SWTOMP
Small Wind Turbines Optimization and Market Promotion

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SWTOMP Project

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1ST INTERNATIONAL SMALL & MEDIUM WIND WORKSHOP 2019
Nordic Folkecenter, 10 - 12 April 2019

SWTOMP

- The main objective of the **SWTOMP** project is **the promotion, development and implementation of the utilization of small and medium size wind turbines for isolated applications and for connection to weak grids**, including the optimization of small/medium-scale wind turbines to meet local wind regimes and regional infrastructure requirements

- Total duration of the project is three years (2016 – 2019)

SWTOMP

- It is a project organized under the umbrella of the ERANET_LAC European Program that was approved in November 2016
  - Each partner has its own national funding
  - Each partner has a different time schedule
  - Total estimated cost: 1.14 M€ (0.64 M€ requested funding)

SWTOMP

The main expected results are:

- Closer inter-regional links between R&D institutions, wind turbine manufacturers, policy makers and end-users.

- Increased awareness of small/medium-scale wind turbines

- Development of new wind turbines designed specifically for tropical and cool environments

SWTOMP – Consortium members

The following institutions participate in the project:

- **CIEMAT** - Spain - **Coordinator**
- **INEEL** (Instituto Nacional de Electricidad y Energías Límpias) – Mexico
- **INTEC** (Instituto Tecnológico de Santo Domingo – Dominican Republic
- **INTI** (Instituto Nacional de Tecnología Industrial) Neuquén - Argentina
- **IZTECH** (Izmir Institute of Technology) – Turkey
- **UdelaR** (Universidad de la República) – Uruguay
- **UTCN** Universitatea Tehnica din Cluj-Napoa) - Romania
- **VTT** (Technical Research Centre of Finland Ltd) -Finland

Working Packages structure

WP Number	Work Package Title	TASK Number	Task Name
WP0	**Project Management**	Task 0.1	Management of the Project
WP1	**Promotion of SWT Market**	Task 1.1	Analysis of the market of SMWT
		Task 1.2	Workshops for Market Promotion
		Task 1.3	Preparation of material for education
WP2	**Wind Resources for SWT**	Task 2.1	Assessment of the wind resources in six locations
		Task 2.2	Methodology for easy assessment of local resources
WP3	**Wind Turbines Optimization**	Task 3.1	Selection of SWTs to be optimised
		Task 3.2	Redesing of the SWT
		task 3.3	Manufacture and installation of prototypes
		Task 3.4	Testing and Certification of SWT
		Task 3.5	Analysis of results
WP4	**Standard for SWT**	Task 4.1	Identification of standards improvements
		Task 4.2	Proposal for IEC 61400/2 Modification

Gantt Diagram

WP Number	Work Package Title	TASK Number	Task Name	YEAR 1 Q1	YEAR 1 Q2	YEAR 1 Q3	YEAR 1 Q4	YEAR 2 Q1	YEAR 2 Q2	YEAR 2 Q3	YEAR 2 Q4	YEAR 3 Q1	YEAR 3 Q2	YEAR 3 Q3	YEAR 3 Q4
WP0	Project Management	Task 0.1	Management of the Project												
WP1	Promotion of SWT Market	Task 1.1	Analysis of the market of SMWT												
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		Task 4.2	Proposal for IEC 61400/2 Modification												

INSTITUTO NACIONAL DE ELECTRICIDAD Y ENERGÍAS LIMPIAS

INTI

IZMIR INSTITUTE OF TECHNOLOGY IZTECH

UNIVERSIDAD DE LA REPÚBLICA URUGUAY

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA ROMANIA

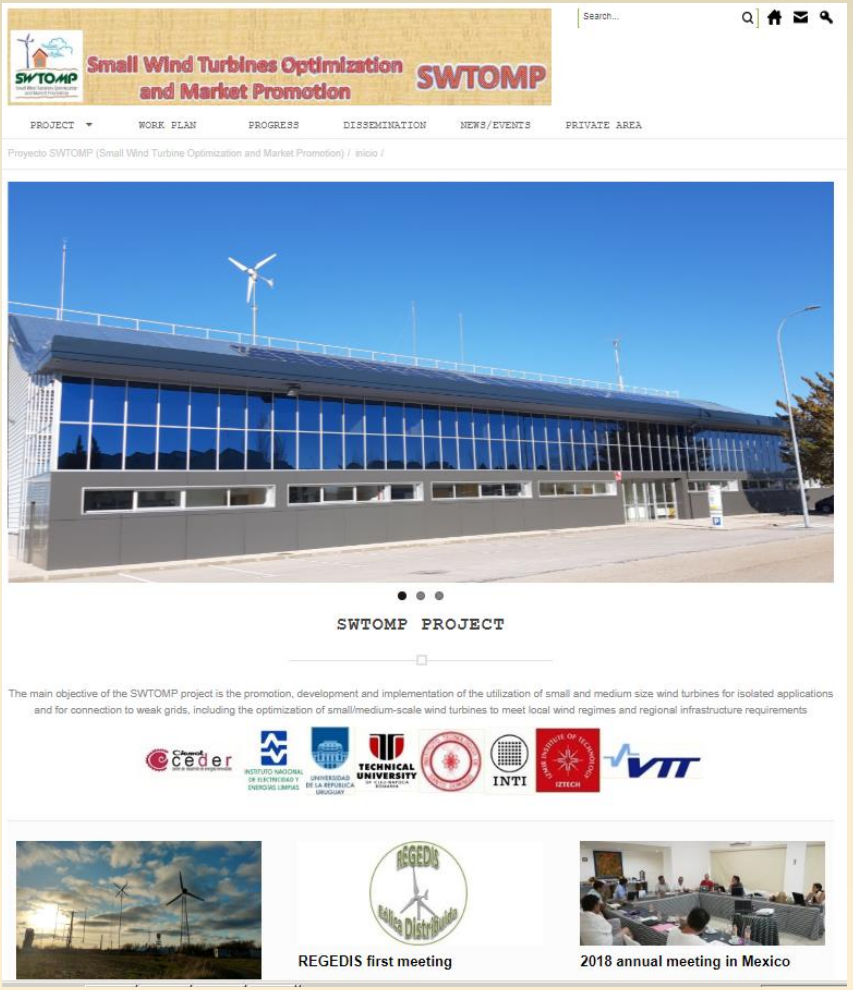
VTT

Ciemat ceder centro de desarrollo de energías renovables

WP0. Project Management

WP Leader: *CIEMAT*

The WP0 is related with the general financial and scientific issues of project management including aspects concerning the cooperation between ERANET_LAC officers and the project consortium.



Main Deliverables:

- *Web creation:* http://swtomp.ciemat.es/
- *Annual Progress Reports*
- *Final Report*

WP1. Promotion of the Potential Market

WP Leader: *CIEMAT*

The objective is the promotion, development and implementation of the utilization of small and medium size wind turbines

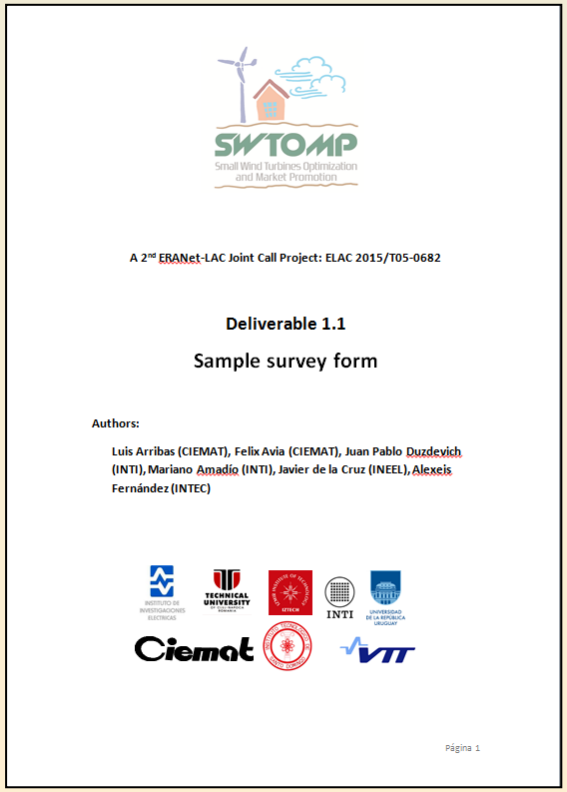
- Task 1.1 Analysis of the market
- Task 1.2 Workshops
- Task 1.3 Preparation of material for education of researches, technical and users

WP1. Promotion of the Potential Market

Task 1.1 Analysis of the market To analyze the present situation of the small and medium size wind turbine markets in the participating countries.

Deliverable 1: Sample survey form

- Five scopes have been identified in relation to the characterization of the market of SWT:
  - the market deployment assessment,
  - the market suitability assessment,
  - the practical aspects of SWT market,
  - the social aspects of SWT market and
  - the regulatory issues of SWT market.
- SWTOMP: not one, but several sample survey forms (INTI, INEEL, CIEMAT)


SWTOMP
Small Wind Turbines Optimization and Market Promotion

A 2nd ERANet-LAC Joint Call Project: ELAC 2015/T05-0682

Deliverable 1.1

Sample survey form

Authors:

Luis Arribas (CIEMAT), Felix Avia (CIEMAT), Juan Pablo Duzdevich (INTI), Mariano Amadio (INTI), Javier de la Cruz (INEEL), Alexeis Fernández (INTEC)

Página 1

WP1. Promotion of the Potential Market

Task 1.1 Analysis of the market

Deliverable 2: Sample survey results

- Different results coming out from different survey forms
  - Different levels of detail
    - México and Argentina, detailed
    - Spain, Dominican Republic, more general
  - Different levels of deployment:
    - Uruguay, very low
    - Argentina, quite high
  - Different level of accomplishment
    - México and Argentina, finished
    - Spain, on-going

WP1. Promotion of the Potential Market

Task 1.2 Workshops In order to promote the increase of awareness of the potential of small/medium wind turbines, four workshops will be organized giving information of the benefits of the use of SWT.

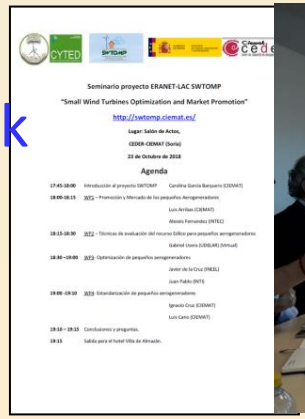
Deliverables: Workshops for information

6/2018: Huatulco, Mexico

http://projects.ciemat.es/web/swtomp/cont_dest4

10/2018: Soria, Spain, in REGEDIS week

http://projects.ciemat.es/web/swtomp/cont_dest5


Seminario proyecto ERANET-LAC SWTOMP

"Small Wind Turbines Optimization and Market Promotion"

http://swtomp.ciemat.es/

Lugar: Salón de Actos,

CEDER-CIEMAT (Soria)

23 de Octubre de 2018

Agenda

WP1. Promotion of the Potential Market

Task 1.3 Preparation of material for education of researches, technical and users Tutorial material will be developed in English and Spanish and will be distributed to several centers for the education of potential researchers, industrial technicians and installers.

Deliverable: Educational material edition

- Different materials for different target audiences
  - Available resources mapping
    - Elaboration of a guide to navigate through these resources
  - New educational material: technically oriented

WP2. Development of methodology for evaluation of wind resources for SWT

WP Leader: *IZTECH*

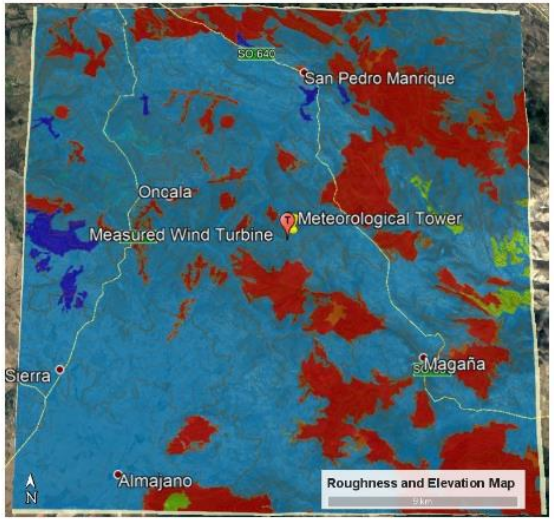
The objective is to develop a methodology for easy assessment of the wind resources in potential locations for the use of SWT

Task 2.1 Use of existing codes for assessment of the wind resources in four locations and verification of the results

Task 2.2 Description of the methodology for easy assessment of local resources using the available information (data bases, etc.)

WP2. Development of methodology for evaluation of wind resources for SWT

- Spatial borders: participating countries
- Turbine sizes: up to 1 MW
- Atlases to be used: Global
- Product type: reporting Webapp
- A fence modelling experiment (Uruguay)
- A building integrated experiment (Spain)



WP3. Optimization of SWT

WP Leaders: *INEEL and INTI Neuquén*

The objective is the optimization of two small turbines to meet local wind regimes and regional infrastructure requirements

Task 3.1 Selection of the SWTs to be optimized for cool sites and tropical sites

Task3.2 Redesign of the SWT

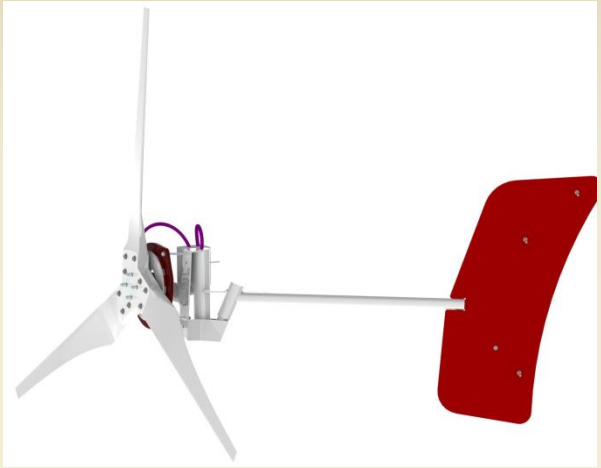
Task3.3 Manufacture and installation of the prototypes

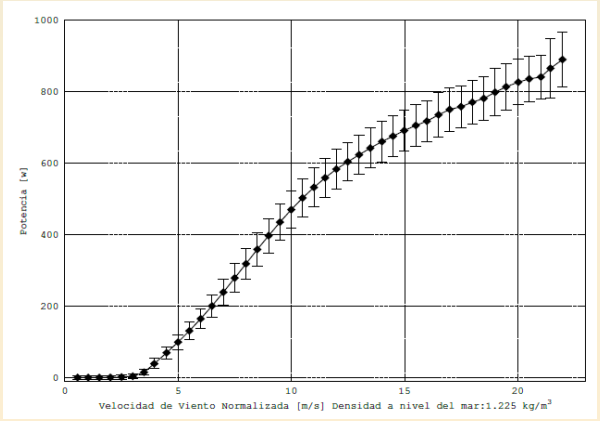
Task 3.4 Testing and certification of the SWT

WP3. Optimization of SWT.
SWTs to be optimized for cool sites

Eolocal Wind Turbine

- Argentinian manufacturer
- Leader: CIEMAT
- Based on Hugh Piggot's design
- 1000 W
- Battery charging model tested at INTI
- Interest in grid tied model:
  - PV Grid Inverter (1kW)
  - Chinese made
  - Matching to the SWT





WP3. Optimization of SWT.

SWTs to be optimized for tropical sites

Aeroluz Wind Turbine

- Mexican manufacturer
- Tower:
  - 18 meters
  - 3 sections
  - Galvanized steel
- Grid Inverter (6kW)
  - Range input operating: 50-580 V
  - Max. Input Current 36 A
  - Input voltage at full power: 200-580
  - Max. Continuous output power: 6000W@ 50°C
  - Frequency range: 59.3-60.5 Hz
  - Power factor: >0.995
  - Nominal output voltage: 277 V/240 V/208 V

WP3. Optimization of SWT.

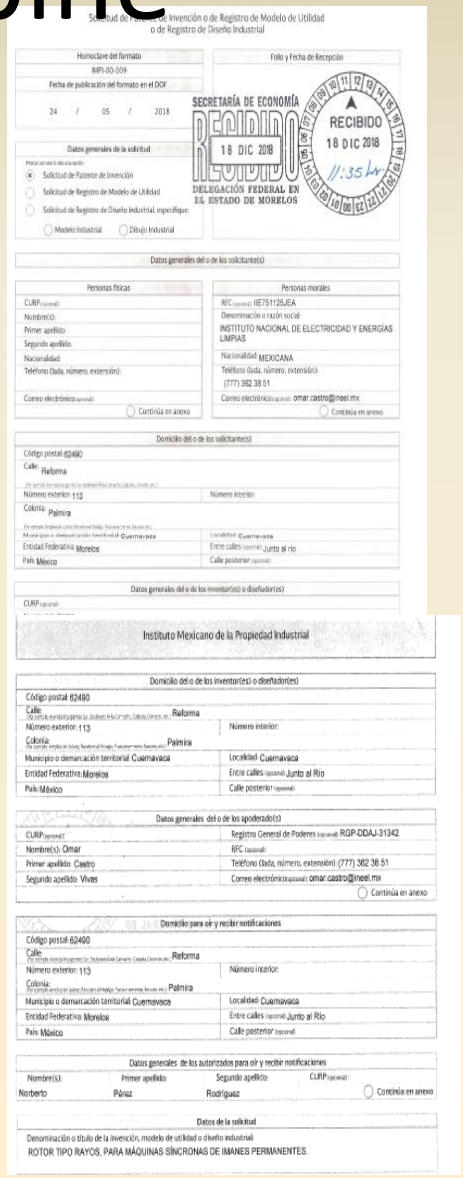
SWTs to be optimized for tropical sites

Aeroluz Wind Turbine

- Leader: INEEL (México)

- Components under study:

1. Electric Generator (INEEL)
   - New design
   - Patent application (Dec 18, 2018)
   - Vibration analysis study
2. Blades (UNISTMO)
3. Control system (CENIDET)
4. Tower (INEEL)



Solicitud de Patente de Invención o de Registro de Modelo de Utilidad o de Registro de Diseño Industrial

Homoclave del formato: IMPI-00-009

Fecha de publicación del formato en el DOF: 24 / 05 / 2018

Folio y Fecha de Recepción

SECRETARÍA DE ECONOMÍA
RECIBIDO
18 DIC 2018
DELEGACIÓN FEDERAL EN EL ESTADO DE MORELOS

RECIBIDO
18 DIC 2018
11:35 hrs

Datos generales de la solicitud

- (X) Solicitud de Patente de Invención
- ( ) Solicitud de Registro de Modelo de Utilidad
- ( ) Solicitud de Registro de Diseño Industrial, especifique:
  - ( ) Modelo Industrial
  - ( ) Dibujo Industrial

Datos generales del o de los solicitante(s)

Personas físicas

CURP (opcional):
Nombre(s):
Primer apellido:
Segundo apellido:
Nacionalidad:
Teléfono (lada, número, extensión):
Correo electrónico (opcional):
( ) Continúa en anexo

Personas morales

RFC (opcional): IIE751125JEA
Denominación o razón social: INSTITUTO NACIONAL DE ELECTRICIDAD Y ENERGÍAS LIMPIAS
Nacionalidad: MEXICANA
Teléfono (lada, número, extensión): (777) 362 38 01
Correo electrónico (opcional): omar.castro@ineel.mx
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Número interior:
Colonia: Palmira
Municipio o demarcación territorial: Cuernavaca
Localidad: Cuernavaca
Entidad Federativa: Morelos
Entre calles (opcional): Junto al río
País: México
Calle posterior (opcional):

Datos generales del o de los inventor(es) o diseñador(es)

CURP (opcional):

Instituto Mexicano de la Propiedad Industrial

Domicilio del o de los inventor(es) o diseñador(es)

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Entidad Federativa: Morelos
Entre calles (opcional): Junto al Río
País: México
Calle posterior (opcional):

Datos generales del o de los apoderado(s)

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Registro General de Poderes (opcional): RGP-DDAJ-31342
Nombre(s): Omar
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( ) Continúa en anexo

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Colonia: Palmira
Municipio o demarcación territorial: Cuernavaca
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Entre calles (opcional): Junto al Río
País: México
Calle posterior (opcional):

Datos generales de los autorizados para oír y recibir notificaciones

Nombre(s):	Primer apellido:	Segundo apellido:	CURP (opcional):
Norberto	Páraz	Rodríguez	

( ) Continúa en anexo

Datos de la solicitud

Denominación o título de la invención, modelo de utilidad o diseño industrial:
ROTOR TIPO RAYOS, PARA MÁQUINAS SÍNCRONAS DE IMANES PERMANENTES.

WP4. Standards for SWT

WP Leader: *CIEMAT*

The objective is to improve the existing standards for design of SWT

Task 4.1 Identification of Standards Improvement.

Task 4.2 Proposal for IEC 61400/2 Modification.

Deliverables: Summary of the improvements identified / Proposal for IEC 61400/2 Modification

WP4. Standards for SWT

Design evaluation

External Conditions

• **Environmental and electrical conditions** may affect the loading, durability and operation of small wind turbines.

• The **environmental, electrical and soil parameters** shall be taken into account in the design and shall be explicitly stated in the design documentation.

• **Environmental conditions:**

– Wind conditions (Affect to the structural integrity of the SWT).

– **Other environmental conditions. (Affect to the control systems function, durability, corrosion, etc.)**

• **Electrical conditions:**

– network conditions

– local electrical conditions like batteries, hybrid systems or local grid.

• **Soil conditions**

– Design of SWT foundations.

• Each type of external condition may be subdivided into a **normal external condition** and an **extreme external condition**.

• The normal external conditions generally concern long-term structural loading and operating conditions, while the extreme external conditions represent the rare but potentially critical external design conditions.

WP4. Standards for SWT

Other Environmental Conditions

• Environmental (climatic) conditions other than wind can affect the integrity and safety of the SWT, by thermal, photochemical, corrosive, mechanical, electrical or other physical action.

• Moreover, **combinations of the climatic parameters** given may increase their effect.

• The following **other environmental conditions** shall be taken into account:

- temperature;
- humidity; (**High humidity**)
- air density;
- solar radiation; **(High Solar Radiation)**
- rain, hail, **snow and ice**;
- chemically active substances;
- mechanically active particles (e.g. **sand and dust particles**);
- lightning;
- **earthquakes**; and
- marine environment - **corrosion.**

* Climatic conditions for the design shall be defined in terms of representative values or by the limits of the variable conditions. The probability of simultaneous occurrence of the climatic conditions shall be taken into account when the design values are selected.

WP4. Standards for SWT

Other normal environmental conditions

• The other normal environmental condition values, which shall be taken into account are:

– normal system operation ambient temperature range of **-10 °C to +40 °C**;

– relative humidity of **up to 95 %;**

– atmospheric content equivalent to that of a **nonpolluted inland atmosphere** (see IEC 60721-2-1);

– solar radiation intensity of **1000 W/m^2**; and,

– air density of **1,225 kg/m^3**.

WP4. Standards for SWT

Additional external condition parameters

When the designer specifies additional external condition parameters, these parameters and their values shall be stated in the design documentation and shall conform to the requirements of IEC 60721-2-1:

- **IEC 60721-2-1 Classification of environmental conditions - Part 2-1: Environmental conditions appearing in nature - Temperature and humidity**

Temperature

- The design values for the extreme temperature range shall be at least **-20 °C to +50 °C** for the standard SWT classes.

Lightning

- The provisions of lightning protection required in clause 9.5 may be considered as adequate for wind turbines in the standard SWT classes.

Ice

- No ice requirements are given for the standard SWT classes.

In case the manufacturer wants to include ice loading in their design load estimation, a minimum of 30 mm layer of ice with a density of 900 kg/m3 on all exposed areas is recommended. This static ice load would then be combined with the drag loads on the parked turbine system at 3*Vave. Ice loads on the support structure including guy wires should be considered in the design loads of the support structure.


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Thank you!