Your ref
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ARUP

Level 10 201 Kent Street
PO Box 76 Millers Point
Sydney 2000
Australia

t +61 2 9320 9320
d +61 2 9320 9658
f +61 2 9320 9321

alex.rosenthal@arup.com
www.arup.com

Kevin Yee
NSW Government
Department of Planning
Sustainability Unit
23-33 Bridge St Sydney NSW 2000
GPO Box 39 Sydney NSW 2001

2 April 2014

Dear Kevin

Crown Hotel - Barangaroo, Sydney

This letter records the expected lift energy use for the Crown Hotel project proposed to be reflected in BASIX certification for the project, following discussions between the Department of Planning and Arup.

Background

Background to the proposal is that lift energy is a significant component for a development of the scale of Crown Hotel. The default assumptions of energy use in the BASIX online tool appear conservative and do not reflect efficiency measures incorporated in the lift design of the project. We therefore propose that BASIX certificates are amended as per discussion with the Department of Planning to reflect the lift expected energy use as calculated in this report. In addition, the project comprises a mixed use development encompassing residential, hotel, retail and gaming areas. The lifts that serve the residential area also serve some of the hotel, retail and gaming floors. As Basix assesses the residential component of the building, calculations were conducted to appropriately exclude any lift energy which would be associated with non-residential portions of the development.

As discussed and recorded in minutes for the meeting conducted on the 5th of February, 2014 between the Department of Planning and Infrastructure, Crown and Arup the following approach has been agreed:

Only lifts serving the residential areas to be included in the assessment. Even though development is 69 storeys height, in order to moderate lift energy use Basix assessment should only account for number of storeys where residential apartments and amenities serving the residential component (i.e. basement level with residential car parks) are located. In order to account for energy efficient measures not included in Basix

(such as regenerative lift drives), Arup to provide calculations demonstrating further energy improvement over and above Basix so this can be also accounted for in Basix algorithms.

As a result,the lift energy as calculated below is intended to be represented in the certificates by lifts of an equivalent number of stories.

Method / Assumptions

The lift energy has been calculated using a lift manufacturer provided calculation tool, available online at:
http://www.kone.com/countries/SiteCollectionDocuments/quick%20energy/KONE_Quick_Energy_2.swf

The calculation is based on assumptions in line with information on lift strategy developed by the VT consultants (Arup) and with lifts shown in the Development Application submission architectural drawings prepared by Wilkinson Aire Architects.

Lifts servicing the residential dwellings have been incorporated with the following features:

Lift No.	V1	V2	V3	B1	B2	B3	G1 to G6
Type of use pattern	Residential/ hotel/retail/ gaming	Residential/ hotel/retail/ gaming	Residential/ hotel/retail/ gaming	hotel/retail/ gaming	Residential/ hotel/retail/ gaming	hotel/retail/ gaming	hotel/retail/ gaming
Serves residential and included in Basix (Yes/No)	Yes	Yes	Yes	No	Yes	No	No
A - Total Travel height (including entire building height)	247m	247m	247m	Not Applicable to Basix	256m	Not Applicable to Basix	Not Applicable to Basix
B -Travel height (V1,V2,V3 from upper residential level to upper gaming areas L24)	154m	154m	154m		na		
C- Final Travel height *	201m (154m+ 247m / 2)	201m (154m+ 247m / 2)	201m (154m+ 247m / 2)		256m		

Total Floors served	43	43	43		72		
Residential related Floors served	34 (car park basement, lobby, swimming pool and residential levels)	34 (car park basement, lobby, swimming pool and residential levels)	34 (car park basement, lobby, swimming pool and residential levels)		34 (car park basement, lobby, swimming pool and residential levels)		
Rated load	1275kg	1275kg	1275kg		2000kg		
Rated speed	7m/s	7m/s	7m/s		6m/s		
Suspension ratio	1:1	1:1	1:1		1:1		
Line voltage	415V	415V	415V		415V		
Regenerative drive	Yes	Yes	Yes		Yes		
Motor drive system	PMSM	PMSM	PMSM		PMSM		
Gear type	Gearless	Gearless	Gearless		Gearless		
Internal lighting	LED	LED	LED		LED		
OCL Power Saving	Yes	Yes	Yes		Yes		
Number of starts per year assumed**	172,003	172,003	172,003		172,003		

* This is the travel height used in the lift calculator. For V1,V2 and V3 lift assumes passenger's lifts travel entire lift shaft height (247m) for 50% of the time and partial lift shaft height from top level to gaming area on L24 (154m) for the remainder of the time. Goods lift travels entire height of the shaft at all times.
** Assumes 3.5trips/person per day (as per Basix) and allows for 1.98 people/apartment (as per Basix). Based on 68 apartments with 1.98 people each, giving a total of 134.64 people. This equates to 3.5 trip/person per day X 134.64 people = 471.24 trip per day.
This results in 471.24 trips per day X 365 days = 172,003 trips per lift/annum

The lift energy requirements calculated using the Kone tool have been combined into an overall annual energy requirement for residential lifts as follows:

Element	Includes lifts	Energy component	Consumption [kWh/a]
Residential lifts	Lifts V1, V2, V3	Hoisting energy consumption per lift	9,151
		Standby energy consumption per lift	9,288
		Total energy consumption per lift	18,439
		Total energy consumption for lifts V1/V2/V3	**55,317**
	Lift B2	Hoisting energy consumption	14,299
		Standby energy consumption	8,419
		Total energy consumption	**22,718**
Total overall energy consumption			**78,035**

This has been compared with lifts capable of being selected under Basix drop down menu which have no regenerative drives and where the most energy efficient option of motor is a VVVF.

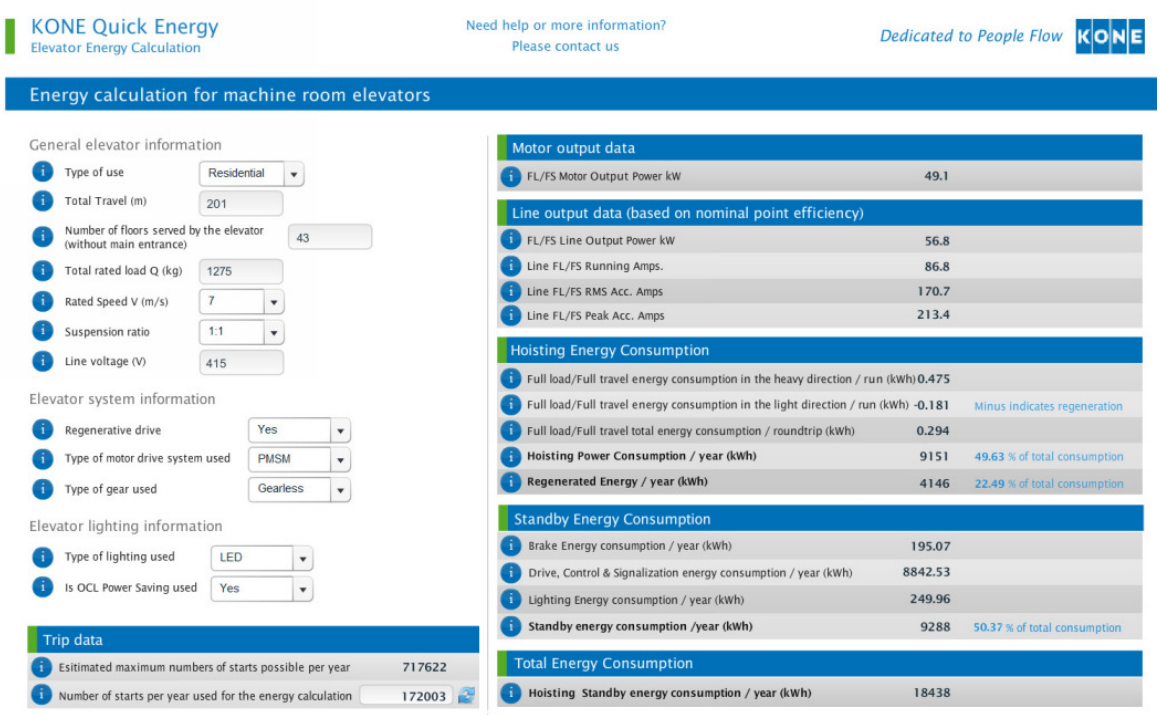
The table below summarizes the energy use improvement based on adding regenerative drives and PMSP motor drives. In the table below, no apportioning of energy use is being considered and lifts serving non residential levels are accounted in the energy figures.

Element	Includes lifts	Energy component	Consumption [kWh/a] Regenerative drives + PMSP drives	Consumption [kWh/a] NO Regenerative drives + VVVF drives – Basix assumptions
Residential lifts	Lifts V1, V2 ,V3	Hoisting energy consumption per lift	9,151	15,159
		Standby energy consumption per lift	9,288	9,288
		Total energy consumption per lift	18,439	24,447
		Total energy consumption for lifts V1/V2/V3 (3lifts)	**55,317**	**73,341**
	Lift B2	Hoisting energy consumption	14,299	25,001
		Standby energy consumption	8,419	8,419
		Total energy consumption	**22,718**	**33,420**
Total overall energy consumption (no apportioning)			**78,035**	**106,761**
% improvement reduction based Regen drives and motor drives				**27%**

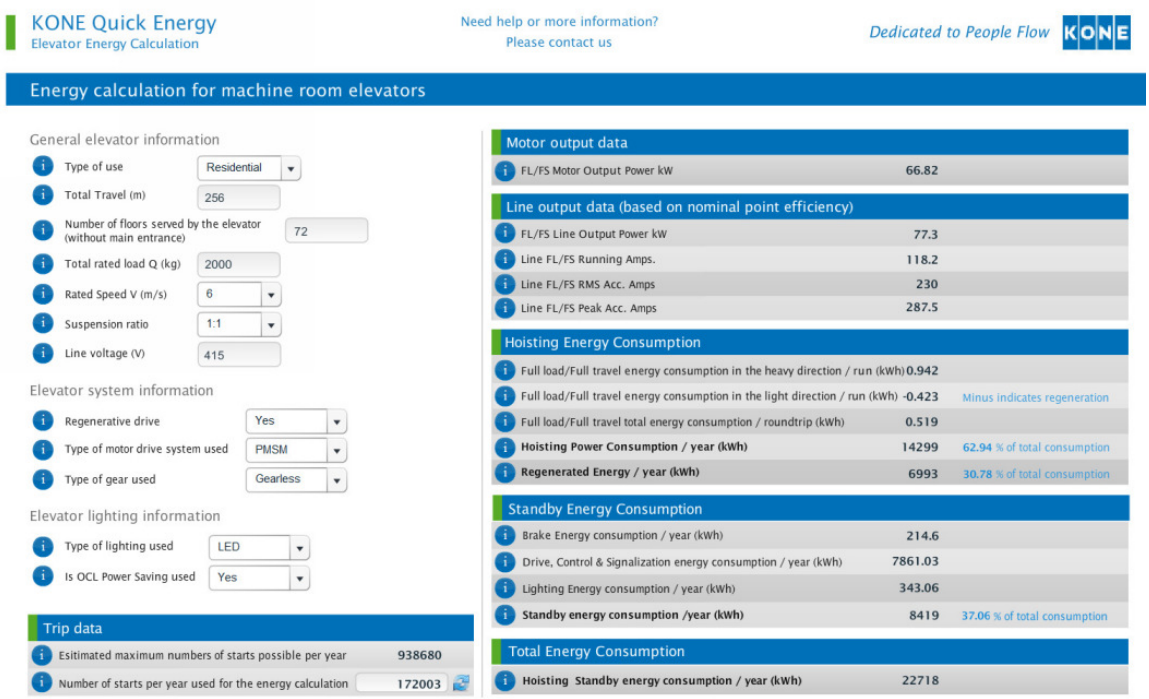
Based on the inclusion of regenerative drives and PMSP (Permanent Magnet Syncronius Motor) technology and excluding the non residential areas it can be observed that a 27% reduction in energy use would be achieved compared to the Basix baseline. The number of floors to be entered in Basix should be equivalent to the energy use of 78,035KWh/annum associated with the lift energy use serving the residential building.

Screen shots from the online calculator are included for reference below:

Passenger Lift V1, V2 and V3 (Regen drives + PMSP motor)



Goods Lift B2 (Regen drives + PMSP motor)



KONE Quick Energy
Elevator Energy Calculation

Need help or more information?
Please contact us

Dedicated to People Flow

Energy calculation for machine room elevators

General elevator information

Type of use	Residential
Total Travel (m)	256
Number of floors served by the elevator (without main entrance)	72
Total rated load Q (kg)	2000
Rated Speed V (m/s)	6
Suspension ratio	1:1
Line voltage (V)	415

Elevator system information

Regenerative drive	Yes
Type of motor drive system used	PMSM
Type of gear used	Gearless

Elevator lighting information

Type of lighting used	LED
Is OCL Power Saving used	Yes

Trip data

Esitimated maximum numbers of starts possible per year	938680
Number of starts per year used for the energy calculation	172003

Motor output data

FL/FS Motor Output Power kW	66.82	

Line output data (based on nominal point efficiency)

FL/FS Line Output Power kW	77.3	
Line FL/FS Running Amps.	118.2	
Line FL/FS RMS Acc. Amps	230	
Line FL/FS Peak Acc. Amps	287.5	

Hoisting Energy Consumption

Full load/Full travel energy consumption in the heavy direction / run (kWh)	0.942	
Full load/Full travel energy consumption in the light direction / run (kWh)	-0.423	Minus indicates regeneration
Full load/Full travel total energy consumption / roundtrip (kWh)	0.519	
Hoisting Power Consumption / year (kWh)	14299	62.94 % of total consumption
Regenerated Energy / year (kWh)	6993	30.78 % of total consumption

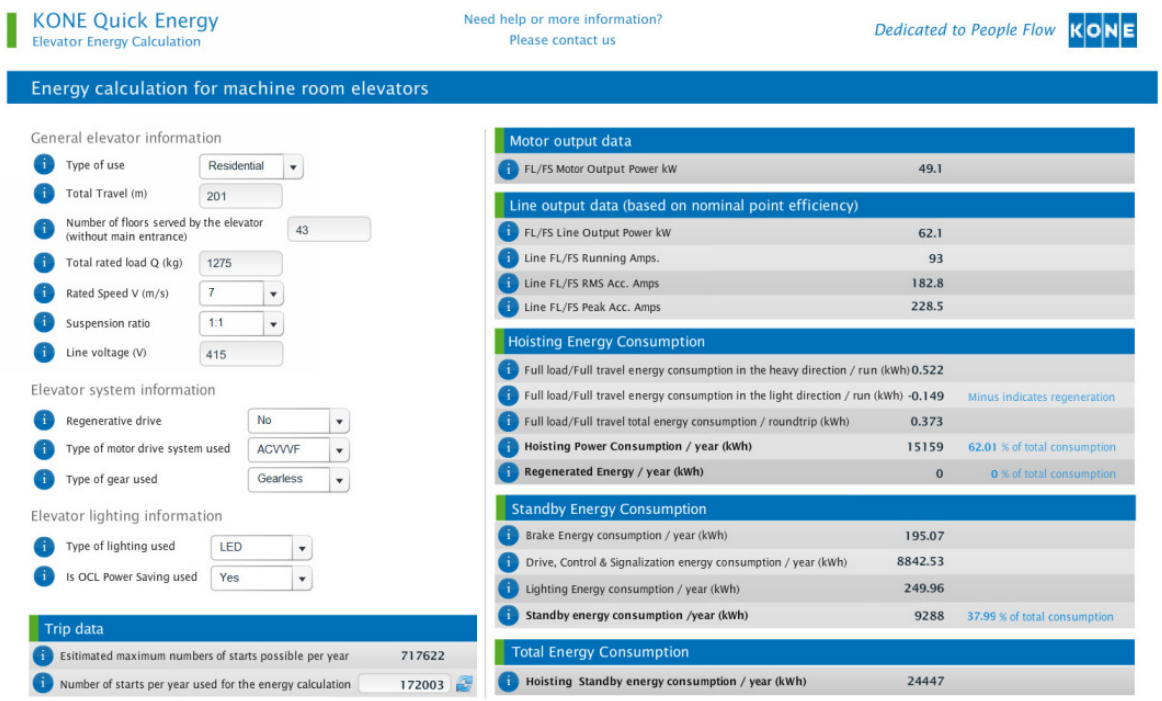
Standby Energy Consumption

Brake Energy consumption / year (kWh)	214.6	
Drive, Control & Signalization energy consumption / year (kWh)	7861.03	
Lighting Energy consumption / year (kWh)	343.06	
Standby energy consumption /year (kWh)	8419	37.06 % of total consumption

Total Energy Consumption

Hoisting Standby energy consumption / year (kWh)	22718

Passenger Lift V1, V2 and V3(NO Regen drives + VVVF motor as per Basix)



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Dedicated to People Flow

Energy calculation for machine room elevators

General elevator information

Type of use	Residential
Total Travel (m)	201
Number of floors served by the elevator (without main entrance)	43
Total rated load Q (kg)	1275
Rated Speed V (m/s)	7
Suspension ratio	1:1
Line voltage (V)	415

Elevator system information

Regenerative drive	No
Type of motor drive system used	ACVVVF
Type of gear used	Gearless

Elevator lighting information

Type of lighting used	LED
Is OCL Power Saving used	Yes

Trip data

Esitimated maximum numbers of starts possible per year	717622
Number of starts per year used for the energy calculation	172003

Motor output data

FL/FS Motor Output Power kW	49.1	

Line output data (based on nominal point efficiency)

FL/FS Line Output Power kW	62.1	
Line FL/FS Running Amps.	93	
Line FL/FS RMS Acc. Amps	182.8	
Line FL/FS Peak Acc. Amps	228.5	

Hoisting Energy Consumption

Full load/Full travel energy consumption in the heavy direction / run (kWh)	0.522	
Full load/Full travel energy consumption in the light direction / run (kWh)	-0.149	Minus indicates regeneration
Full load/Full travel total energy consumption / roundtrip (kWh)	0.373	
Hoisting Power Consumption / year (kWh)	15159	62.01 % of total consumption
Regenerated Energy / year (kWh)	0	0 % of total consumption

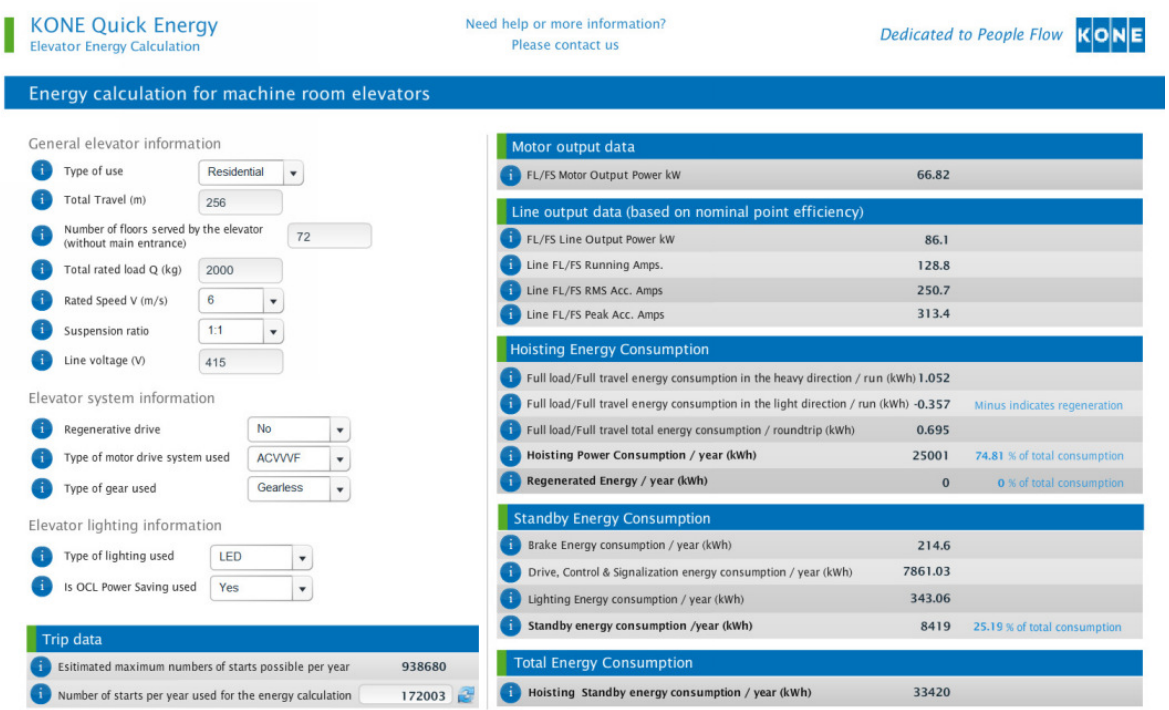
Standby Energy Consumption

Brake Energy consumption / year (kWh)	195.07	
Drive, Control & Signalization energy consumption / year (kWh)	8842.53	
Lighting Energy consumption / year (kWh)	249.96	
Standby energy consumption /year (kWh)	9288	37.99 % of total consumption

Total Energy Consumption

Hoisting Standby energy consumption / year (kWh)	24447

Goods Lift B2(NO Regen drives + VVVF motor as per Basix)



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Suspension ratio	1:1
Line voltage (V)	415

Elevator system information

Regenerative drive	No
Type of motor drive system used	ACVVVF
Type of gear used	Gearless

Elevator lighting information

Type of lighting used	LED
Is OCL Power Saving used	Yes

Trip data

Esitimated maximum numbers of starts possible per year	938680
Number of starts per year used for the energy calculation	172003

Motor output data

FL/FS Motor Output Power kW	66.82

Line output data (based on nominal point efficiency)

FL/FS Line Output Power kW	86.1
Line FL/FS Running Amps.	128.8
Line FL/FS RMS Acc. Amps	250.7
Line FL/FS Peak Acc. Amps	313.4

Hoisting Energy Consumption

Full load/Full travel energy consumption in the heavy direction / run (kWh)	1.052	
Full load/Full travel energy consumption in the light direction / run (kWh)	-0.357	Minus indicates regeneration
Full load/Full travel total energy consumption / roundtrip (kWh)	0.695	
Hoisting Power Consumption / year (kWh)	25001	74.81 % of total consumption
Regenerated Energy / year (kWh)	0	0 % of total consumption

Standby Energy Consumption

Brake Energy consumption / year (kWh)	214.6	
Drive, Control & Signalization energy consumption / year (kWh)	7861.03	
Lighting Energy consumption / year (kWh)	343.06	
Standby energy consumption /year (kWh)	8419	25.19 % of total consumption

Total Energy Consumption

Hoisting Standby energy consumption / year (kWh)	33420

Yours sincerely

Alex Rosenthal
Associate

cc Haico Schepers, Arup
Josef Seidler - Crown
Jason Redgrave - Crown
Kristjan Young -Crown