

**The 100% electric Tenax World**

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# GLOBAL POLLUTION

Every day pollution becomes a more serious problem and it is shared by the whole world population, with devastating effects on the nature surrounding us and dangerous consequences on the quality of our lives.

- Air pollution;
- Land pollution;
- Water pollution.



The awareness of the public opinion and, above all, of politics towards this issue is totally changed and constantly changing.

- GPP (1996)
- KYOTO PROTOCOL (2009)
- PARIS AGREEMENT (2015)
- HORIZON 2020 (2014)



Nations Unies  
Conférence sur les Changements Climatiques 2015  
COP21/CMP11  
Paris, France



# PARIS 2015 AGREEMENT

The Paris Agreement is an agreement between the member states of the United Nations Convention on Climate Change (UNFCCC), signed by 196 countries worldwide:

- **Maintaining a global temperature increase of 2°.**
- **Global consensus and commitment to reduce Co2 emissions**  
(including the four largest polluters: Europe, China, India and the United States)
- **Objectives of the Agreement in progress, reviewed every five years.**
- **Funds for clean energy.** Old industrialised countries will provide one hundred billion per year (2020-2025) to spread green technologies worldwide and decarbonise the economy.
- **Refunds to the most exposed countries.** The agreement initiates a reimbursement mechanism to compensate for financial losses caused by climate change in the most geographically vulnerable countries, which are often the poorest.

# GREEN PUBLIC PROCUREMENT

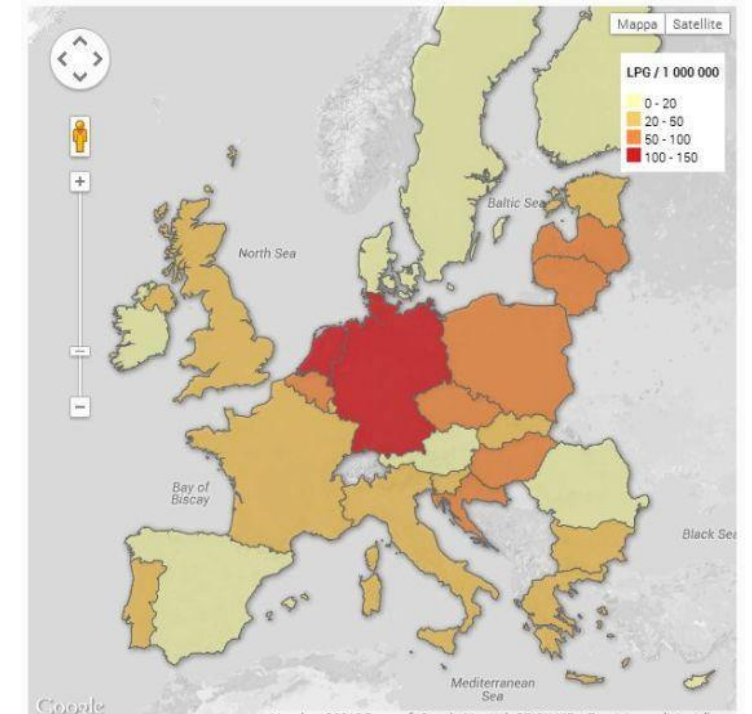
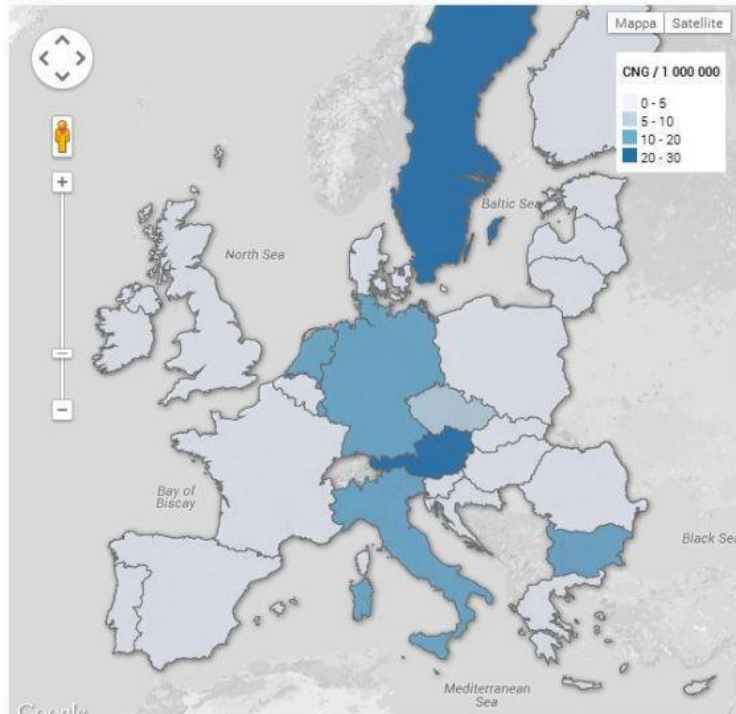
*Directive 2004/18/EC on March 31st, 2004*

- Green Public Procurement (GPP) is the integration of environmental considerations into public procurement procedures.
- Of all countries, the EU has worked actively to make a major contribution by taking measures to reduce emissions by at least 40% by 2030.
- Europe has undoubtedly been one of the continents with the greatest technological devotion, aimed at developing products with a lower environmental impact, including alternative fuels.



## Attuazione del GPP negli stati europei

Green	<b>AAA</b>	Piano di azione nazionale GPP/Criteri ambientali/Previsione di obbligatorietà piena
Light Yellow	<b>AA+</b>	Piano di azione nazionale GPP/Criteri ambientali/Obbligatorietà limitata ad alcuni criteri
Orange	<b>AA</b>	Piano di azione nazionale GPP/Criteri ambientali/mancanza obbligatorietà
Red	<b>A</b>	Piano di azione nazionale GPP/mancanza Criteri ambientali/Mancanza di obbligatorietà
Dark Red	<b>B</b>	Mancanza Piano di azione nazionale GPP/Mancanza di Criteri ambientali/Mancanza obbligatorietà



LPG (Compressed liquid gas) and natural gas (Methane) are reliable and technically sound alternative energy sources, but are poorly implemented within the EU.

# WHY?

- ✓ **Need for storage facilities**
- ✓ **Long-term investment needs**
- ✓ **Bureaucratic slowness in obtaining licences and permits**
- ✓ **Fiscal complexity**
- ✓ **Geopolitical reasons**



**TOWARDS ELECTRICITY**

# WHAT IS HORIZON 2020?

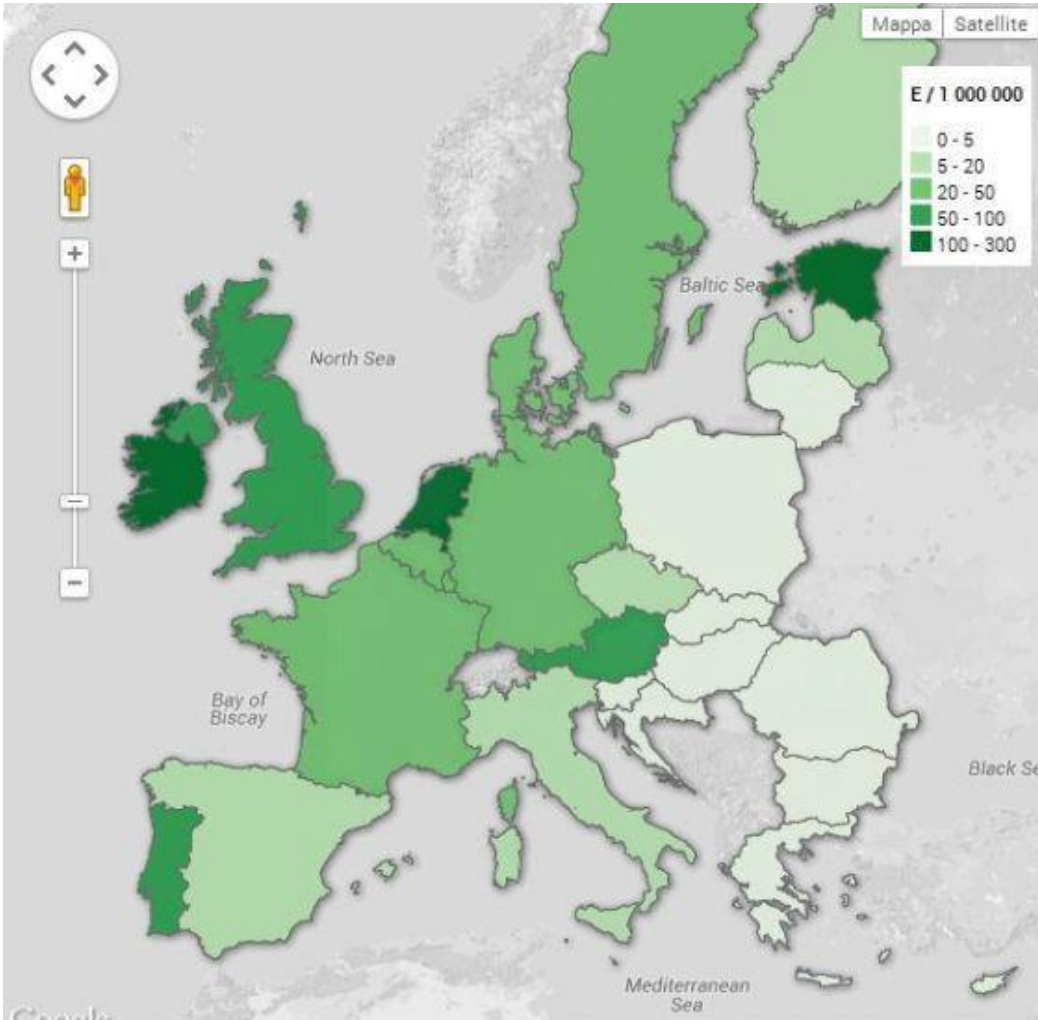
**Horizon 2020** is the European Union's largest ever **framework programme** for research and innovation covering the period **2014-2020**.

**EUR 80 billion** have been made available to support this programme with the aim of integrating the various instruments dedicated to supporting research and innovation into a common strategic framework to promote smart, sustainable and inclusive growth.





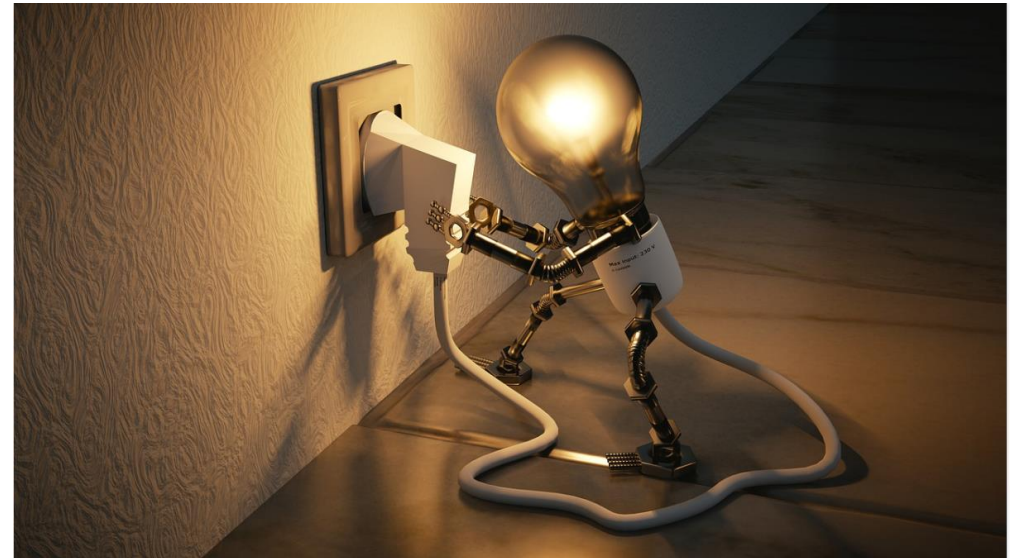
# HORIZON 2020: ELECTRICITY NETWORK INVESTMENT PLAN



European countries	Charging point (2011)	2020 target	Plan for electrical machines 2020
Austria	489	12 000	250 000
Belgium	188	21 000	-
Bulgary	1	7 000	-
Ciprus	-	2 000	-
Czech Republic	23	13 000	-
Germany	1 937	150 000	1 000 000
Denmark	280	5 000	200 000
Estony	2	1 000	-
Greece	3	13 000	-
Finland	1	7 000	-
France	1 600	97 000	2 000 000
Hungary	7	7 000	-
Ireland	640	2 000	350 000
Italy	1 350	125 000	130 000 (before 2015)
Lithuania	-	4 000	-
Luxemburg	7	1 000	40 000
Latvia	1	2 000	-
Malta	-	1 000	-
Netherlands	1 700	32 000	200 000
Poland	27	46 000	-
Portugal	1 350	12 000	200 000
Romania	1	10 000	-
Spain	1 356	82 000	2 500 000
Slovakia	3	4 000	-
Slovenia	80	3 000	14 000
Sweden	-	14 000	600 000
United Kingdom	703	122 000	1 550 000

# THE ELECTRIFICATION IS NOT A FASHION BUT A TREND JUSTIFIED BY:

- ✓ **The general increase in electricity production from renewable sources**
- ✓ **The omnipresence of infrastructures providing easy access to electricity**
- ✓ **Reduced cost compared to traditional energy sources (Diesel, LPG, etc...)**
- ✓ **Improving the technology, performance and reliability of electric motors**



# LIMITS OF ELECTRIFICATION:



- ✓ **Political willingness**
- ✓ **Insufficient supply infrastructure**
- ✓ **High initial investment cost**
- ✓ **Charging times**
- ✓ **Unbalanced cost-benefit**
- ✓ **Typical customer: private citizen**

THE ELECTRIC APPLICATION IS IDEAL FOR  
VEHICLES DEDICATED TO PUBLIC SERVICES

**AND IN PARTICULAR FOR  
STREET SWEEPING**



# ADVANTAGES OF ELECTRICAL APPLICATION ON STREET SWEEPING:

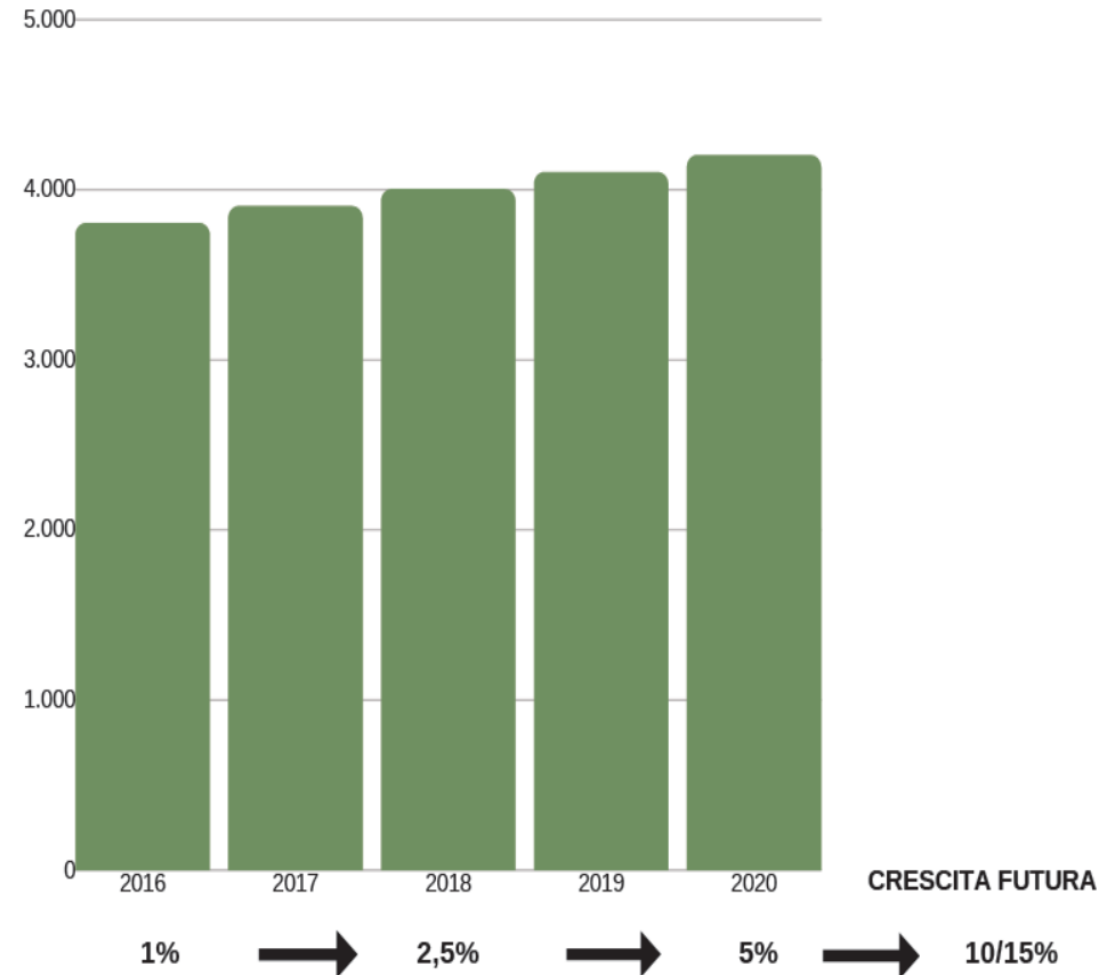
- ✓ **Vehicle designed for "CLEANING" (therefore should not pollute)**
- ✓ **Use at times sensitive to citizens**
- ✓ **Regular and repetitive work shifts**
- ✓ **No need for ad hoc infrastructure**
- ✓ **Work in close contact with citizens**



# PERFORMANCES OF THE "ELECTRIC SWEEPERS" MARKET IN EUROPE

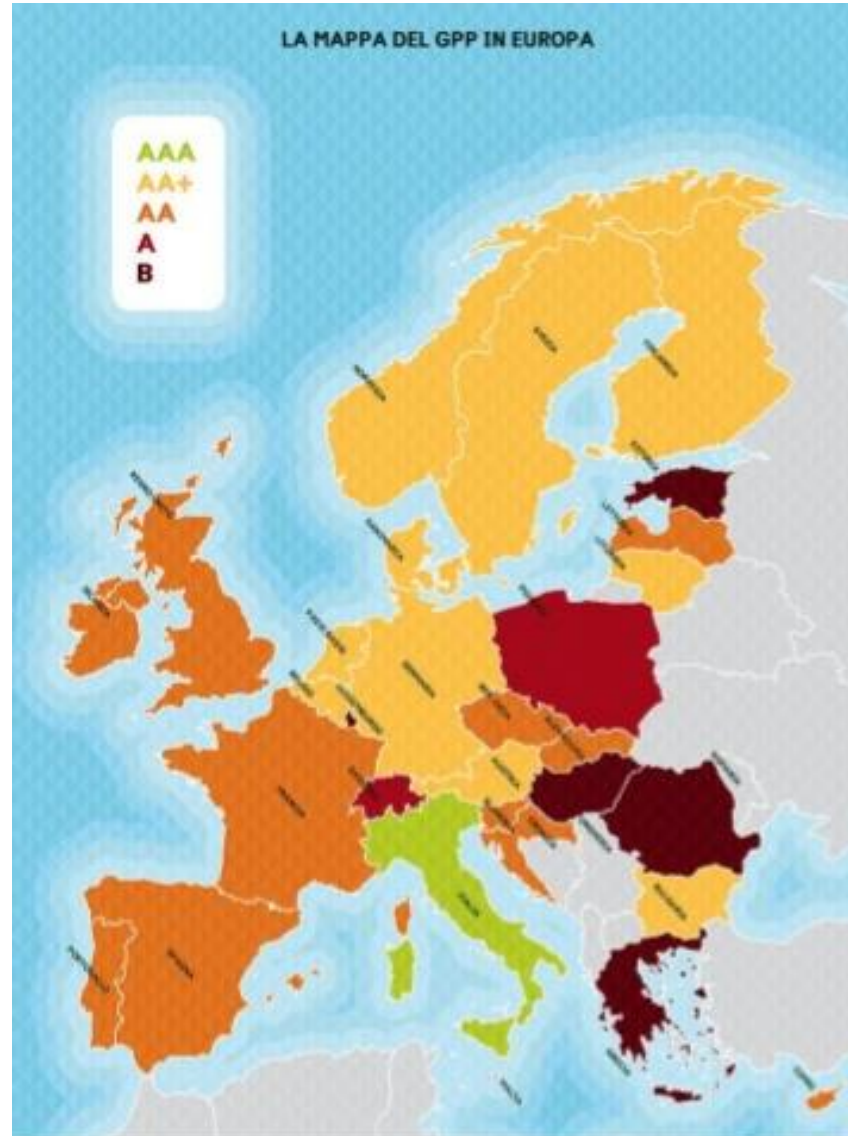
## MAIN COUNTRIES CHOOSING ELECTRIC MACHINES FOR STREET CLEANING :

- ✓ FRANCE
- ✓ SPAIN/PORTUGAL
- ✓ HOLLAND
- ✓ GERMANY
- ✓ BELGIUM
- ✓ POLAND
- ✓ SWITZERLAND
- ✓ SWEDEN



# GREEN PUBLIC PROCUREMENT

*Directive 2004/18/EC of 31 March 2004*



## Attuazione del GPP negli stati europei

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- AA** Piano di azione nazionale GPP/Criteri ambientali/mancanza obbligatorietà
- A** Piano di azione nazionale GPP/mancanza Criteri ambientali/Mancanza di obbligatorietà
- B** Mancanza Piano di azione nazionale GPP/Mancanza di Criteri ambientali/Mancanza obbligatorietà

Fonte: Materia rinnovabile – Remade in Italy

# BARRIERS TO ENTRY IN THE ELECTRIC SWEEPER MARKET

- ✓ **Insufficient political will**
- ✓ **Established habits that are difficult to change**
- ✓ **Prejudices arising from past experiments**
- ✓ **High initial investment costs**
- ✓ **Lack of qualified personnel to maintain high-voltage vehicles (> 48 Volts)**
- ✓ **Maintenance and disposal of batteries**



# Diesel Sweeper => 37.000 Kg CO2



# THE 100% ELECTRIC MISSION OF



- ✓ SPECIALIZATION IN ELECTRICAL TECHNOLOGY
- ✓ CONSTANT UPDATING IN STEP WITH RAPID TECHNOLOGICAL AND REGULATORY EVOLUTION
- ✓ TECHNICAL AND COMMERCIAL DEVOTION TO THE INTRODUCTION OF ELECTRICAL PRODUCTS
- ✓ WAY OF THINKING IN AN ELECTRIC KEY



# Tenax's innovation lies in energy efficiency:

The electric current accumulated in the batteries directly powers the mechanical organs through alternating current electric motors, without intermediate steps.

## Tenax= 100% electric technology



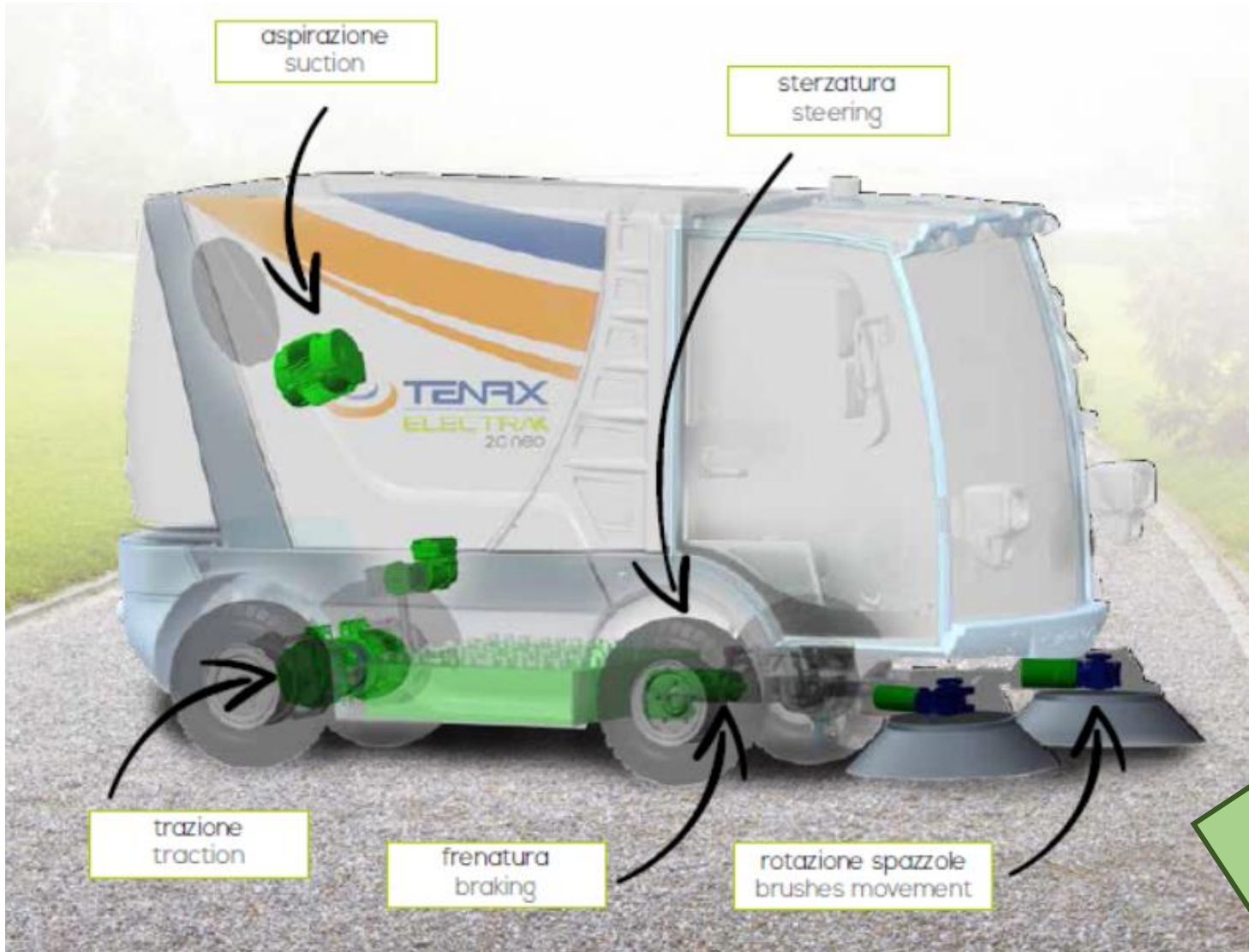
Less waste allows less energy demand for the machine, resulting in greater autonomy and lower operating and maintenance costs.

## Electrification technology



## Diesel





**100% Electric  
functions**

**technology  
prepared for  
automated driving**



Tenax International offers a wide variety of 100% electric sweepers with a Taylor made range of batteries and chargers, providing the most suitable energy solution for the customer's needs.

# «TAYLOR MADE» BATTERIES



**LIFE Solution** – Lithium-Ion LiFePO4 Lithium-Ion Accumulator Iron Phosphate – Sealed battery, maintenance-free with extremely low weight. It presents the possibility of being recharged very quickly and frequently in any type of environment. 2000 Minimum life cycles and 24-month warranty. Autonomy 10 hours. (Available for Electra 2.0 Neo and Hydro).



**NexSys® Solution designed by EnerSys®** – AGM Accumulator ( TPPL, Thin Plate Pure Lead) – Sealed Battery and without the need for water recoiccal. It presents the possibility to be recharged in fast and frequent mode in any type of environment. 1560 Life cycles (60% DoD discharge depth) and 24-month warranty. Autonomy 8 hours. (Available for Electra 1.0, Electra 2.0 Neo and Hydro)



**IRONCLAD® Solution designed by EnerSys®** – High capacity square positive plate lead accumulator – Open pot battery, with maintenance expected every 3 weeks. It has the possibility to be recharged in standard mode in a ventilated environment. 1800 Minimum life cycles expected and warranty 36 months + 36 months pro rata (50% -32% - 16%). Autonomy 10 hours. (Available for Electra 1.0, Electra 2.0 Neo and Hydro)



**Waterless® Solution designed by EnerSys®** –Low maintenance tubular positive plate lead accumulator – Open pot battery, with maintenance expected every 8 weeks. It has the possibility to be recharged in standard mode in a ventilated environment. 1500 Expected lifecycles and 24-month warranty. Autonomy 9 hours. (Available for Electra 1.0 and Electra 2.0 Neo)



**Autonomy** - Tenax 100% electric sweepers always allow you to complete a complete shift. Equipped with LifeP04 lithium-ion batteries or IRONCLAD acid lead batteries® exceed 10 hours of battery life.



**Service life** - Tenax 100% electric sweepers are equipped with batteries with an estimated life span ranging from 1560 cycles (to 60% DoD discharge depth) with NexSys Thin Plate Pure Lead (TPPL) batteries® up to 2000 life cycles with Lithium-Ion batteries application LiFeP04; this duration results in a time interval ranging from 3 to 8 years of average life span.



**Charging time and place** - Tenax 100% electric sweepers are equipped with batteries that can be recharged indoors (LifeP04 – NexSys®) or that require ventilated areas (Waterless® – IRONCLAD®). Single-phase or 220 V-400 V Triphase batteries can also be charged, single or double that allow charging times ranging from 12 to 3 hours.



**Budget and depreciation**- Tenax 100% electric sweepers are equipped with batteries that perfectly adapt to the budgets and depreciation period expected by our customers, allowing considerable savings depending on the performance required. In addition, Tenax plug & play energy solutions offer the possibility to change the type of battery in itinere during the life of the sweeper.



**Maintenance** – Tenax 100% electric sweepers are equipped with sealed batteries with reduced maintenance (LiFeP04 – NEXSYS®) or with maintenance frequencies ranging from 3 (IRONCLAD®) to 8 weeks (Waterless®). In addition, all Tenax 100% electric sweepers are equipped with centralized electrolyte loading and charging systems intelligent batteries that constantly monitor and equalize the cells, thus ensuring the correct functioning of the batteries.



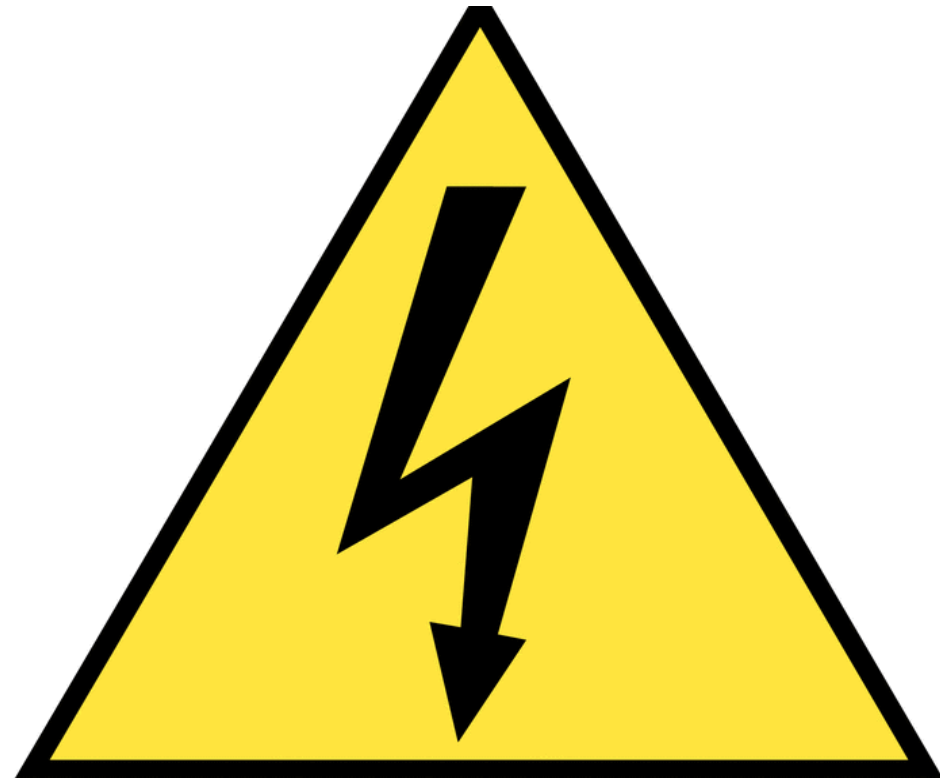
**Rental solutions** – Tenax 100% electric sweepers can be equipped with energy solutions of the Type Lead Acid and AGM (TPPL, Thin Plate Pure Lead) for rental, for periods from 36 to 60 months.

# Legislation about electric vehicles











EIA Standard 11-27:2014 has not been specifically developed for the application of electric vehicles to plants but is recommended to apply its principles on all types of plants above 50 volts.

There are three types of figures to train and certify:

- PAV (person warned)
- PES (expert person)
- PEI (person suitable for electrical work in voltage)





-  • Elimination of CO2 emissions to reduce global pollution
-  • Improvement the quality of life of both the operator and the citizen
-  • Reduction of over 30% of sound emissions
-  • Improvement of urban environment
-  • Simplicity of use and driving comfort
-  • Ease of maintenance, thanks to self-diagnostics and the possibility of remote monitoring
-  • No risk of leakage of hydraulic oil
-  • Save more than 70% of maintenance costs
-  • Save more than 90% of fuel costs (diesel or gasoline)
-  • Reduction of the TCO (Total Cost of Ownership) which allows a quick amortization of the investment

Tenax  
=  
The advantages of  
our 100% electric  
machines



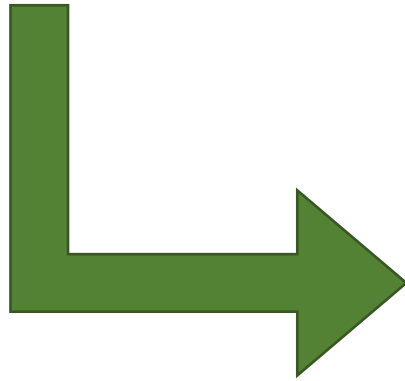
TCO

Total Cost  
of  
Ownership



The TCO represents the total cost of ownership of a machine (purchase, use, maintenance and maintenance) during the entire life cycle of a machine.

# 2 m sweeper with lithium batteries



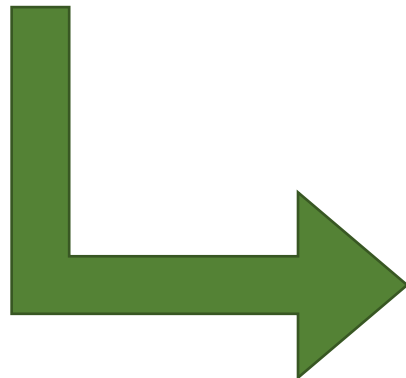
	Electric sweeper Electra 2.0 neo Lithium	2mc Diesel sweeper
Price without TVA with Lithium batteries	161.200,00 €	105.000,00 €
Consumption: (kWh/day)/ liters diésel	37	56
Price: electricity (kWh)/ liters diésel	0,18 €	1,44 €
Daily working hours	8	8
Annual working days	300	300
Annual working hours	2.400	2.400
Hour maintenance cost (consumption material)	€ 3,00	€ 8,50
Annual maintenance costs	7.200,00 €	20.400,00 €
Machines' lifetime (years)	8	8
<b>Total Costs in 8 years</b>	<b>Electra 2.0 neo Sweeper</b>	<b>Diesel Sweeper</b>
Initial investment	161.200,00 €	105.000,00 €
Spent in fuel in 8 years	15.984,00 €	193.536,00 €
Spent in maintenance in 8 years	57.600,00 €	163.200,00 €
Possible battery change (lead acid)		0 €
<b>Total investment in 8 years</b>	<b>234.784 €</b>	<b>461.736 €</b>

## AMORTISATION

	Electra 2.0 neo Sweeper	Diesel Sweeper
<b>Year 1</b>	<b>170.398,00 €</b>	<b>149.592,00 €</b>
Year 2	179.596,00 €	194.184,00 €
Year 3	188.794,00 €	238.776,00 €
Year 4	197.992,00 €	283.368,00 €
Year 5	207.190,00 €	327.960,00 €
Year 6	216.388,00 €	372.552,00 €
Year 7	225.586,00 €	417.144,00 €
Year 8	234.784,00 €	461.736,00 €

2 m<sup>3</sup> sweeper  
with acid  
batteries

	Electric sweeper Electra neo 2.0 Lead Acid	2mc Diesel sweeper
Price without TVA with Lead Acid batterie:	138.000,00 €	105.000,00 €
Consumption: (kWh/day)/ liters diésel	37	56
Price: electricity (kWh)/ liters diésel	0,18 €	1,44 €
Daily working hours	8	8
Annual working days	300	300
Annual working hours	2.400	2.400
Hour maintenance cost (consumption materia	€ 3,00	€ 8,50
Annual maintenance costs	7.200,00 €	20.400,00 €
Machines' lifetime (years)	8	8
<b>Total Costs in 8 years</b>	<b>Electra 2.0 neo sweeper</b>	<b>Diesel sweeper</b>
Initial investment	138.000,00 €	105.000,00 €
Spent in fuel in 8 years	15.984,00 €	193.536,00 €
Spent in maintenance in 8 years	57.600,00 €	163.200,00 €
Possible battery change (lead acid)	15.000,00 €	0 €
<b>Total investment in 8 years</b>	<b>226.584 €</b>	<b>461.736 €</b>

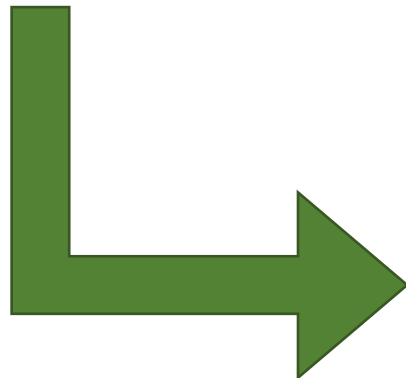


#### DEPRECIATION

	Electra 2.0 neo Sweeper	Diesel Sweeper
Year 1	147.198,00 €	149.592,00 €
Year 2	156.396,00 €	194.184,00 €
Year 3	165.594,00 €	238.776,00 €
Year 4	174.792,00 €	283.368,00 €
Year 5	198.990,00 €	327.960,00 €
Year 6	208.188,00 €	372.552,00 €
Year 7	217.386,00 €	417.144,00 €
Year 8	226.584,00 €	461.736,00 €

2m<sup>3</sup> sweeper  
with acid  
batteries rental

	Electric sweeper Electra 2.0 neo with Lead-Acid batteries	2mc Diesel sweeper
Price without TVA without Lead Acid batterie	124.500,00 €	105.000,00 €
Consumption: (kWh/day)/ liters diésel	37	56
Price: electricity (kWh)/ liters diésel	0,18 €	1,44 €
Daily working hours	8	8
Annual working days	300	300
Annual working hours	2.400	2400
Hour maintenance cost (consumption material)	€ 3,00	8,5
Annual maintenance costs	7.200,00 €	20.400,00 €
Cost of battery rental per year	6.000,00 €	
Sweepers' lifetime (years)	8	8
Total Costs	Electra 2.0 neo Sweeper	Diesel Sweeper
Initial investment	124.500,00 €	105.000,00 €
Spent in fuel in 8 years	15.984,00 €	193.536,00 €
Spent in maintenance in 8 years	57.600,00 €	163.200,00 €
cost of battery rental in 8 years	48.000,00 €	0 €
annual cost	15.198,00 €	44.592,00 €
<b>Total investment in 8 years</b>	<b>246.084 €</b>	<b>461.736 €</b>



#### DEPRECIATION

	Electra 2.0 neo Sweeper	Diesel Sweeper
<b>Year 1</b>	<b>139.698,00 €</b>	<b>149.592,00 €</b>
Year 2	154.896,00 €	194.184,00 €
Year 3	170.094,00 €	238.776,00 €
Year 4	185.292,00 €	283.368,00 €
Year 5	200.490,00 €	327.960,00 €
Year 6	215.688,00 €	372.552,00 €
Year 7	230.886,00 €	417.144,00 €
Year 8	246.084,00 €	461.736,00 €



Thank you for your Attention!