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Recommended cables applicable to increasing the conductor size

ECSO design is recommended to be applied to Low-voltage Cross-linked Polyethylene Insulated Cables (CVT) and Low-voltage eco-cables (EM-CET) used in factories and buildings which are operated with high loading or medium loading within the operating categorization.

If applied to transmission and distribution cables with high loading, there is a big advantage, but it is necessary to pay attention because size up (optimization) may affect the strength of the steel tower and the utility pole, the diameter of the duct, etc. Low-voltage cables used in factories, buildings, etc. are laid in racks (shelves) and pits (grooves) and are recommended because they are relatively unlikely to have problems in application.

Selection Table – ECSO (Environmental Current Rating) Table

The following is the environmental current rating calculated as JCS 4521:2014

Table2. Environmental Current Rating

Conductor Size	CVT Environmental Current Rating (A)		
	High Loading Operation	Mid. Loading Operation	Low Loading Operation
8 mm^2	8	9	12
14 mm^2	13	15	20
22 mm^2	20	23	31
38 mm^2	32	37	49
60 mm^2	55	64	85
100 mm^2	82	95	127
150 mm^2	107	124	165
200 mm^2	151	174	232
250 mm^2	182	210	280
325 mm^2	285	329	439
200 mm^2 dual	302	348	464
250 mm^2 dual	364	420	560
325 mm^2 dual	570	658	878

Conductor Size	EM-CET Environmental Current Rating (A)		
	High Loading Operation	Mid. Loading Operation	Low Loading Operation
8 mm^2	8	9	12
14 mm^2	13	15	21
22 mm^2	21	24	33
38 mm^2	34	39	52
60 mm^2	59	68	91
100 mm^2	88	102	137
150 mm^2	116	134	179
200 mm^2	164	189	252
250 mm^2	196	226	302
325 mm^2	306	353	471
200 mm^2 dual	328	378	504
250 mm^2 dual	392	452	604
325 mm^2 dual	612	706	942

・High loading: 100% in the daytime, 60% to 80% in the night ・Medium loading: 100% in the daytime, 50% in the night ・Low loading: 100% only in the daytime

Standards to be referred

(1) Japanese Standard: JCS 4521:2020 "Optimal current calculation considering the environment and economy of electric cables"
(2) JEAC 8001-2016 "The Interior Wiring Code"
(3) International Standard: IEC 62125 ED.1.0 :2019 "Environmental considerations specific to insulated electrical power and control cables"

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Introducing New Design Technology

Considering the environmental and economical aspects

ECSO

Introduction also in The Interior Wiring Code

(ECSO: Environmental and Economical Conductor Size Optimization)

Cost reduction by increasing the conductor size

The Japanese Electric Wire & Cable Makers' Association

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Ecology with Economy!

Outline

By increasing the conductor size of the power cable, you can reduce the transmission / distribution losses, which leads to reduction of CO_2 emissions and energy saving.

We at JCMA have established the design technologies of optimum conductor size (ECSO*[1]) to publish "JCS 4521: Calculation of the Environmental Current Rating for the Electric Cables", which put the ECSO design methods together. This standard is also introduced in the "JEAC 8001-2016 The Interior Wiring Code ". Since the environmental issues need to be addressed in a global base, we are making the term, ECSO as an Internationally Common Key Word, to ensure the intelligence to be shared globally, and to have it as a global standard.

※1 Environmental and Economical Conductor Size Optimization

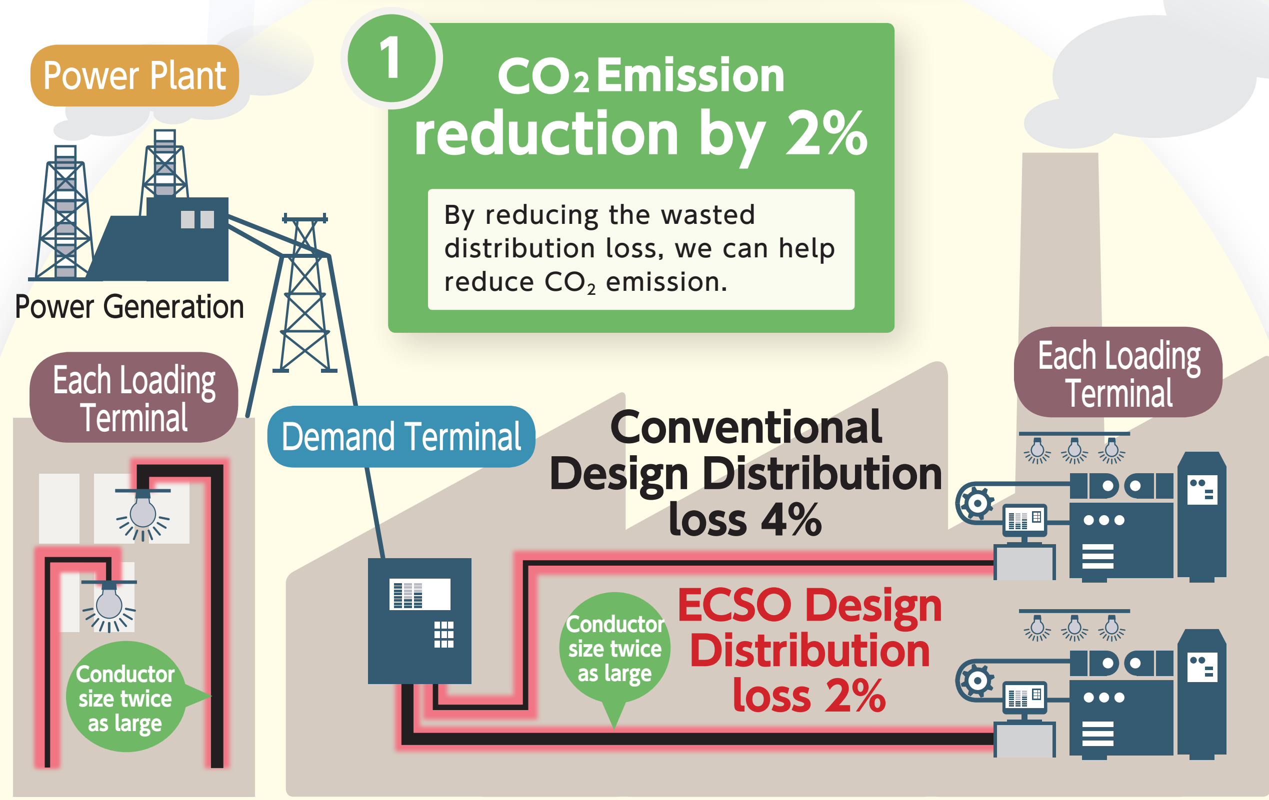
Design Technology for Optimum Conductor Size (ECSO)

From 'Minimum Initial Cost' to 'Minimum Life Cycle Cost' *2

Preference has always been given to the lowest initial cost, i.e., the smallest possible conductor, as long as safety measures (current rating and preventing the voltage drop) are secured. Design technology for optimum conductor size (ECSO) is to define the most appropriate size to make the life cycle cost lowest, which means the larger cables. This technology considers both economical and environmental aspects, to make it possible to design the optimum conductor size.

※2 Life Cycle Cost = Initial Cost + Running (operational) Cost

3 Advantages



1 CO_2 Emission reduction by 2%

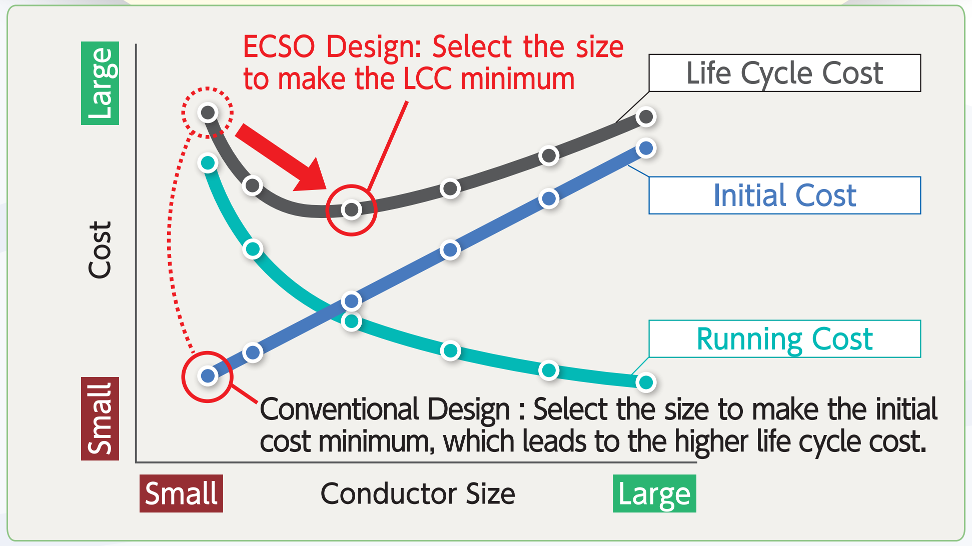
By reducing the wasted distribution loss, we can help reduce CO_2 emission.

2 Cut peak demand lower by 2%

During the peak demand time zone, the load at the plants can be lowered - this can be used favorably on negotiation of the power tariff for the following year.

3 Energy Saving - reduce the distribution loss by 2%

The cables selected by ECSO design can transmit the power with a leeway, so the loss (or heat generation) can be less.



Economic Advantages – 3 Advantages

By switching the cable from the conventionally used size to ECSO designed size, we can get the Advantages as follows (Fig.1).

❶ CO_2 Emission reduction ❷ Peak-demand control ❸ Energy Saving

These 3 advantages can bring in/direct financial advantages to us. Table. 1 shows one example of financial advantages calculated, together with the years needed to be break-even for the investment.

Eco-friendly conductor size selection (effect trial calculation) software which can be easily calculated by anyone is released below.
https://www.jcma2.jp/gijyutu/ecso/index.html

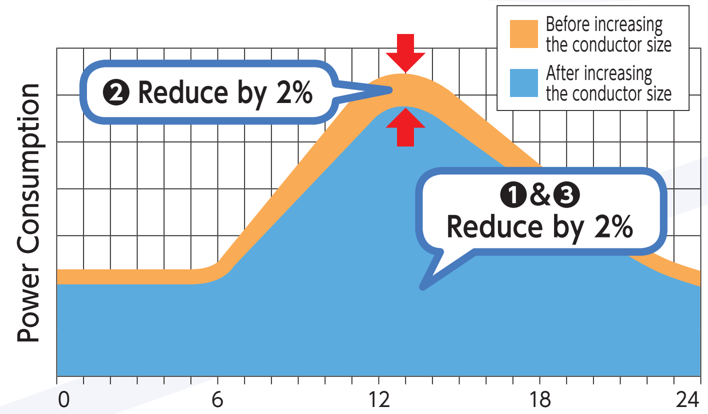


Fig. 1 - Power Consumption - Transition by Hour

Table 1 - Calculation results of Economic Advantages - High Loading Condition

Max. Load Current [A]	Increasing the Conductor Size Existing → ECSO	3 Advantages※3 Energy Saving (kWh/year)	CO_2 Reduction (CO_2-t/year)	Peak Demand Control (kW)	ROI vs Invst.※4 (year)
30	8 mm² → 38 mm²	24,200	10.9	5.0	3.0
40	14 mm² → 60 mm²	23,700	10.7	4.9	4.3
50	14 mm² → 60 mm²	37,000	16.7	7.7	2.8
75	38 mm² → 100 mm²	24,600	11.1	5.1	5.6
100	38 mm² → 150 mm²	52,600	23.7	11.0	4.5
125	60 mm² → 200 mm²	48,600	21.9	10.1	5.7
150	100 mm² → 200 mm²	29,800	13.4	6.2	6.2

※3 Calculated amount per 1,000m length of cable
※4 Three effects are proportional to the length of the cable, but the number of years to recover the increased investment is determined regardless of length.

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