



ELECTRIFICATION IN AGRICULTURAL MACHINERY

Electrification is a major challenge for the agricultural machinery industry and its evolution. Manufacturers prepares this evolution through R&D studies or prototypes fabrication from the perspective to improve products or process.

Outcome from the joint study of the CETIM⁽¹⁾ and Tech2Market⁽²⁾ which have been released in december 2013, this paper gives a technology watch and an analysis of the factors that will bring the agricultural machinery industry to the electrification and might be taken as a guideline by the different stakeholders.

Opportunities for the manufacturer

Through the electrification, many opportunities are given to the manufacturer :

- New technical functions
- Increase of performance
- Decrease of production costs
- Simplifying the architecture of machine
- Increase of safety (to balance with the electrical safety)
- Improve of comfort / ergonomics
- New ranges / New Markets

Analysis of the influence factors

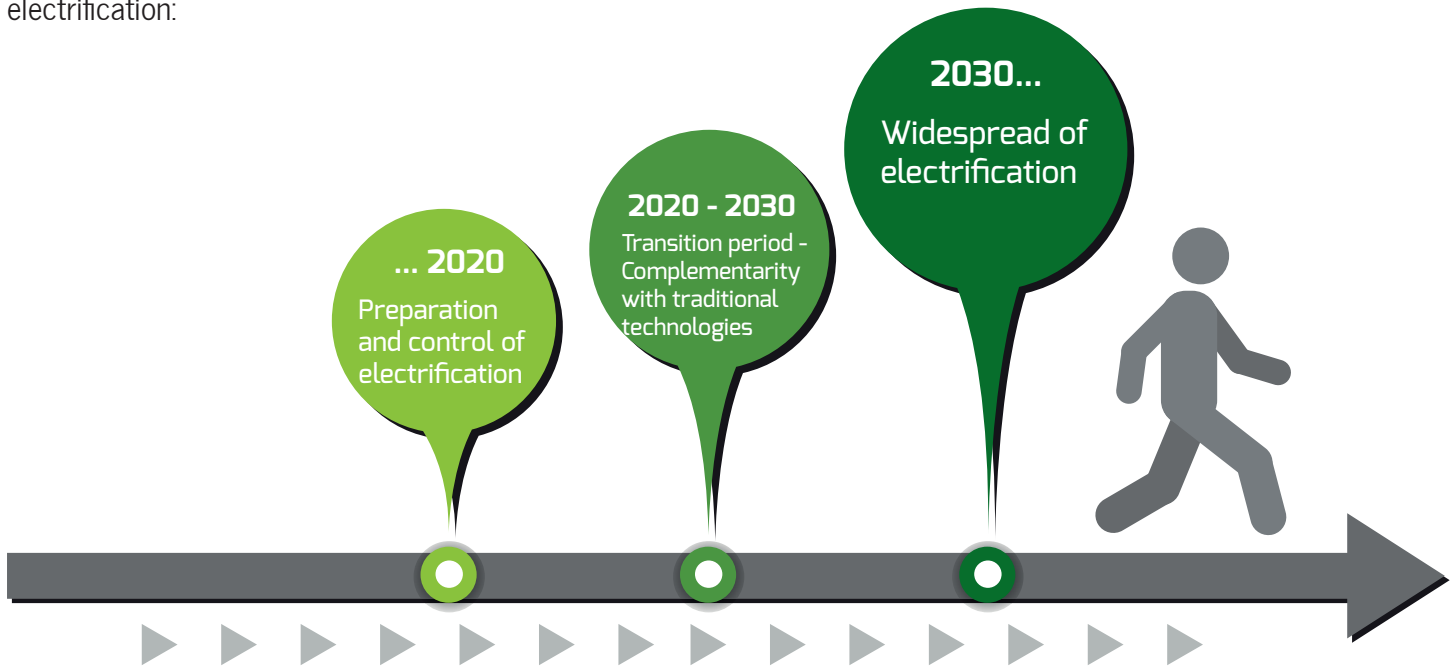
Several factors will influence the evolution of the electrification in the industry with a variable impact depending of the timeline

(1) Technical Center of Mechanical Industries / (2) consulting firm specializing in technological innovation.

INFLUENCE FACTOR	PERIOD	IMPACT ON THE PERIOD	ASSUMPTIONS TO BE CONSIDERED (STEPS, MILESTONES AND FUTURE EVENTS, TECHNOLOGIES)	EFFECTS ON ELECTRIFICATION
A - Economic environment	- 2020	Medium	Lower prices of electrical components is the key factor for the development of electrification.	Development and integration of electrical components and systems by industrial.
	2020 - 2030	Medium	Fleet renewal following the appearance of the first electrified implements. Acceleration of the drop of price decline of electrical components.	Fleet renewal by electrical equipment. Marketing of external generators and electrical components and systems for medium and high power features
B - Needs and expectations of the market	- 2020	Low	Acceleration of the integration of the Isobus terminals. Electrification is an answer to the growing needs of automation and precision farming.	Growing awareness of the interest of electrification by market and decrease of the reluctance of users.
	2020 - 2030	Medium / High	Opening of the market. Widespread of Isobus.	Increased demand for electrical machinery.
C - Strategies and stakeholders positioning	- 2020	High	Significant R&D development for tractor manufacturer. Heavy dependence of the implement manufacturers to the tractor manufacturers offers.	Better control of electrification through new projects. Working with R & D centers and electrical equipment suppliers. Likely benefit for manufacturers with electrical tools offer.
	2020-2030	High	Stabilization in R&D developments for tractor manufacturers and their partners and launch of the commercial policy by range. Increasing R&D efforts for implement manufacturers.	Development, enhancement and marketing of a complete range of tractors / trailed equipment (in addition to non-electrical equipments).
D - Standards	- 2020	High	Definition of standards (ISO, main characteristics, connectors and wiring) and safety regulations.	Booster factor for the development and effective industrialization of electrical machinery.
	2020-2030	Low	Main standards established.	"Standardization" of components and electrical drive line.
E- Availability of expertise and skills	- 2020	Low to medium	Launch and / or strengthening of R&D partnership Recruitments expected if the R&D activity is significant	Development of the first electrified functions.
	2020-2030	High	Launch of recruitments.	Competitive tools offer.
F- Technological aspects	- 2020	High	Confrontation and resolution of problems ; Choice of architectures to be defined. Technologies transfer from other industries.	Choice of architectures. Patenting.
	2020-2030	Medium	Technological problems solved and choice of available architectures.	Privileged generators. Transition phase with low voltages as the 48 Volts DC with power \leq 10 Kw Democratization of components. Price drop.

Timeline

As a synthesis, stakeholders plan three main steps in the evolution of the agricultural machinery towards electrification:



Summary

As a matter of facts the needs of the market will go crescendo, this will result for the industry in a development of the R&D investments and the work with R&D centers and electrical equipment suppliers.

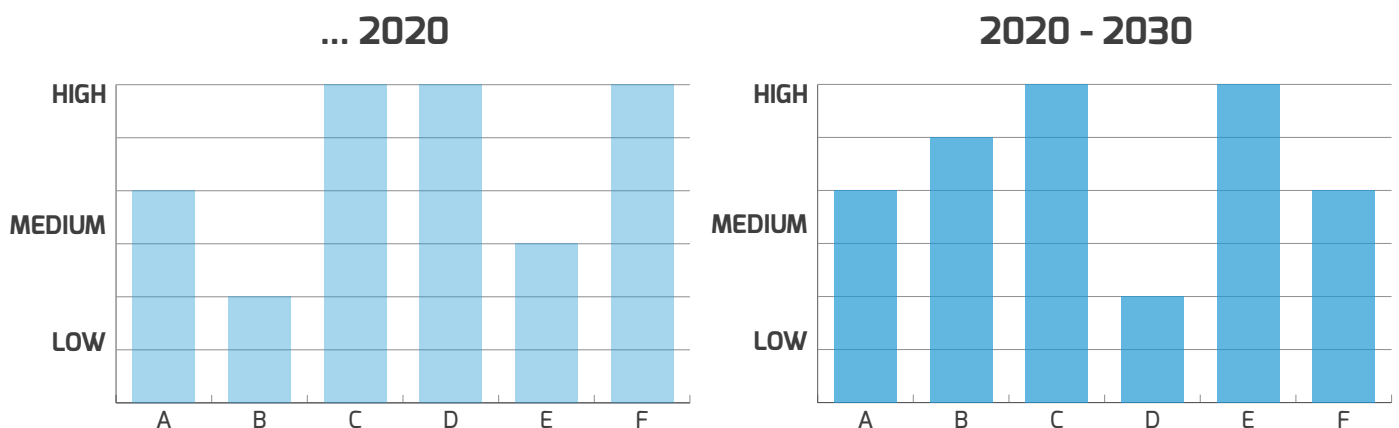
Tools manufacturers are mainly in a technology watch situation of the tractor manufacturers offers but develop their knowledge on the technology.

During the period 2020-2030 embedded external generator on tractor expected to grow and firsts complete offers of tractors with trailed equipment could appear between 2020 – 2025.

A phase of transition with low voltages as the 48 Volts DC with a power under or equal to 10KW may also appear as an intermediate stage especially if the roadmap will shift in time.

Regarding safety standards the EN ISO 16230-1 (Agricultural tractors and machinery - Safety components and high-voltage electric and electronic systems) is already released, its scope is about 50 to 1000 V AC and 75 to 1 500 V DC. Concerning standardization on power, connectors and ISOBUS communication protocols for DC voltage, technical guidelines will be published by the AEF in 2017.

Impact of the influence factors



Beyond 2030...

...a generalization of electrical machinery is expected. Others technologies especially the fuel cell will spark an interest.

The stop of the mechanical Power Take Off use is conceived and a partial or total substitution of hydraulics systems for electrical on small and medium power machinery is possible.



AXEMA

19 rue Jacques Bingen – 75017 Paris – France – Tel : +33 (0)1 42 12 85 90 – Fax : +33 (0)1 42 12 83 69

Mail : infos@axema.fr – Website : www.axema.fr