

Q-ONE DIGIMELTER  
SUCCESS STORY  
TOKYO STEEL  
KYUSHU WORKS



**TOKYO STEEL**

**DANIELI AUTOMATION**



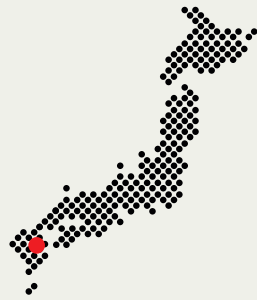
**Q-ONE  
TOKYO STEEL  
PROJECT**

The new and successful project execution with the long-term partner Tokyo Steel confirms Danieli's abilities in satisfying the demanding Japanese steel market with innovative technologies. Designed with a single, high-current module for the 125-ton ladle furnace, and working with an up-to 20-kA current and 205-V arc voltages, Q-ONE successfully processed the first heat on August 12, 2021. The full system was installed in just 20 days during the summer stoppage (just one day for

dismounting, 11 days for erection and 8 days for commissioning), working on three shifts to reach the challenging target. Based on the data retrieved from the first 50 heats, sharp improvements have been already assessed by the customer and Danieli's team. Recorded power consumption, in a 24-h production, is now at 26.8 kWh/ton (40 Hz), for energy savings higher than 12%, when compared to the 30 kWh/ton pre-Q-ONE estimated power consumption (SVC consumption not included).

Erection and commissioning activities were conducted to coincide with the Kyushu plant planned shutdown. Activities included dismantling of the existing 18-MVA transformer, power system, and the filters, plus civil activities, installation and start-up of a new Q-ONE system, medium-voltage circuit breakers, the drive transformer and water cooling unit, while interfacing with the existing plant's automation.

**TOKYO STEEL KYUSHU WORKS**



Tokyo Steel Kyushu Works is one of the four companies part of Tokyo Steel Manufacturing. It specializes in H-beams, I-beams, sheet piles and steel plates.

Tokyo Steel Manufacturing Co., Ltd. engages in the manufacturing and sale of steel products, including steel ingots, U-shaped steel sheet piles, checkered H-beams, channels, wire rods, reinforcing bars, hot-rolled coils, heavy plates, checkered coils, pickled and oiled coils, hot-dip galvanized coils, checkered coils, steel sheets and others.

Founded on November 23, 1934, the company is headquartered in Tokyo, Japan.



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Q-ONE PERFORMANCE  
UPDATES <<**

**Q-ONE PERFORMANCES COMPARED TO CONVENTIONAL TECHNOLOGY**

**-36%**

**POWER-ON TIME**

**-12%**

**ELECTRIC ENERGY  
CONSUMPTION**

**-9%**

**ELECTRODE  
CONSUMPTION**





Danieli's and Tokyo Steel's teams, joined by Toshikazu Nishimoto-san, President of Tokyo Steel Manufacturing, during Q-ONE successful startup.

Q-One installed at Tokyo Steel, Kyushu Works, Japan

**TECHNOLOGICAL  
COMPARISON  
BEFORE  
AND AFTER  
Q-ONE  
INSTALLATION**

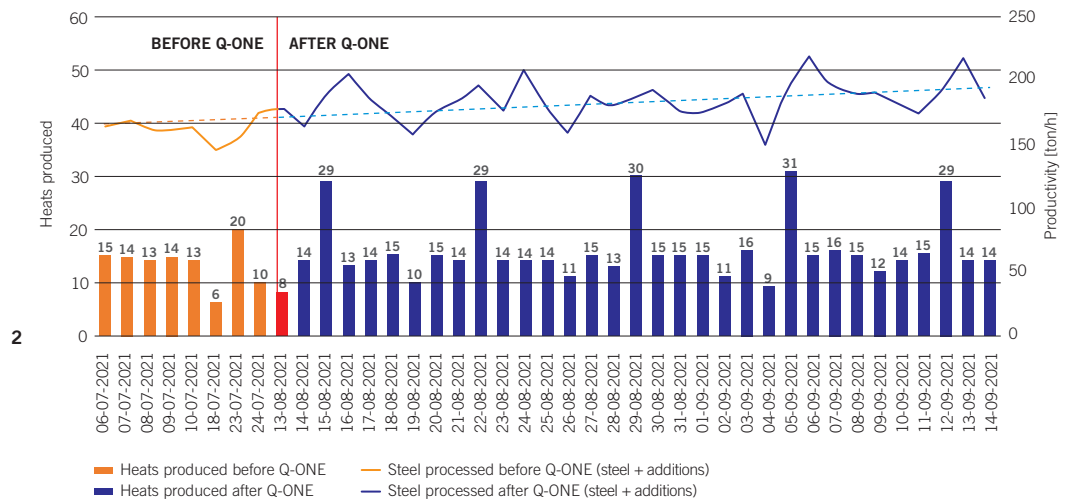
As indicated in the table, with Q-ONE system we are able to get more active power with same apparent power thanks to higher  $\cos \varphi$  achievable. Before, Q-ONE active power was limited due to vibrations on electrode arms induced by secondary current; after Q-ONE installation, vibration disappear thanks to current stability, allowing active power increasing (tab 1). Thanks to Q-ONE technology it was possible to increase the

productivity of the LF and manage production peaks thanks to the shorter power on time reachable in LF station (fig 2). The energy consumption recorded at different frequencies, based on same Delta Temperature ( $\Delta T$ ), has shown that at 40 Hz it is possible to obtain an electricity saving of 12% compared to the refining process without the Q-ONE. The frequency variation, possible dynamically only thanks to the

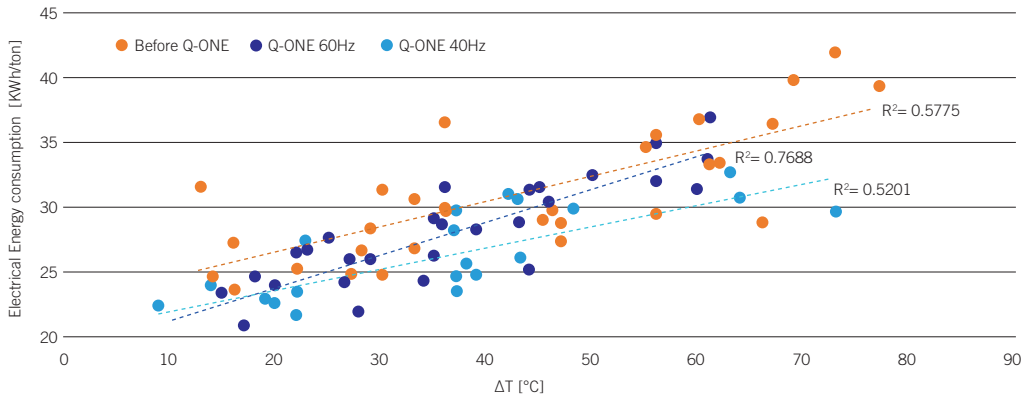
innovative Q-ONE, allows to reach and set new targets for the steel industry (fig 3). Thanks to the higher powers that can be reached through the Q-ONE it is possible to increase the heating rate, allowing to manage production peaks while minimizing sequence loss (fig 4). The power-on time was decreased by 36%, passing from 30 min to 22 min, thus enabling the production rise (fig 5).

	<b>BEFORE Q-ONE</b> (DT range 40-60°C POFF < 90 min)	<b>AFTER Q-ONE</b> (from last 3 production days - DT range 40-60°C POFF < 90 min)
APPARENT POWER [MVA]	18	15 + 20%
AVERAGE SPEC. EE. [KWh/ton]	30	26.8 (@ 40Hz)
POWER FACTOR	0.90	> 0.96
AVERAGE POWER* [MW]	8.8	11.3
PON [min]	> 30	< 22
FIRST TEMPERATURE [°C]	1538	1542
DELTA T [°C]	53	52
ABSOLUTE HEATING RATE AVG. [°C/min]	1.8	2.4
SPEC. KWh/ton/°C	0.69	0.67
AVERAGE SPECIFIC CaO [Kg/ton]	2.5	2.2

1

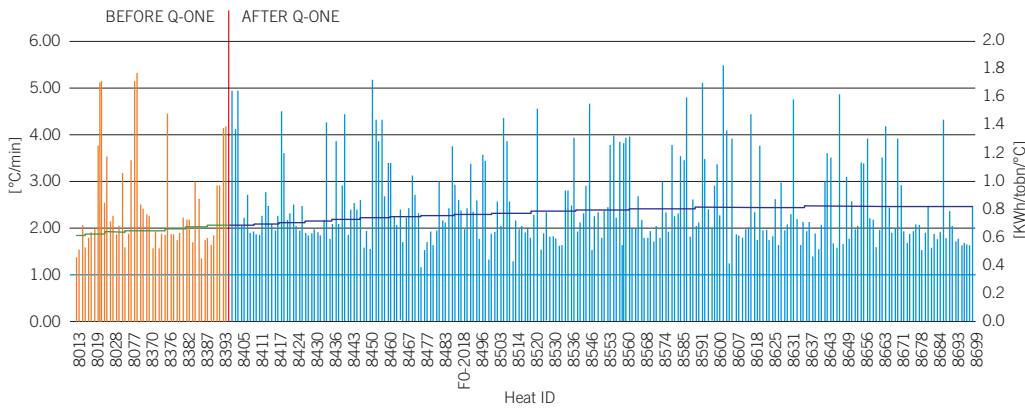


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- 1 Technology comparison table
- 2 LF productivity
- 3 Electrical Energy consumption
- 4 Heating rates and Electrical energy consumption.
- 5 Average power and power-on

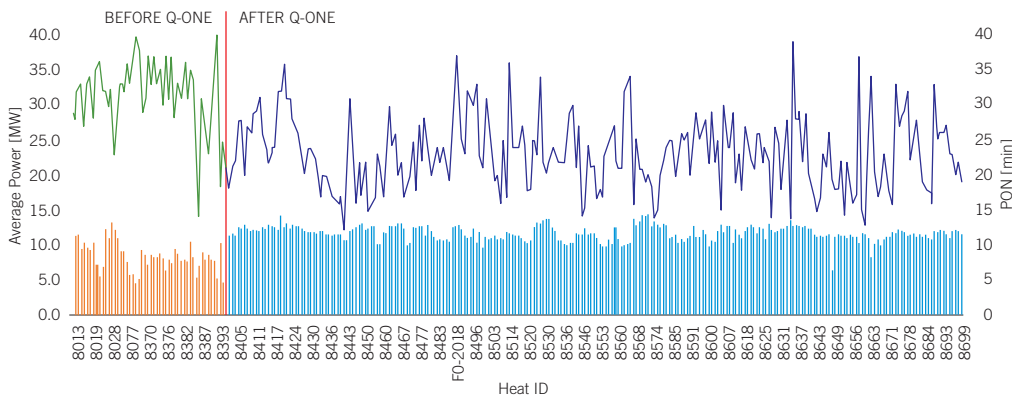
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4

(Filter: POFF < 90 min; heating rate outliers excluded)

Legend: kWh/ton°C before Q-ONE (orange), kWh/ton°C after Q-ONE (light blue), °C/min before Q-ONE (green), °C/min after Q-ONE (dark blue)

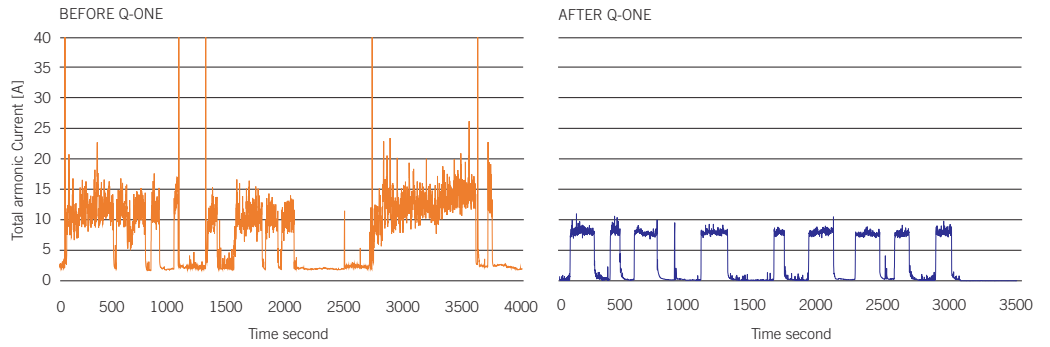


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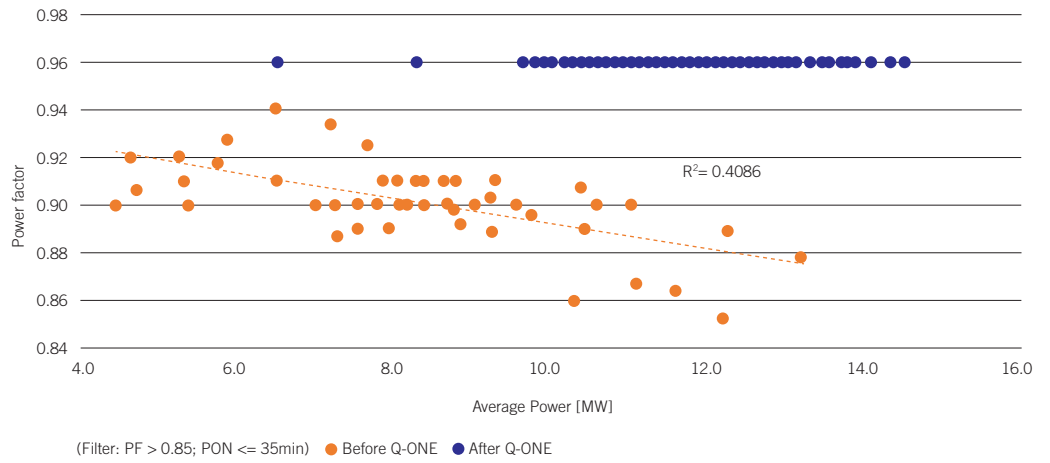
(Filter: POFF < 90 min; heating rate outliers excluded)

Legend: Average Power before Q-ONE (orange), Average Power after Q-ONE (light blue), PON before Q-ONE (green), PON after Q-ONE (dark blue)

Thanks Q-ONE system we can reduce the total harmonic current distortion to handle irregular load in a more flexible and reliable way.

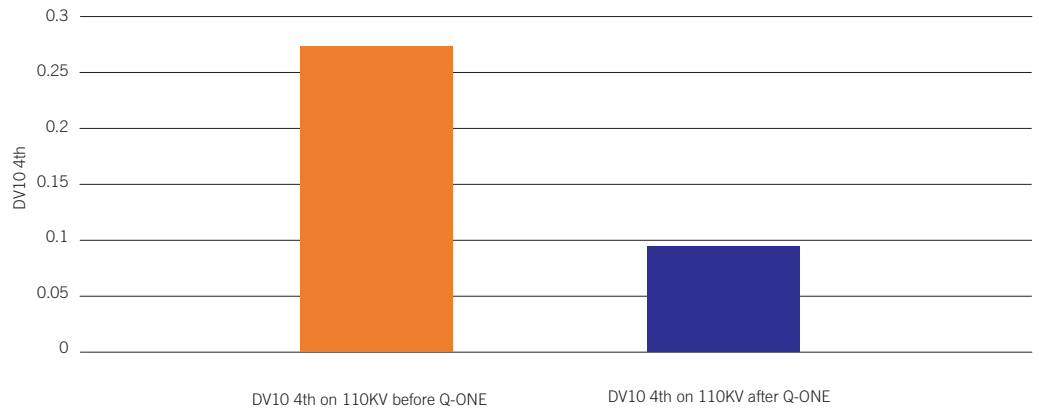


The Power Factor is stable at around 0.96, compared to previous 0.90, while flicker value DV10 4<sup>th</sup> measured on 110 kV is below 0.1.



Flicker value DV10 4<sup>th</sup> measured on 110 kV is below 0.1 (without background flicker).

The target requested by the customer and the Japanese electricity company was achieved thanks to the configuration of the Q-ONE, which can be fully customized according to the network requirements.







REFERENCES	START UP	EQUIPMENT	TAPPED STEEL	POWER SUPPLY	PROJECT CURRENT FOR EACH MODULE
<b>FLAG</b> Italy	2016	EAF	4.5 t	3 x 1 MVA	10 kA
<b>AFC CIVIDALE</b> Italy	2019	EAF	30.5 t	2 x 7.5 MVA +10%	12.5 kA
<b>ABS SISAK</b> Croatia	2019	EAF	68 t	4 x 10.5 MVA + 20%	12.5 kA
<b>NOT DISCLOSABLE</b> East Europe	2019	EAF	50 t	3 x 10.5 MVA +20%	12.5 kA
<b>TOKYO STEEL</b> Japan	2021	LF	115 t	15 MVA + 20%	25 kA
<b>NOT DISCLOSABLE</b> North America	2021	LF	40 t	9 MVA + 20%	20 kA
<b>BASHUNDHARA GROUP</b> Bangladesh	2022	EAF	100 t	6 x 15 MVA +10 %	10 kA
<b>NOT DISCLOSABLE</b> North America	2023	EAF	55 t	4 x 12 MVA + 10%	12.5 kA
<b>NOT DISCLOSABLE</b> North America	2023	LF	55 t	9 MVA + 20%	25 kA
<b>NOT DISCLOSABLE</b> Central Europe	2023	EAF	60 t	4 x 15 MVA + 10%	12.5 kA
<b>ALGOMA STEEL</b> Canada	2023	EAF	250 t	9 x 18 MVA + 20%	10 kA
<b>ALGOMA STEEL</b> Canada	2023	EAF	250 t	9 x 18 MVA + 20%	10 kA

## HEADQUARTERS



### DANIELI

Via Nazionale, 41  
33042 Buttrio (UD) Italy  
Phone +39 0432 195 8111  
Fax +39 0432 195 82 89  
www.danieli.com  
info@danieli.com



### DANIELI AUTOMATION

Via Bonaldo Stringher, 4  
33042 Buttrio (UD) Italy  
Phone +39 0432 518 111  
Fax +39 0432 673 177  
www.dca.it  
info@dca.it

## WORLDWIDE DANIELI COMPANIES

### GERMANY

Brunshofstrasse, 12  
D-45470 Mülheim - Ruhr  
Phone (49) 208.3780000  
info@germany.danieli.com

### UNITED KINGDOM

722 Prince of Wales Road  
Sheffield S9 4EU  
Phone (44) 114.2800300  
info@uk.danieli.com

### SWEDEN

Nya Agatan, 23  
S-77782 Smedjebacken  
Phone (46) 240.668500  
info@sweden.danieli.com

### SPAIN

Poligono Sondikalde  
Calle Portu Bidea, 2  
48150 Sondika - Vizcaya  
Phone (34) 94.4872800  
info@spain.danieli.com

### AUSTRIA

Max Planck Strasse, 5  
A - 9100 Völkermarkt  
Phone (43) 4232.51440.6101  
info@austria.danieli.com

### FRANCE

Les Mercuriales  
F-93176 Bagnolet Cedex  
Phone (33) 1.49722269  
info@france.danieli.com

### USA

600 Cranberry Woods Drive  
Suite 200  
Cranberry Township, PA 16066  
Phone (1) 724.7785400  
info@usa.danieli.com

### CHINA

Jingyuan Street, 8, BDA  
Beijing, 100176  
Phone (86) 10.58082828  
infodme@china.danieli.com

### CHINA

No. 19, Xing Gang Road, CEDZ  
Changshu, Jiangsu 215513  
Phone (86) 512 52267088  
infodcs@china.danieli.com

### INDIA

Technopolis Building  
Plot 4, Block - BP, 5th Floor  
Wing - B, Sector - V, Salt Lake  
700 091 Kolkata - West Bengal  
Phone (91) 33.39847777  
info@india.danieli.com

### THAILAND

Land Plot N. K11  
The Eastern Seaboard Ind. Estate  
Tambol Pluakdaeng, Amphur  
Pluakdaeng, 21140 Rayong  
Phone (66) 38 929000  
infodfe@thailand.danieli.com

## WORLDWIDE OFFICES AND SERVICE CENTERS

### USA

114 Chesser Crane Road  
Chelsea, AL 35043  
Phone (1) 205.6787451  
info@usa.danieli.com

### CANADA

P.O. Box 24062  
Sault St. Marie  
Ontario P6C 6G7  
Phone (1) 705.9468779  
info@canada.danieli.com

### BRAZIL

Rua Georg Rexroth, 609  
Jardim Padre Anchieta  
CEP 09951 270 Diadema, SP  
Phone (55) 11.35085900  
info@brazil.danieli.com

### MEXICO

Edificio Sierra Madre  
Ave. Vasconcelos Oriente 310  
Colonia del Valle  
66250 Garza Garcia, N.L.  
Phone (52) 81.83781055  
Fax (52) 81.83781058  
info@mexico.danieli.com

### SWITZERLAND

Olsbergerstrasse 2  
4310 Rheinfelden  
Phone (41) 61.8368310  
info@switzerland.danieli.com

### RUSSIA

Leningradskiy Prospekt 31A  
Building 1, floor 24  
125284 Moscow  
Phone (7) 495.9819073  
info@russia.danieli.com

### RUSSIA

Lenin avenue 130, office 109  
Chelyabinsk region  
455038 Magnitogorsk  
Phone (7) 963.4768886  
info@russia.danieli.com

### RUSSIA

Business Center Vysotskiy  
Malyshev street 51, floor 42  
Office 43/07  
620075 Ekaterinburg  
Phone (7) 343.3784517  
info@russia.danieli.com

### RUSSIA

Avtozavodskoye Shosse 48  
Nizhniy Novgorod region  
606000 Dzerzhinsk  
Phone (7) 8313.310310  
info@russia.danieli.com

### UKRAINE

Most Citi Business Center  
Glinky Street, 2, 3rd Floor  
49000 Dnepropetrovsk  
Phone (380) 56.7904301  
Fax (380) 56.7904304  
info@ukraine.danieli.com

### EGYPT

Mohamed Farid Street, 37  
11351 Heliopolis West-Cairo  
Phone (20) 2.26379229  
info@egypt.danieli.com

### UAE

Etihad Towers 5 - Flat 5104  
P.O. Box 127231 Abu Dhabi  
Phone (971) 2.6812268  
info@uae.danieli.com

### KSA

Silver Tower 6th floor  
P.O. Box 4867  
Al-Khobar 31952  
Phone (966) 3.8993145  
info@ksa.danieli.com

### TAIWAN

26F-1, No. 31  
Hai-Bian Road  
Kaohsiung City, Taiwan 802  
Phone (886) 7.3358655  
info@taiwan.danieli.com

### THAILAND

Muang Thai-Phatra Office  
16th Floor, Tower II  
252-91 Rachadaphisek Road  
Huaykwang - Bangkok 10310  
Phone (66) 2.6933520  
info@thailand.danieli.com

### INDIA

271 Business Park, 5th floor  
Model Industrial Colony  
Off Aarey road  
Goregaon (E) Mumbai 400 063  
Phone (91) 22.39917100  
info@india.danieli.com

### KOREA

Room 201, Daecheon Building  
157-4 Samsung-dong  
Gangnam-gu 135-090, Seoul  
Phone (82) 2.5626622  
info@korea.danieli.com

### JAPAN

42F, Yokohama Landmark Tower  
2-2-1, Minatomirai, Nishi-ku,  
Yokohama-City  
220-8142 Japan  
Phone (81) 45.651.7077  
info@japan.danieli.com

### VIETNAM

Sang Tao Road, E-Office Park  
Tan Thuan Exp. Pro. Zone  
Tan Thuan Dong Ward, Dist. 7  
Ho Chi Minh City, Vietnam  
Phone (84) 08.62999130  
info@vietnam.danieli.com