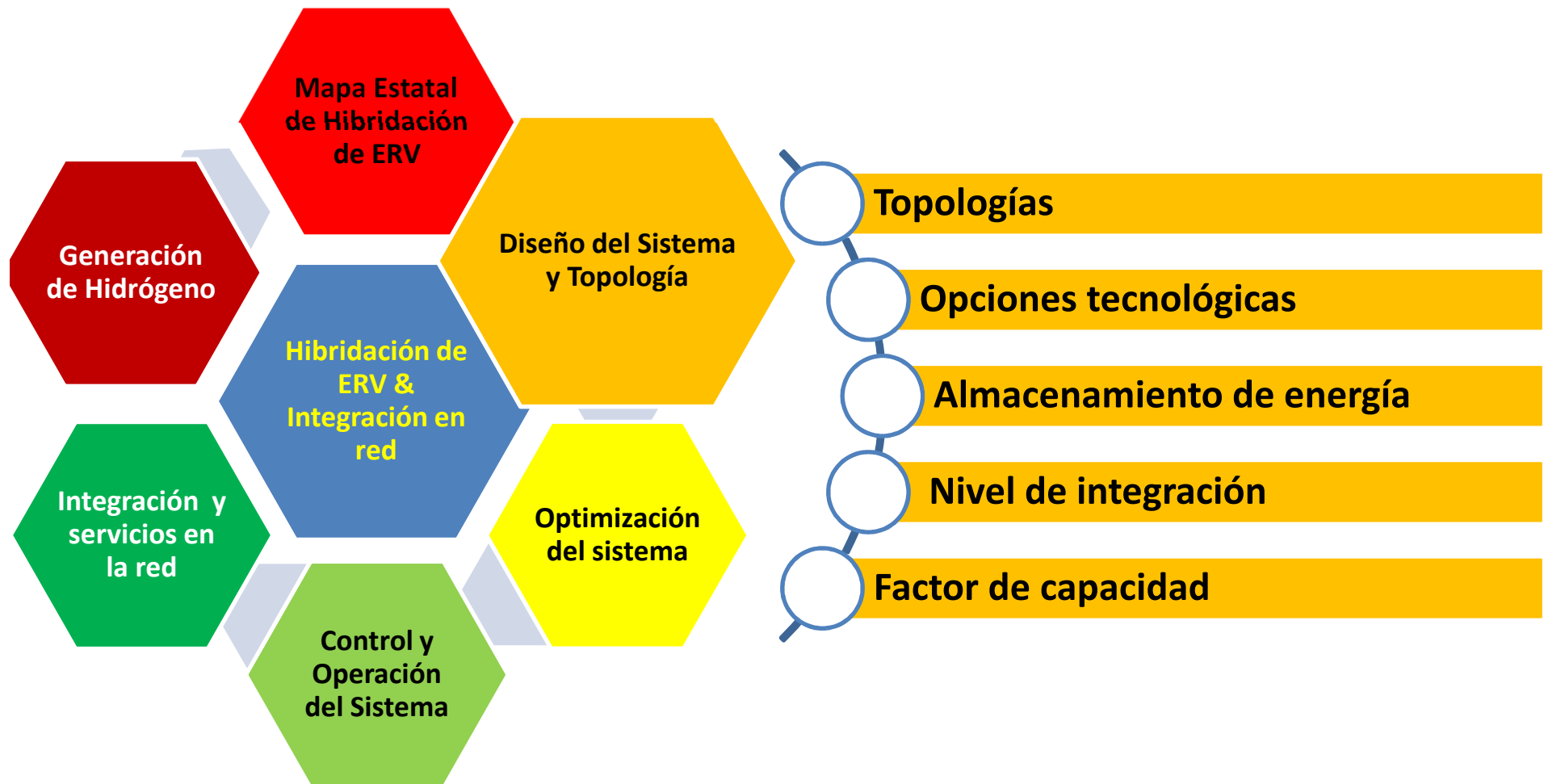


RENEWABLE ELECTRIC GENERATION AND INTEGRATION INTO THE GRID

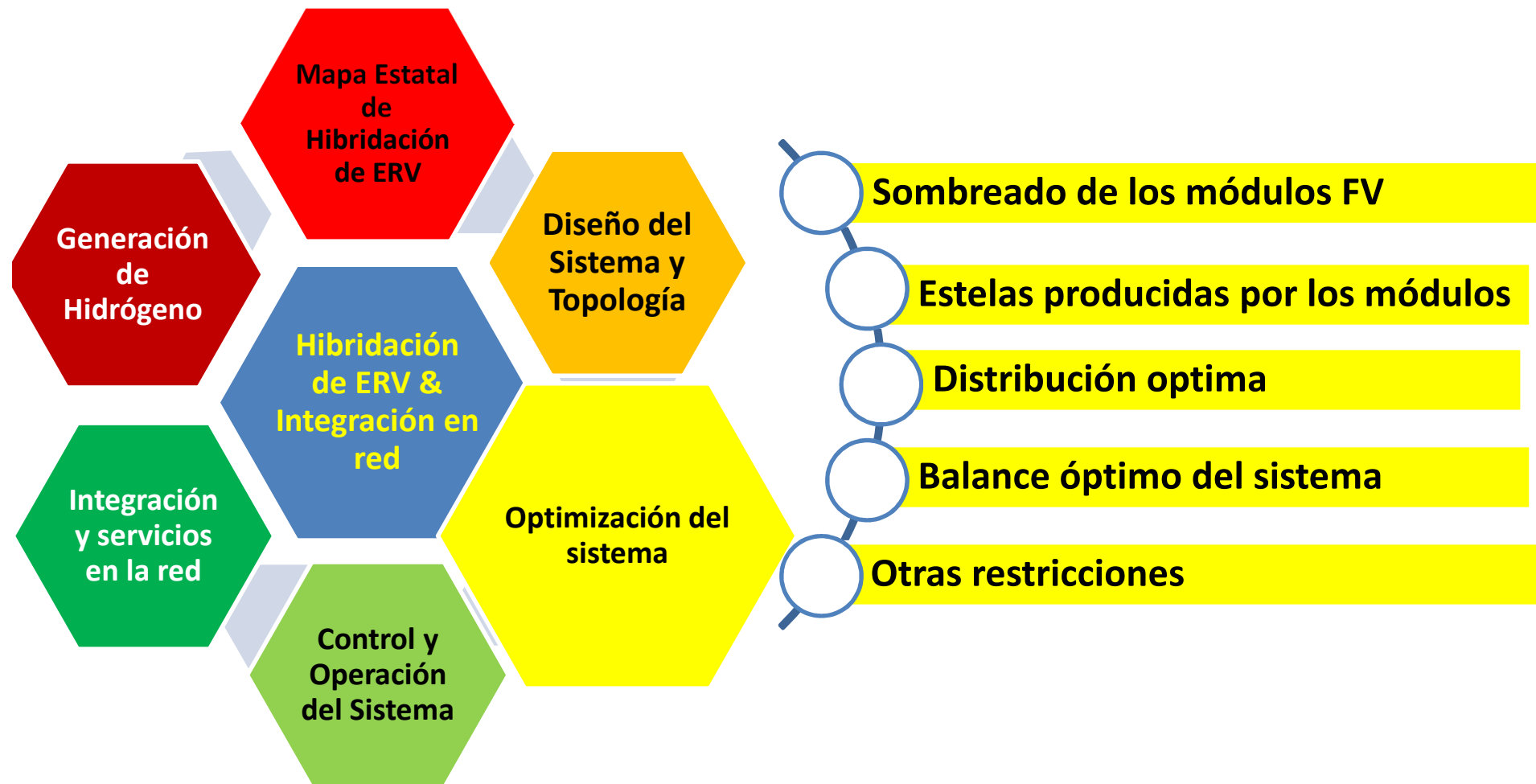
I+D en hibridación de sistemas de energías renovables variables e integración en red



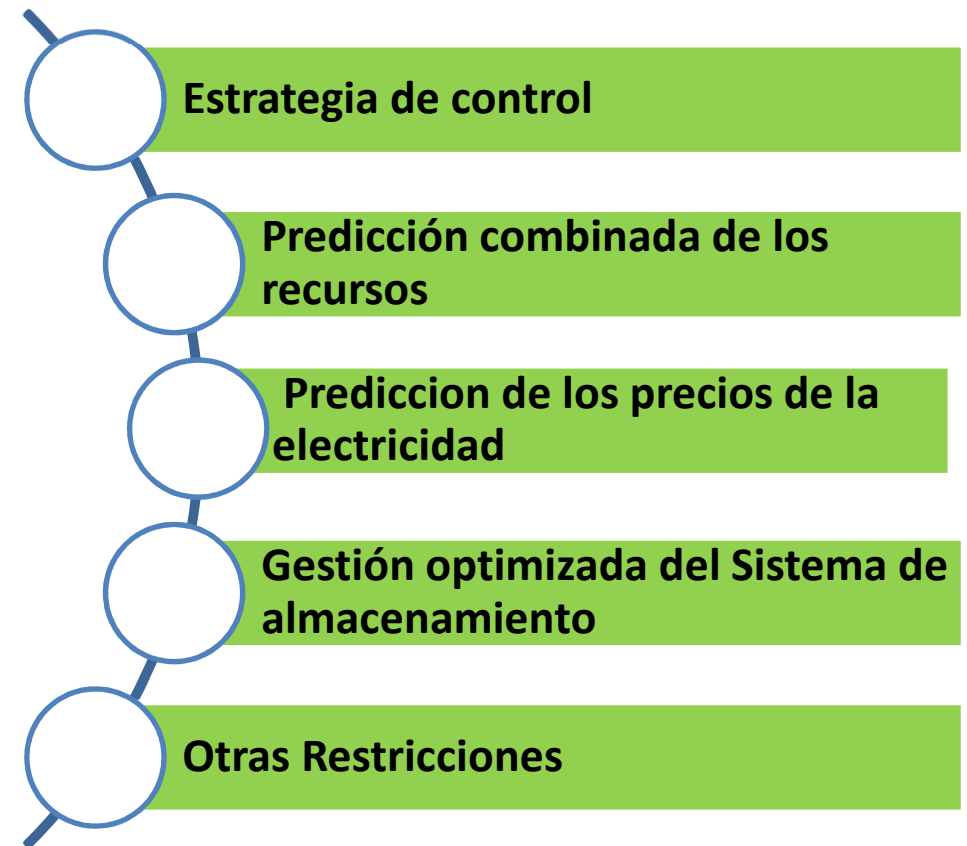
I+D en hibridación de sistemas de energías renovables variables e integración en red



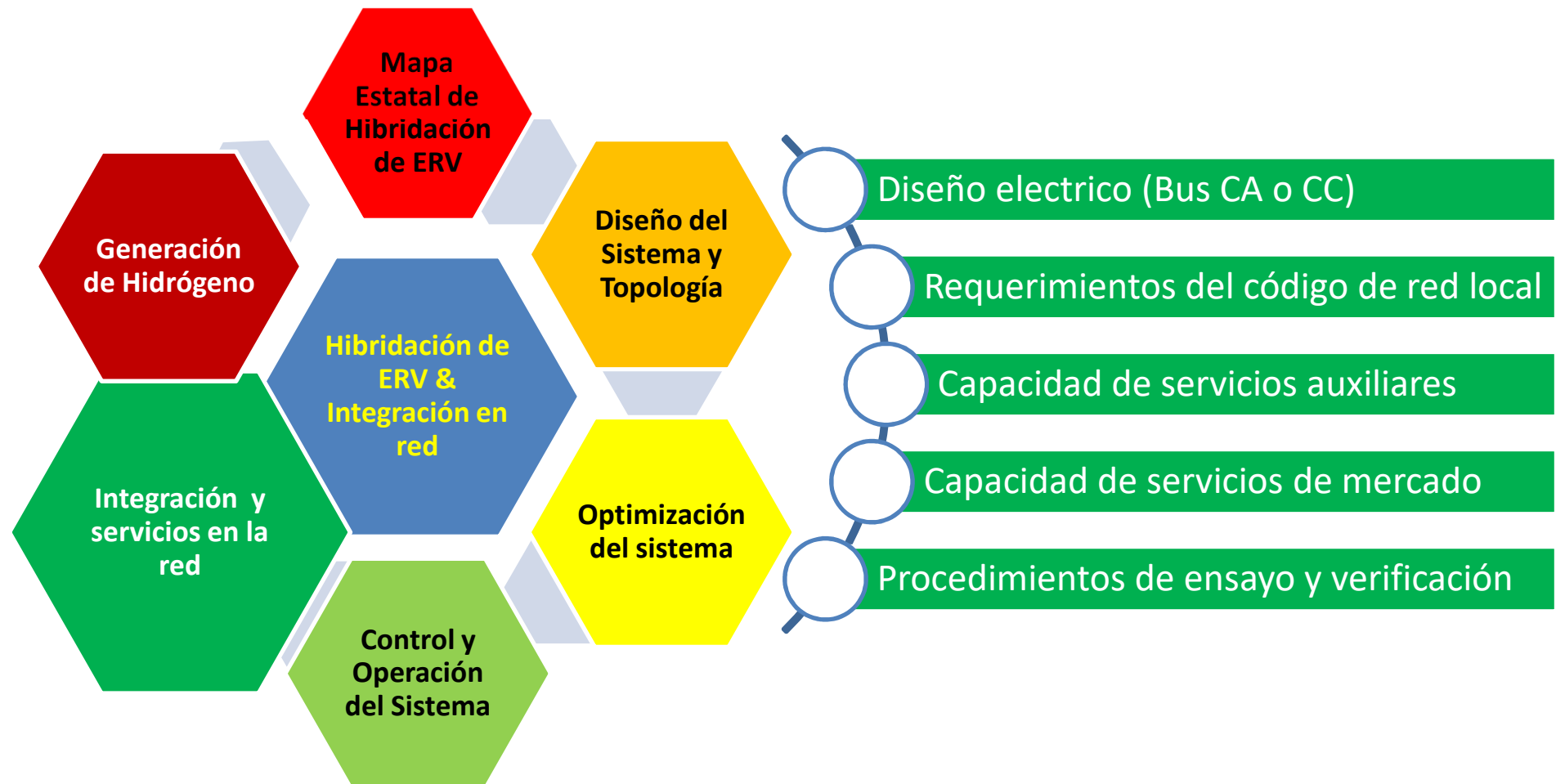
I+D en hibridación de sistemas de energías renovables variables e integración en red



I+D en hibridación de sistemas de energías renovables variables e integración en red

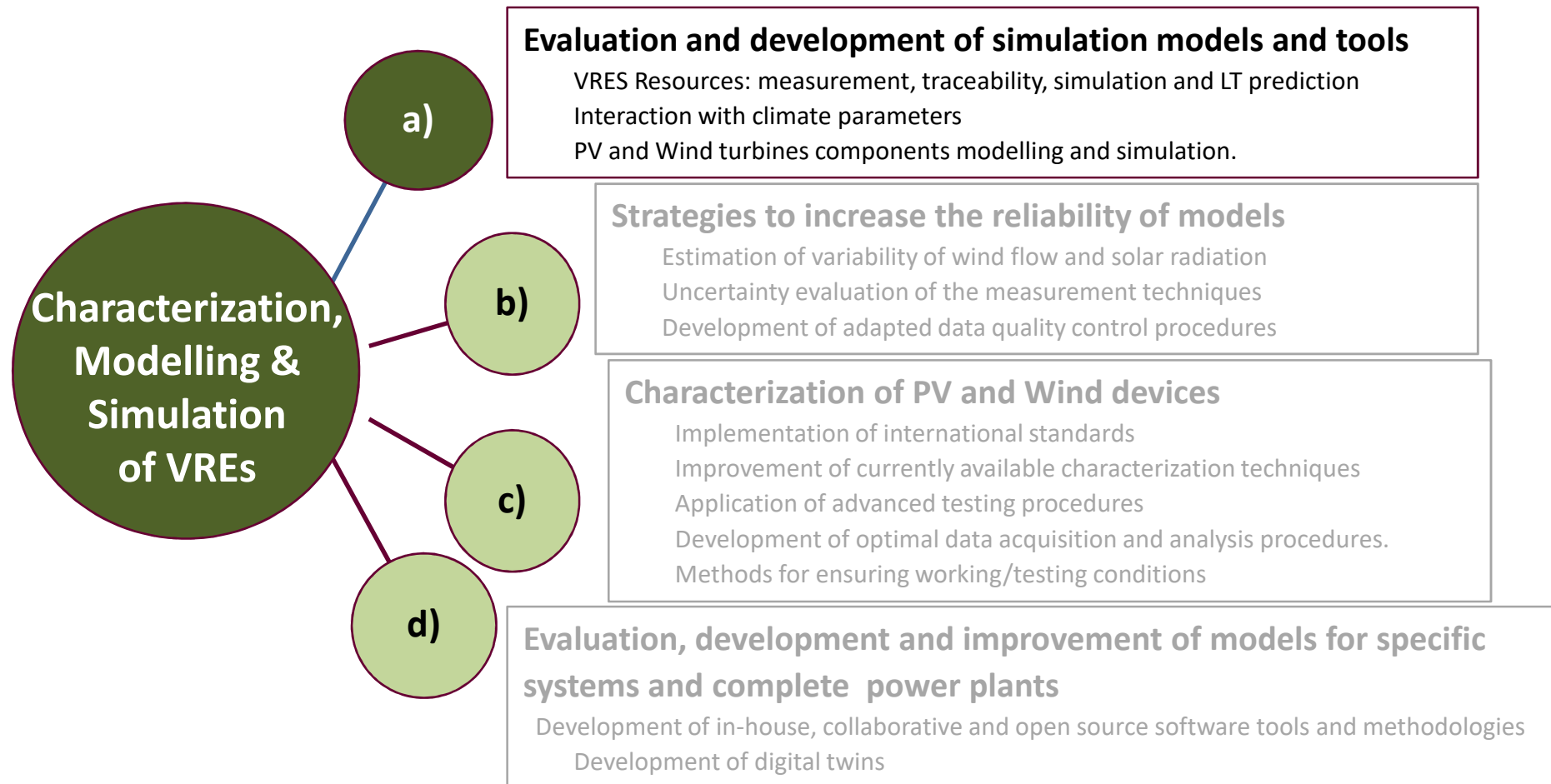


I+D en hibridación de sistemas de energías renovables variables e integración en red



I+D en hibridación de sistemas de energías renovables variables e integración en red





Wind Resources Research

1. Evaluation of the wind resource based on models:

1.1 Simulation of wind resource with very high resolution global and regional climate models.

1.2 Estimation of wind with statistical models.

1.3 Optimization, improvement and model development techniques.

2. Acquisition and Quality Control of Wind Data and other atmospheric / climatic variables.

3. Model validation techniques with observational data.

4. Statistical and climatic analysis of the wind resource based on models and observations:

4.1 Analysis of extreme wind speeds.

4.2 Analysis of climatic trends.

4.3 Estimation of the impact of the future climate on the wind resource.



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100 m met mast



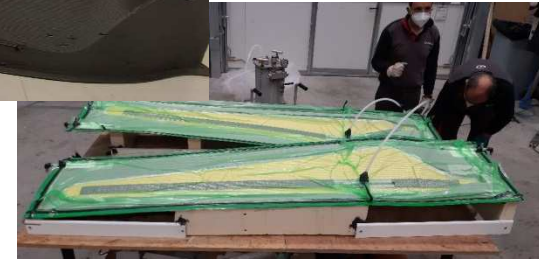
CEDER-CIEMAT
LIDARS

Wind R&D available Infrastructure

Blades manufacturing



Moulds developed by
Additive manufacturing



Blade and generators test benches



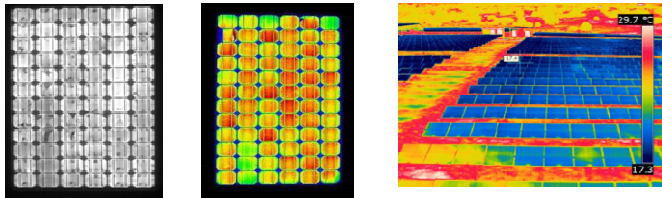
Filament winding & spin tester

Wind turbines characterization: Five field test plants (IEC 61400-2 Class I (2) and Class IV (3))

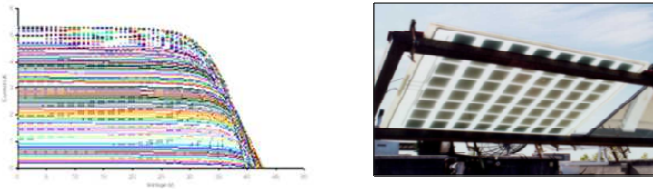


Solar R&D Available infrastructure

Full characterization of PV modules and Plants



Electroluminescence and IR images



I-V curves, optical properties



Accredited lab for solar irradiance measurements



PV components
testing (batteries,
inverters,
regulators, ...)



RENEWABLE ELECTRIC GENERATION AND INTEGRATION INTO THE GRID

R&D Available infrastructure

Microrred CEDER

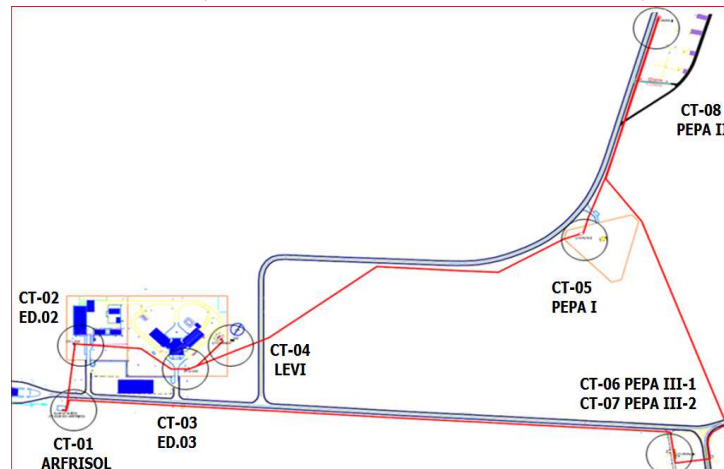
La microrred del CEDER parte de una línea de 45 kV que da servicio a una subestación de 45/15 kV. (Potencia contratada: 115 kW).

Desde ahí se distribuye (red subterránea) en media tensión a 8 centros de transformación que ajustan el voltaje a 400 V de baja tensión trifásica.

La red se puede operar tanto en anillo como en modo radial (4.200 m).

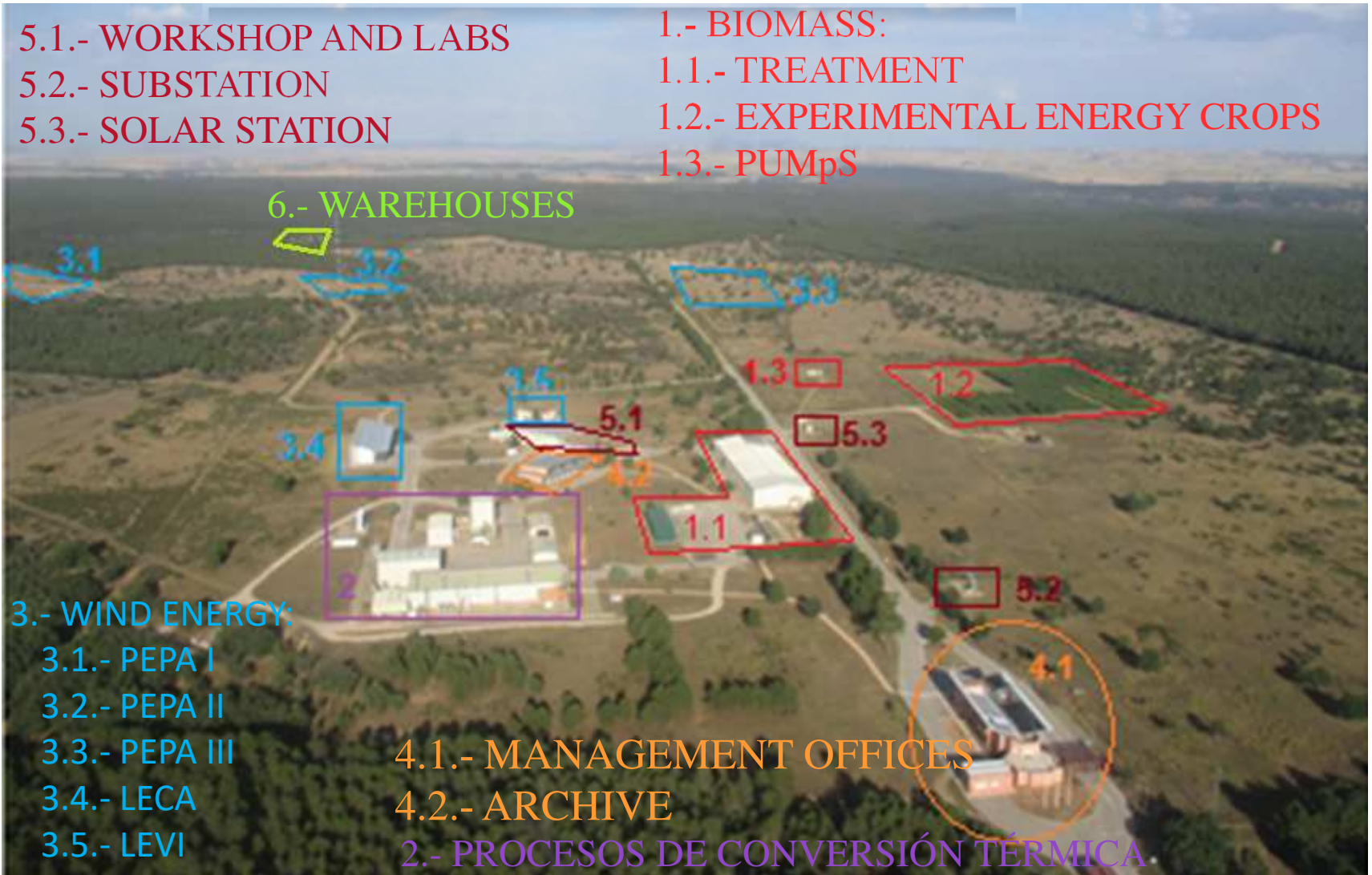
Todos los elementos de generación distribuida, almacenamiento eléctrico distribuido y cargas, están conectados a baja tensión.

El centro presenta diferentes perfiles de consumo, que son similares a los que se pueden encontrar en un entorno industrial, en sector de servicios, incluso consumo doméstico.



R&D Available infrastructure

Microrred CEDER



R&D Available infrastructure

Microrred CEDER

Generation Distributed Units:

- **Small wind** installed capacity: 60.7 kW (6 Wind turbines)
- **Solar PV** installed capacity: 116.9 kW (7 distributed arrays)
- **ICE** Internal Combustion Engine: 100 kW (1 unit)

Energy Storage Distributed Units:

- **Mechanical Energy Storage**
 - **HPS** Hydro Pumping System: (H = 67 m) 60 kW Pelton turbine
+ 2 x 16 solar pumping + 2 kW Archimedes generator Capacity: 114 kWh (C3)
 - **KESS**: ACEBO Flywheel 25 kW , 1,78 kWh
- **Electrochemical energy Storage**
 - **Lead acid batteries**: (3 battery banks distributed)
 - **Li-Ion Batteries**: Rated capacity: 50 Ah Rated voltage: 627,2 V

R&D Available infrastructure

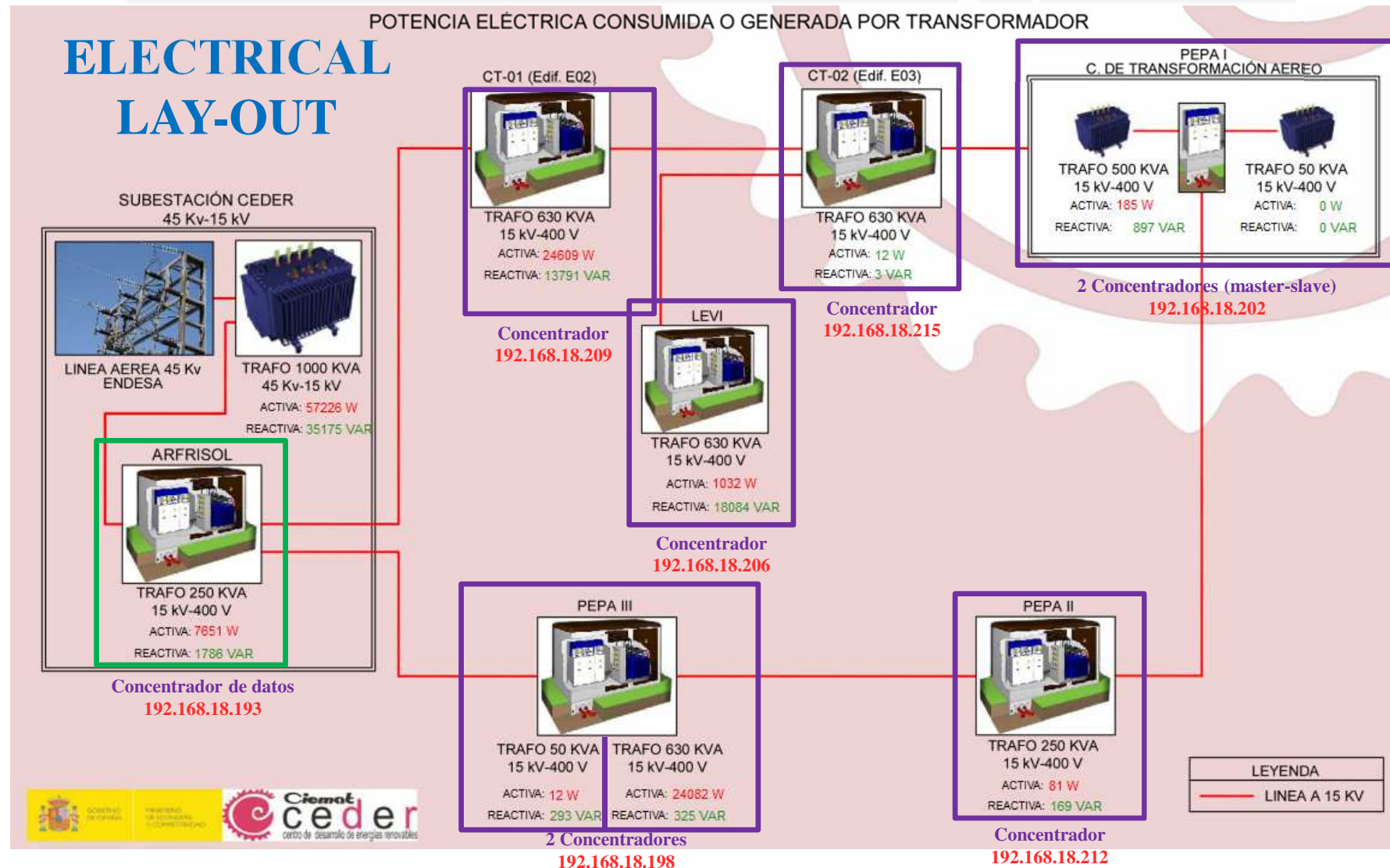
Microrred CEDER

- MV Distribution lines
- 1 Substation
- 6 Transformer stations
- 53 smart meters one and three phasic (V, I, P, 4C Q, AE, 4C RE, inst PF)
- 9 data concentrators
- PRIME data connection
- 8 Power analyzers



R&D Available infrastructure

Microrred CEDER - Monitoring System



An aerial photograph showing a large-scale renewable energy project. In the foreground and middle ground, there are extensive solar panel arrays (photovoltaic modules) laid out in neat rows on a flat, grassy field. To the right of the solar panels, several tall, white wind turbines are visible, their blades extending into the sky. The background shows a mix of agricultural fields, some trees, and a small town or village under a clear blue sky with a few wispy clouds.

¡Muchas gracias!

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