Appendix 1

Business Council for Sustainable Energy (BCSE)

Approved Inverters

Tested and Approved Grid Connected Inverters

Manufacturer / Distributer	Series	Model Number	DC Voltage	AC Power (Watts) - 1 hour rating	AS 3100 (or IEC Standard)			AS 4777 Standard			Australian Certificate of Suitability		
					Report No	Laboratory	Date	Report No	Laboratory	Date	Cert No	State	Date
Conergy	WR Series	WR1700	150-400 V	1500	TGM-VA EE-30098C SFT	TGM (Austria)	13-Apr-05	REP-RL13-T-001-0	ResLab	6-Jul-04	8506	NSW	27-Sep-05
Conergy	WR Series	WR2300	150-400 V	2000	TGM-VA EE-30098C SFT	TGM (Austria)	13-Apr-05	REP-RL12-T-001-0	ResLab	1-Jul-04	8506	NSW	27-Sep-05
Conergy	WR Series	WR3300	150-400 V	2650	TGM-VA EE-30098C SFT	TGM (Austria)	13-Apr-05	REP-RL11-T-001-0	ResLab	18-Jun-04	8506	NSW	27-Sep-05
Conergy	WR Series	WR4600	150-400 V	4100	TGM-VA EE-30098B SFT	TGM (Austria)	5-Apr-05	REP-RL18-T-001-0	ResLab	14-Oct-04	8506	NSW	27-Sep-05
Conergy	WR Series	WR5900	150-400 V	5000	TGM-VA EE-30098B SFT	TGM (Austria)	5-Apr-05	REP-RL19-T-001-0	ResLab	19-Oct-04	8506	NSW	27-Sep-05
FRONIUS / Choice Electric Co	IG Series	IG15	150-500	1500	TGM-VA EE 30098A SFT	TGM - Staatliche Versuchsanstalt	13-Apr-05	REP-RL13-T-0002 rev 0	ResLab	16-Jul-04	Q041167	QLD	20-Jul-05
FRONIUS / Choice Electric Co	IG Series	IG20	150-500	2000	TGM-VA EE 30098A SFT	TGM - Staatliche Versuchsanstalt	13-Apr-05	REP-RL12-T-0002 rev 0	ResLab	9-Jul-04	Q041167	QLD	20-Jul-05
FRONIUS / Choice Electric Co	IG Series	IG30	150-500	2650	TGM-VA EE 30098A SFT	TGM - Staatliche Versuchsanstalt	13-Apr-05	REP-RL11-T-0002 rev 1	ResLab	23-Jun-04	Q041167	QLD	20-Jul-05
FRONIUS / Choice Electric Co	IG Series	IG40	150-500	4100	TGM-VA EE 30098A SFT	TGM - Staatliche Versuchsanstalt	5-Apr-05	REP-RL18-T-0002 rev 0	ResLab	14-Oct-04	Q041167	QLD	20-Jul-05
FRONIUS / Choice Electric Co	IG Series	IG60	150-500	5000	TGM-VA EE 30098A SFT	TGM - Staatliche Versuchsanstalt	5-Apr-05	REP-RL19-T-0002 rev 0	ResLab	19-Oct-04	Q041167	QLD	20-Jul-05
KACO / Solar Sales	Powador	1501xi	125-400V (MPP range)	1500W	05 KFS 062	Innova (Germany)	26-Sep-05	05 KFS 062	Innova (Germany)	26-Sep-05	Q051689	QLD	17-Oct-05
KACO / Solar Sales	Powador	3501xi	125-400V (MPP range)	3300W	05 KFS 062	Innova (Germany)	26-Sep-05	05 KFS 062	Innova (Germany)	26-Sep-05	Q051689	QLD	17-Oct-05
Latronics	PV Edge	PVE1200	48V	1200W	206/342	AUSTEST	15-Sep-06	REP-RLO611-T-002	ResLab	16-Feb-07	CV06713V	VIC	13-Nov-06
Latronics	PV Edge	PVE2500	96V	2500W	206/342	AUSTEST	16-Sep-06	REP-RLO611-T-002	ResLab	16-Feb-07	CS06713V	VIC	13-Nov-06
Plug & Power / Armson Nom P/L	IPC 2	SDEIP2	24 - 50	27-Aug-00	T20903	EMC	14-Nov-02	Acrelab 018	ACRE	27-Nov-02	8092N	NSW	12-Dec-03
SMA / BP Solar	SWR1100E	SWR1100E	139 - 400	1100	Tested IEC950	BG	8-Jan-01	43130	UNISEARCH	16-Nov-00	CS7395/3	NSW	9-Aug-02
SMA / BP Solar	SWR1700E	SWR1700E	139 - 400	1700	Tested IEC950	BG	17-Sep-02	ACRELab010	Acre	21-Feb-02	CS7395/4	NSW	11-Oct-02
SMA / BP Solar	SB2500E	SB2500E	224 - 600	2500	BGFE 1-11:FE5104	BG	16-Jul-04	REP-RL1003-T-0002	ResLab	19-Dec-03	CS8414	NSW	13-Apr-05
SMA / BP Solar	SB700	SB700	73 - 150;96 - 200;119 - 250	460;600;700	71308048-1	TÜV SÜD Product Service GmbH	27-Jul-06	REP-RL0604-T-0001	ACRE	24-Jul-06	CS 8414/2	NSW	1-Sep-06

Manufacturer / Distributer	Series	Model Number	DC Voltage	AC Power (Watts) - 1 hour rating	AS 3100 (or IEC Standard)			AS 4777 Standard			Australian Certificate of Suitability		
					Report No	Laboratory	Date	Report No	Laboratory	Date	Cert No	State	Date
SMA / BP Solar	SB1100	SB1100	139 - 400	1100	71308048-2	TÜV SÜD Product Service GmbH	27-Jul-06	REP-RL46-T-0001/2	ACRE	18-Nov-05	CS 8414/1	NSW	16-Aug-06
SMA / BP Solar	SB1700	SB1700	139 - 400	1700	71308048-2	TÜV SÜD Product Service GmbH	27-Jul-06	REP-RL46-T-0001/2	ACRE	18-Nov-05	CS 8414/1	NSW	16-Aug-06
SMA / BP Solar	SB3300	SB3300	200 -500	3600	70122015-1	TÜV SÜD Product Service GmbH	28-Apr-06	REP-RL47-T-0002	ACRE	10-Mar-06	CS 8414/2	NSW	10-Mar-06
SMA / BP Solar	SB3800	SB3800	200 -500	3800	70122015-1	TÜV SÜD Product Service GmbH	28-Apr-06	REP-RL47-T-0002	ACRE	10-Mar-06	CS 8414/2	NSW	10-Mar-06
SMA / BP Solar	SMC5000A	SMC5000A	246 - 600	5500	70122015-2	TÜV SÜD Product Service GmbH	28-Apr-06	REP-RL0601-T-0002	ACRE	7-Apr-06	CS 8414/2	NSW	10-Mar-06
SMA / BP Solar	SMC6000A	SMC6000A	246 - 600	6000	70122015-2	TÜV SÜD Product Service GmbH	28-Apr-06	REP-RL0601-T-0002	ACRE	7-Apr-06	CS 8414/2	NSW	10-Mar-06
Solar Energy Australia	Novastar	SEAG-110-2K5	72-115V	2200W Continuous	5402	Austest Laboratories	21-Oct-04	REP-RL14-T-0001 & REP-RL14-T-0002	ResLab	22-Oct-04	CS8385N	NSW	18-Mar-05
Solar Energy Australia	Novastar	SEAG-110-2K5-232	72-115V	2200W Continuous	5402	Austest Laboratories	21-Oct-04	REP-RL14-T-0001 & REP-RL14-T-0002	ResLab	22-Oct-04	CS8385N	NSW	18-Mar-05
SunTechnics	STW series	STW1400	150-400	1500	TGM-VA EE-30098C SFT	TGM	13-Apr-05	REP-RL13-T-001-0	ResLab	6-Jul-04	8506	NSW	27-Sep-05
SunTechnics	STW series	STW1900	150-400	2000	TGM-VA EE-30098C SFT	TGM	13-Apr-05	REP-RL12-T-001-0	ResLab	1-Jul-04	8506	NSW	27-Sep-05
SunTechnics	STW series	STW2600	150-400	2650	TGM-VA EE-30098C SFT	TGM	13-Apr-05	REP-RL11-T-001-0	ResLab	18-Jun-04	8506	NSW	27-Sep-05
SunTechnics	STW series	STW3600	150-400	4100	TGM-VA EE-30098B SFT	TGM	5-Apr-05	REP-RL18-T-001-0	ResLab	14-Oct-04	8506	NSW	27-Sep-05
SunTechnics	STW series	STW4600	150-400	5000	TGM-VA EE-30098B SFT	TGM	5-Apr-05	REP-RL19-T-001-0	ResLab	19-Oct-04	8506	NSW	27-Sep-05

Please note: Certificates of Suitability will automatically expire after 5 years. Inverters will be deleted at this time.

NATA Accredited Laboratories

AS 3100

1. ITACS	Adelaide	03 9875 9001
2. SGS	Perth	08 9473 8100
3. Wakefields	Auckland NZ	0011 64 9415 3355
4. Energex	Brisbane	07 3407 5454
5. TCA	Sydney	02 9410 5122

AS 4777

1. ResLab	Perth	08 9360 7355

Updated: 5/03/2007 12:21

Appendix 2

Windyboy Manufacturer Assurance

Windy Boy

WB 700, WB 1100, WB 1100LV, WB 1700, WB 2500, WB 2800i, WB 3000, WB 3300, WB 3800, WB 5000(A), WB 6000(A)

Herstellererklärung für die Übertragbarkeit von Zertifikaten für "Sunny Boy" Wechselrichter auf "Windy Boy" Wechselrichter

Die Wechselrichter der Windy Boy Produktserie sind absolut baugleich mit dem dazugehörigen Sunny Boy Wechselrichter (siehe Tabelle). Jeder Sunny Boy Wechselrichter kann somit als Windy Boy betrieben werden und umgekehrt. Die jeweilige Betriebsart des Wechselrichters kann jederzeit vom Anlagenbetreiber durch Setzen eines Softwareparameters definiert oder geändert werden. Bei werkseitiger Auslieferung der Wechselrichter als "Windy Boy" ist der Softwareparameter bereits auf Windgenerator-Betriebsart gesetzt. Zur Kennung dieses Auslieferungszustandes besitzt der Windy Boy folgende Unterscheidungsmerkmale gegenüber dem baugleichen Sunny Boy:

- Deckel mit dem Aufdruck "Windy Boy" anstatt "Sunny Boy".
- Typenschild mit Aufdruck "WB(SB) xxxx" anstatt "SB xxxx".

Alle Zertifikate der "Sunny Boy" Wechselrichter sind somit auf entsprechende "Windy Boy" Wechselrichter übertragbar.

Declaration of the manufacturer concerning the validity of the certificates regarding the "Sunny Boy" inverters with respect to the "Windy Boy" inverters

The Windy Boy inverters are identical with the according Sunny Boy inverters (see table). Each Sunny Boy inverter can therefore be used as Windy Boy inverter and vice versa. The respective operating mode of the inverter can be set or changed by the operator be means of an according software parameter. The delivery of "Windy Boy" inverters is done with the according setting of the operating mode to "Wind-Turbine Mode". The presetting of this operating mode in the Windy Boy includes:

- Enclosure lid with label "Windy Boy" instead of "Sunny Boy"
- Type label with a type indication "WB(SB) xxx" instead of "SB xxx"

All certifications of the "Sunny Boy" inverters are therefore also valid for the respective "Windy Boy" inverters.

Explicación del fabricante sobre la transferibilidad de los certificados de los inversores "Sunny Boy" a los inversores "Windy Boy".

Los inversores de la serie "Windy Boy" presentan una construcción absolutamente idéntica con los de la serie "Sunny Boy" (véase tabla). Por lo tanto, todos los inversores "Sunny Boy" se pueden manejar como los "Windy Boy" y viceversa. El usuario del equipo puede, en todo momento, definir o modificar el modo de funcionamiento respectivo configurando un parámetro de Software. Los inversores "Windy Boy" que vienen de fábrica disponen de un parámetro de Software ya configurado para el modo de funcionamiento generador eólico. Para reconocer este estado de entrega de fábrica, el "Windy Boy" presenta respecto al "Sunny Boy", que está construido idénticamente, las siguientes características:

- Tapa donde aparece impreso, en lugar de "Sunny Boy", "Windy Boy".
- Placa de identificación donde aparece impreso, en lugar de "SB xxxx", "WB(SB) xxxx".

Por las razones expuestas anteriormente, todos los certificados referentes a las características del inversor "Sunny Boy" son transferibles a los correspondientes inversores "Windy Boy".

SMA Technologie AG

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WBIDENT.11-BX3504 /1

Windy Boy

WB 700, WB 1100, WB 1100LV, WB 1700, WB 2500, WB 2800i, WB 3000, WB 3300, WB 3800, WB 5000(A), WB 6000(A)

Déclaration du fabricant relative à la transmissibilité des certificats des onduleurs "Sunny Boy" aux onduleurs "Windy Boy"

Les onduleurs de la série Windy Boy sont, en termes de construction, parfaitement identiques aux onduleurs correspondants Sunny Boy (voir tableau). De cette manière, chaque onduleur Sunny Boy peut être exploité comme un Windy Boy et inversement. L'exploitant de l'installations est donc en mesure de définir ou de modifier le mode de service respectif de l'onduleur en configurant un paramètre du logiciel. Si l'onduleur a été livré avec un réglage usine en tant que "Windy Boy", le paramètre du logiciel est déjà configuré en mode de service générateur éolien. Afin de reconnaître le type de livraison dont il est question, le Windy Boy présente les caractéristiques distinctives suivantes par rapport au Sunny Boy de construction identique:

- sur le couvercle, l'inscription "Windy Boy" remplace "Sunny Boy".
- sur la plaque signalétique, l'inscription "WB(SB) xxxx" remplace "SB xxxx".

Pour les raisons évoquées précédemment, tous les certificats relatifs aux appareils de la série d'onduleurs "Sunny Boy" sont transmissibles aux onduleurs correspondants "Windy Boy".

Dichiarazione del produttore sulla trasferibilità delle certificazioni per inverter "Sunny Boy" rispetto agli inverter "Windy Boy".

Gli inverter della serie Windy Boy sono di costruzione assolutamente identica rispetto al corrispondente inverter Sunny Boy (vedi tab). Ogni inverter Sunny Boy può quindi essere utilizzato come Windy Boy e inversamente. Il modo di funzionamento dell'inverter può essere definito o modificato di volta in volta dal gestore dell'impianto impostando un parametro del software. In caso di fornitura dell'inverter da parte del costruttore come "Windy Boy", il parametro del software viene preimpostato di fabbrica sul modo di funzionamento generatore eolico. Ai fini dell'identificazione di tale configurazione al momento della consegna, il Windy Boy presenta le seguenti caratteristiche distintive rispetto al Sunny Boy di costruzione identica:

- coperchio con la scritta "Windy Boy" invece di "Sunny Boy".
- targhetta con la scritta "WB(SB) xxxx" invece di "SB xxxx".

In virtù ai motivi suddetti, tutte le certificazioni relative agli inverter "Sunny Boy" sono trasferibili sui corrispondenti inverter "Windy Boy".

Niestetal, 28.08.2006

SMA Technologie AG

i.V. Frank Greizer

i.V. Frank Greizer
(Entwicklungsleiter Solartechnik / Head of Development Department Solar Technology)

Sunny Boy		Windy Boy
SB 700	=	WB 700
SB 1100	=	WB 1100
SB 1100LV	=	WB 1100LV
SB 1700	=	WB 1700
SB 2500	=	WB 2500
SB 2800i	=	WB 2800i
SB 3000	=	WB 3000
SB 3300	=	WB 3300
SB 3800	=	WB 3800
SMC 5000(A)	=	WB 5000(A)
SMC 6000(A)	=	WB 6000(A)

WBIDENT.11-BX3506 /2

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Appendix 3

Turbines Available in Australia

Brand/made In	Model	Power rating (watts)	Cut-in speed (m/s)	Voltages available	Overspeed protection	Number of blades	Blade material	Rotor diameter	Weight (kg)	Generator type	Comments	RRP (inc GST)	Warranty (years)	Manufacturer or distributor
Soma (Australia)	Soma400	400W @ 10m/s	4	12, 24	Tilt up	2	Hollow moulded fibreglass	2	40	Brushless permanent magnet		4900	1	Sunrise Solar ph:(02) 43811531 sunrise@comcen.com.au www.somapower.com.au
	Soma1000	1000W @ 10m/s	3.5	24, 48, 110				2.7	50			6250		
Southwest Windpower (USA)	Air X Land	400W @ 12.5m/s	3.58	12, 24, 48	Electronic torque control	3	Carbon fibre composite	1.15	5.85	3 phase permanent magnet alternator		1210	3	Precision Wind Technology ph:(02) 66791234 martypwt@bigpond.com www.pwt.com.au and Conergy Pty Ltd ph:(02) 8507 2222 sales@conergy.com.au www.conergy.com.au
	Air X Marine	400W @ 12.5m/s	3.58			3		1.15	5.85			1485	3	
	Air X Industrial	400W @ 13.4m/s	2.7	12, 24, 48	Variable pitch aerolastic twist	3	Carbon fibre reinforced	1.15	6.2			2057	3	
	Whisper 100	900W @ 12.5m/s	3.4	12, 24, 36, 48	Side furling	3	Polypro/carbon glass reinforced	2.1	21			3670	5	
	Whisper 200	1000W @ 11.6m/s	3.1			3		2.7	30			4532	5	
	Whisper 500	3000W @ 10.5m/s	3.5	24, 32, 48		2	Carbon reinforced fibreglass	4.5	70			12615	5	
	Skystream	1800W @ 9.4m/s	3.5	240VAC	Electronic stall regulation with redundant relay switch control	3	Fibreglass reinforced composite	3.72	77	Slotless, brushless permanent magnet	Awailting Aus Approval	11000	5	
Westwind (Northern Ireland)	3kW	3000 @ 14m/s	3.5	48, 110, 120	Tail furl	3	Fibreglass	3.7	190	Direct drive permanent magnet	Now located in Northern Ireland	9619	2	Numerous sellers, but no central distributor. See www.westwind.com.au
	5kW	5000 @ 14m/s	3			3		5.1	200			15466		
	10kW	10000 @ 14 m/s	3	110, 120		3		6.2	380			27566		
	20kW	20000 @ 14m/s	3	240, grid	Blade pitch/tail fur	3	Epoxy/carbon	10.4	750			53196		
LVM (UK)	212	48 @ 20.5m/s	6.2	12	None	5	Glass filled polypropylene	0.58	5	3 phase permanent magnet alternator	Hobby boats	1190	1	Neosid Australia (Importer) ph:(02) 9660 4566 sales@neosid.com.au www.neosid.com.au
	412	228 @ 31m/s	4.1	12, 24		6		0.87	9.3		Regular cruising	1786.4		
	424	228 @ 31m/s	4.1					0.87	9.3			1966.8		
	612	360 @ 23.1m/s	3.3					1.22	12.5		Houseboats	2860		
	624	360 @ 23.1m/s	3.3					1.22	12.5		*6F will furl - land only	3128.4		
Bergey (USA)	XL.1	1000 @ 11m/s	3	24	Autofurl	3	Pultruded fibreglass	2.5	34	Permanent magnet alternator		4790	5	Several sellers
Aeromax (USA)	Lakota Land	900 @ 12.9m/s	2.7	12, 24, 48	Upward furling	3	Carbon fibre	2.09	16	Rare-earth permanent magnet		3025	5	M + H Power systems ph:1300 733 006 www.mhpower.com.au
	Lakota Marine										stainless steel parts	3566.2	5	
Ampair (UK)	Pacific 100	100 @ 12.6m/s	3	12, 24	None	6	Glass filled polypropylene	0.928	12.5	Permanent magnet alternator		1969	1	Conergy Pty Ltd ph:(02) 8507 2222 sales@conergy.com.au www.conergy.com.au
	Pacific 300	300 @ 12.6m/s			PowerFurlTM blade pitch control system	3	Glass reinforced polypropylene	1.2	10.5			3520		
	Pacific 600	698 @ 11m/s		24				1.7	16			4950		
EnviroWind (China)	200W	200 @ 8m/s	3	24	Autofurl	3	Aluminium	2.1	71	3 phase permanent magnet alternator		589	1	Todae ph:1300 138 483 info@todae.com.au www.todae.com.au
	500W	500 @ 8m/s		24			Reinforced Fibreglass	2.7	125			1795	1	
	1000W	1000 @ 9m/s		48				3.1	180			2980	1	
	Phoenix	300 @ 12m/s	2.5	12	None		Carbon Fibre	1.5	12.5	3 phase permanent magnet alternator		890	1	
Rutland (UK)	1803	720 @ 12m/s	4	12, 24	Autofurl	2	Glass fibre composite	1.8	38	3 phase alternator		POA	Unknown	
	910-3		2.6	12, 24	Autofurl	6	unknown	0.91	15			1732		
	913	90 @ 9.8m/s		12	None			0.91	10.5			1305		
	503	25 @ 9.8m/s						0.5	6			POA		
Forgen	500	10	Not specified	12, 24	None	3, vertical	Extruded aluminium	0.2	3.65	3 phase permanent magnet alternator		1100	1	Solazone ph:(03) 9808 7337 vic@solazone.com.au www.solazone.com.au
	1000	30						0.3	6.25			1450		

Appendix 4

Hush Turbine Field Visit Summary

Field visit to Hume city council Hush turbine

27 April 2007

Tech Specs
Rated 1000W @ 13m/s
Cut in 4m/s - No cut out speed
Height 9m
Tip speed ratio ~ 0.9

Project Aim
The Hume city council and Hush Turbines have erected a 1kW prototype. They are hoping to generate 2-4kWh per day to match the output of a typical domestic PV system located in Melbourne. The system will be promoted for use in places where it is possible to match PV output but for a cheaper initial investment. Hush are hoping to market the turbine for less than $12,000 fully installed; where they estimate an equivalent PV system would cost around $24,000.

Siting and anemometer
The turbine location simulates a domestic situation while actually being sited in an industrial area. The annual average wind speed at the site is 6 to 6.5 m/s. The anemometer is a generic brand and was purchased from Dick Smiths for around $400 or $500. When tested in a wind tunnel it was proved to be accurate with a tolerance of 15%. The engineer believes it is difficult to find a reasonably priced accurate anemometer. The data sampling rate at the site is 1 minute intervals.

Failure speed
The turbine has no cut out speed however the engineer predicts that it may fail at 150km/hr. No such wind speeds have been observed at the Hume city council location and this theory has never been tested. The marketable version will be a single piece of injection moulded plastic and will be destructively tested.

Mounting
The turbine was originally going to be mounted on the building, 3m above the roof. Instead it is on a stand alone tower and 4.5m above the roof. The tower is a modified street light post. It was decided to mount it this way due to structural concerns for the council building. RMIT students completed some tunnel testing and estimated that the turbine only needs to be 1500mm above the roof to work effectively.

Inverter
The inverter is a modified SunnyBoy inverter, originally designed for PV systems. The Hush will possibly be marketed with its own custom inverter.

Control System
Originally the control system needed 95 seconds of power before it would cut in and start exporting to the grid. Because wind is more intermittent than solar power, this was wasting a lot of power. The delay was brought down to 40 seconds about a month before this field visit. The custom built inverter will have no delay and will be half of

the size of the existing one due to the elimination of unnecessary components in the off-the-shelf systems.

Load Dump
The load dump is necessary because only a certain amount of current can be drawn out of the generator before it overheats. The load dump is used in times of extreme gusts, grid failure, or when the power company shuts the grid down for maintenance. Also, the power generated in the 40 seconds delay time before grid connection goes to the load dump. The load is turned into heat which has not been noticeable in the Hume city council offices.

Losses
Recently changed out the 70V generator to a 240V generator to minimize losses.
About 5% in the inverter
About 5% elsewhere, totaling around 10% losses.

Planning
There were no planning requirements for this installation because the council owns the land and were able to approve the project themselves.

No council has a specific clause in their planning guidelines that refers to small wind turbines. Arthur O'Connor's application for his first prototype is still the only application to Hume city council in the last five years.

The issue that Hush is facing is anticipating the acceptable diameter measurement that will be enforced when and if the councils do come up with a planning regulation. The only current benchmark is the ~1.5m diameter maximum for television satellite dishes.

If hush decide to develop a 1.4m diameter turbine then city councils may defer to this as the industry standard. Generally a new guideline would be copied by all other councils in an attempt to avoid reinventing and save time and money.

Maintenance
The turbine will be exceptionally reliable and require maintenance every 5 years for the duration of its 20 year life. The maintenance is expected to be a 2 hour job and may or may not involve a cherrypicker.

Availablilty
Hush are hoping to make the turbine available within the next 12 months.

Appendix 5

Bureau of Meteorology Wind Data for Melbourne

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean 9am wind speed (km/h)	10.1	9.2	9.1	8.8	9.3	9.6	10.7	11.5	12.6	12.8	11.7	11	10.5	53
Mean 3pm wind speed (km/h)	15	14.5	13.4	13.2	12.8	13	14.5	15.6	16	15.8	15.2	15.6	14.5	53

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean 9am wind speed (m/s)	2.8	2.6	2.5	2.4	2.6	2.7	3.0	3.2	3.5	3.6	3.3	3.1	2.9	53
Mean 3pm wind speed (m/s)	4.2	4.0	3.7	3.7	3.6	3.6	4.0	4.3	4.4	4.4	4.2	4.3	4.0	53

Mean 9am (3pm) wind speed (km/h)

Wind speed measured at 9am (or 3pm) local time during a calendar month or year, averaged over the period of record. The wind speed is generally measured at a height of 10 metres above the surface, averaged over the ten minutes leading up to the time of observation.

Wind speed and direction are normally measured at a height of 10 m above the surface. The rotating cup anemometer is commonly used to measure wind speed

Data taken from http://www.bom.gov.au/climate/averages/tables/cw_086071.shtml

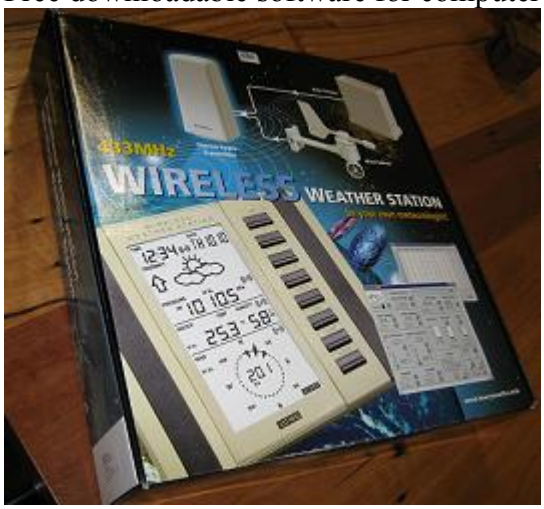
Appendix 6

Anemometers available from the ATA

Anemometers for Sale at the ATA

1. AAG 1-wire wind instrument - $185
Cups and vane for measuring wind speed and direction
Easily mounted to pole
Plugs into a computer
Free software download
Computer must be on at all times to log

2. Wireless weather station computer connect - $349
Cups and vane for measuring wind speed and direction
Temperature and rain gauge included
Indoor wireless LCD display with limited logging capability
LCD plugs into computer which is switched on intermittently to download data
Free downloadable software for computer logging



3. Wireless weather station - $149
Kit as above but without computer connect capability
User must manually record LCD data at intervals

4. APRS World wind data logging kit - ~$500
Can be powered by any 12V source
Logger stores data onto an ordinary SD card
Data can then be imported into any program such as Excel and analysed manually
Cups, vane and logger can be purchased separately

The ATA hires this anemometer to members for $50/month

Appendix 7

Record of correspondence with councils regarding planning

Planning – council correspondence records

Because so few urban wind turbines have been installed, councils are yet to establish guildelines for them. This makes it difficult for councils to respond to questions of how large/noisy/high a domestic turbine may be. Stuart Nesbitt who is the Sustainable Resources Technical Officer at the Hume city council believes that guidelines will be drawn up when installations reach a critical mass. He cites the example of television satellite dishes which were initially installed with no rules or guidelines whatsoever but once a certain number were mounted on houses councils responded by drawing up standards.

Emails requesting information were sent to three city councils, namely Port Phillip, Maribyrnong and Banyule. Additionally, an email was sent to the Department of Sustainability and Environment.

Port Phillip council

Dan Thompson from Port Phillip council replied the next day;

Hi Alicia

The planning scheme does not specifically mention domestic wind turbines. The only mention of wind turbines is in relation to large wind farms in Clause 52.32 and this is not really relevant due to the significant difference in scale. We would class a domestic wind turbine as buildings and works. This would mean that due to the zoning and overlays in Port Phillip a permit would be required in the majority of locations within the municipality. Once you have a specific location for a wind turbine we would beable to tell you with certainty if a permit is definately required for that site. I hope that this helps.

Dan Thompson.

After being prompted for more information, he said that

The applicant would need to submit plans showing the turbine in plan and elevation view in its proposed location, a current copy of title (available from land titles office), application form (available @ www.portphillip.vic.gov.au), and any fees. There will not be a fee if the works are under 10,000 dollars and for a single dwelling on a lot. All this info is available on the above website. Prior to lodging an application the applicant should ring council and check if a permit is necessary at that location due to zoning and overlays on 9209 6881. Additionally it would be helpful to provide information on any noise created by the turbines as that would no doubt be a concern to nearby residents.

Banyule Council

Scott Walker from Banyule city council was very helpful indeed and came back with the following detailed information:

I have had one of the planners (Tasha Tyler-Moore) have a look at the Banyule Planning Scheme so that we could form a view on the relevant requirements for domestic wind turbines. As a preface, it should be noted there are no major concerns in Banyule in relation to wind turbines at this point in time and therefore the issue is not one that has been examined in detail from a planning perspective to date. Nonetheless, here is our interpretation of the relevant requirements:

State Policy

The only reference to wind turbines in the Banyule Planning Scheme is Clause 52.32, however this does not include domestic use turbines. Clause 15.14 (in the State Policy Section of all Victorian Planning Schemes) refers to renewable energy. The state policy encourages the use of renewable energy, however the policy mainly refers to commercial wind farms.

Clause 62.02 lists buildings and works not requiring a planning permit, including domestic services normal to a dwelling. The definition then goes on to make reference to solar panels, but nothing about wind turbines.

Local requirements for a dwelling

It is considered that a domestic wind turbine used for private residential energy generation purposes would be ancillary to a dwelling, and therefore would not need a planning permit (unless triggered but another planning control). The key assumption is that there is no other planning control such as a heritage overlay or other overlay control, that the site is greater than 500 square metres, that the site is in a standard Residential 1 Zone and contains a single dwelling and that a previous planning permit for the site is not in existence. The requirements for satellite dishes would not apply as these controls relate specifically to satellite dish type of structures only.

However, it is noted that some amenity issues may arise if domestic wind turbines are more widely erected in residential areas. This may result in the Department of Sustainability and Environment (DSE) to consider specific controls in the future, similar to the satellite dish control which was introduced following the proliferation of these on residential properties without any specific control.

The Victorian Civil and Administrative Tribunal has dealt with issues associated with a residential wind turbine in the past where a planning permit was required. In *Warren v Golden Plains SC [2001] p*lanning approval requirements were triggered because the wind turbine was considered building and works associated with a section 2 use (dwelling in Rural zoning). There are amenity issues discussed in the decision.

The other matter which may influence the interpretation of whether a permit is needed relates to the potential connection back to the electricity grid. If the turbines are erected and the power "sold" back to the grid it may be considered that the turbine is not for domestic purposes but rather for commercial purposes. Obvious factors to be considered will be the amount of electricity generated vs the amount of electricity

needed for domestic purposes. This issue may need to be explored further in a test case to VCAT.

Building Requirements

Finally, a building permit may be required for some turbines depending on the type of structure and location on the property including whether they are part of a building or not. This will need to be determined on a case by case basis.

A second follow-up email attached the Building Commission information on the next page.

Just a quick follow up on my previous e-mail. Please find attached an information sheet from the Building Commission relating to the building requirements for wind turbines.

A 'wind energy facility' is a specific land use type referred to in the Planning Scheme but it doesn't include "turbines principally used to supply electricity for domestic or rural use of the land".

The following question was sent in reply:

You say that the export of electricity to the grid could cause the turbine to be considered used for commercial purposes rather than domestic purposes. What is the effect of this rule on domestic solar panels? Is there a clause exempting them from this rule or have they just not exported enough energy to be considered under the clause?

And Scott replied

There is no clear "rule" in place which says that electricity cannot be exported back to the grid. It would come down to a planning interpretation on a case by case basis. The key question would be "what is the principal purpose of the facility". My assumption is that the principal purpose of domestic solar panels is clearly for domestic use and the amount of energy exported has not raised concern. It is also likely that no-one has challenged the purpose of a solar panel at VCAT yet. It is a matter that may become an issue in the future if people start attempting to "harvest" energy in their backyard and make money out of it and the structures used cause an amenity impact for their neighbours. (I emphasise that I'm not a solicitor and therefore these views are my opinion and interpretation as a planner rather than a legal interpretation of planning law).

Maribyrnong council

Maribyrnong are yet to respond.

The Department for Sustainability and Environment

Simon Cover wrote

Thank you for your recent query regarding planning and building approvals for mast mounted and roof mounted wind turbines in residential areas.

Whilst there are no specific references in the Victoria Planning Provisions (VPPs) for such domestic wind turbines, such developments could be classified as an 'extension to a dwelling' in residential areas. Also, specific overlays, for example, may trigger the requirement for a planning permit for such uses.

Regarding building permit requirements, please refer to the attached brochure from the Building Commission.

The attached brochure is the same one as sent by Scott Walker of Banyule council.

Moreland Council

Moreland council approved the CERES wind turbine and submitted the draft report attached in the following Appendix.

Appendix 8

Draft report from Moreland City Council regarding CERES turbine

DRAFT

MORELAND CITY COUNCIL STATUTORY PLANNING UNIT
REPORT ON PLANNING PERMIT APPLICATION

Application Number:	MPS2004/0124
Property:	CERES 6-8 LEE STREET BRUNSWICK EAST VIC 3057
Proposal:	Use and development of land for the construction of a Wind Energy Facility comprising a single turbine to replace the existing
Property No:	11563
Date Received:	09/03/2004
Planning Officer:	Jessica Cutting
Zones:	Public Park and Recreation Zone
Overlays:	ESO
Applicant:	CINNAMON EVANS EDUCATION TEAM LEADER 6 LEE STREET BRUNSWICK EAST VIC 3057

1 PROPOSAL

The application proposes to erect a Wind Energy Facility of the site in the form of a single Horizontal Axis Wind Turbine (HAWT). The wind turbine will comprise a tower and three blades that capture the wind with electricity generated through the movement of the blades.

Details of the proposed Wind Energy Facility are as follows:

- The wind turbine will be located 28.65m east of Roberts Street and 44.29m north of Lee Street.
- The output of the wind turbine will be 15kW at 11 metres/second and will be connected to the existing electricity grid via a new underground cable.
- The tower will have a height of 17 metres above ground and a diameter at the base of 810mm and 495mm at the highest point.
- The tower will be made from pre-stressed concrete.
- The structure will have a total height (or height to maximum rotar tip) of 21.5 metres
- The blades will have a length of 4.5 metres and a diameter of 9.0 metres.
- The blades will be made from fibreglass.
- The structure will be white in colour.

2 LOCATION AND SITE CONTEXT

The site forms part of the CERES Community Environment Park, which is located to the west of Merri Creek and bound to the east by Roberts Street, Brunswick East. Access to the site is from Lee Street and Weigall Street.

The proposed Wind Energy Facility is to be located in the Origin Energy Park, in the south west corner of the park. This area is bound by Roberts Street to the west, Lee Street to the south and the CERES carpark to the north. The Origin Energy Park contains 200 PhotoVoltaic Panels, a methane digester (or composting toilet), inverter buildings, energy efficient buildings with solar air and water heaters and a weather station.

To the north-west of the site is Kingfisher Gardens, a recent residential development. The land directly to the north operates a Limousine Hire Service. On the opposite side of Lee Street are dwellings and the land to the west is currently vacant. The vacant land to the west is subject to a current planning application for the construction of 60 dwellings. A decision has not been made on this application.

A wind turbine previously existed on the site, north-east of the location of the proposed wind turbine. This wind turbine was slightly smaller than the proposed turbine with a blade diameter 7.5 metres, a tower height of 18 metres and a maximum output of 10kW.

3 SITE HISTORY

The site has no relevant history.

4 ZONES AND OVERLAYS

4.1 Zoning

The subject site is located within a Public Park and Recreation Zone.

The purpose of the Public Park and Recreation Zone is:

- *"To implement the State Planning Policy Framework and the Local Planning Policy Framework, including the Municipal Strategic Statement and local planning policies.*
- *To recognise areas for public recreation and open space.*
- *To protect and conserve areas of significance where appropriate.*
- *To provide for commercial uses where appropriate."*

A Wind Energy Facility is defined in Clause 74 as:
"Land used to generate electricity by wind force. It includes any turbine, building, or other structure or thing used in or in connection with the generation of electricity by wind force. It does not include:

a) turbines principally used to supply electricity for domestic or rural use of the land: or
b) an anemometer"

The proposed Wind Energy Facility falls within this definition as it will be used to generate electricity through wind force that will not be used for domestic or rural purposes.

As the use is not listed in Section 1 or 3 and will be operated privately, it is considered to be a Section 2 – permit required use. A planning permit is required for the use pursuant to Clause 36.02-1.

A planning permit is required pursuant to Clause 36.02-2 for Buildings and Works.

The proposed Wind Energy Facility is consistent with the purpose of the zone.

4.2 Overlays

The land is affected by an Environmental Significant Overlay.

The purpose of the Environmental Significance Overlay is :

- *"To implement the State Planning Policy Framework and the Local Planning Policy Framework, including the Municipal Strategic Statement and local planning policies.*
- *To identify areas where the development of land may be affected by environmental constraints.*
- *To ensure that development is compatible with identifiable values."*

A planning permit is required pursuant to Clause 42.01-2 for Buildings and Works.

The proposed Wind Energy Facility is consistent with the purpose of the Environmental Significance Overlay.

5 PUBLIC NOTIFICATION UNDER SECTION 52 OF PLANNING & ENVIRONMENT ACT

The application was advertised from 01/07/2004 to 28/07/2004. Advertising of the application involved notifying owners and occupiers of adjoining properties in addition to signs being displayed at the front boundary of the site. No objections were received to the proposal.

6 STATE POLICY INFLUENCES

The state planning policies relating to the Environment at Clause 15 are of relevance to this application. Of particular relevance are the provisions at Clause 15.14 - Renewable Energy where the objective at 15.14-1 states:
"To promote the provision of renewable energy, including wind energy facilities, in a manner that ensures appropriate siting and design considerations are met."

The proposed Wind Energy Facility is consistent with above state planning policy.

7 LOCAL PLANNING POLICY FRAMEWORK

The Municipal Strategic Statement is incorporated at Clause 21 of the Moreland Planning Scheme. The following themes/ strategies are of relevance to this application:

- 21.06-6 Open Space and Outdoor Recreation
- 21.06-7 Community and Leisure Facilities

8 OTHER USE AND DEVELOPMENT PROVISIONS

8.1 Particular Provisions

Wind Energy Facility
The particular provisions relating to Wind Energy Facilities at Clause 52.32 are of relevance to this application.

The purpose of this provision is:
"To facilitate the establishment and expansion of wind energy facilities, in appropriate locations, with minimal impact on the amenity of the area."

Pursuant to Clause 52.32, the responsible authority must also consider as appropriate:

- The views of the Sustainable Energy Association of Victoria about the contribution of the proposal to reducing greenhouse gas emissions.
- The effect of the proposal on the surrounding area in terms of noise, blade glint, shadow flicker and electromagnetic interference.
- The impact of the development on significant views, including visual corridors and sightlines.
- The impact of the facility on the natural environment and natural systems.
- The views of the Civil Aviation Safety Authority if within a 30-kilometre radius of an airfield.
- The Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria, 2003.

Assessment of the proposed Wind Energy Facility is detailed in Section 9 of this report.

8.2 General Provisions

The general provisions at Clause 65 (Decision Guidelines) are of relevance to this application. The application has been assessed and is considered to be consistent with the relevant decision guidelines.

9 APPLICATION ASSESSMENT AND ISSUES

9.1 Visual Amenity

Wind turbines and associated structures will usually have some degree of impact on the landscape. The degree to which a Wind Energy Facility has a visual impact depends on the magnitude of change to the landscape caused by the development. The Policy and planning guidelines of wind energy

facilities in Victoria states that *"it may be useful to consider planning scheme objectives for the landscape, including whether the land is subjected to an Environmental Significance Overlay, Vegetation Protection Overlay or a Significant Landscape Overlay".*

The site is subject to an Environmental Significance Overlay (ESO 1 - Merri Creek and Environs). Of particular relevance to this application is the Landscape Character detailed in 2.0 of Schedule 1 to the Environmental Significance Overlay:

"Landscape Character

- *To protect and enhance the natural and visual character of the waterway corridor.*
- *To ensure that the scenic qualities and visual character of the waterway corridor are not compromised by the inappropriate siting of buildings, the placement of fill or lack of screening vegetation.*
- *To restore those sections of the waterway corridor which have been modified to create artificial bed, banks and landforms to a more natural, visually attractive and ecologically diverse landscape."*

The degree of visual impact on Merri Creek resulting from the proposed wind turbine is considered appropriate for the following reasons:

- The wind turbine will be located in excess of 180 metres from Merri Creek and is therefore not likely to impact the immediate environs of the Merri Creek.
- The visual qualities and visual character of the waterway corridor will not be compromised given the proximity to the wind turbine and the extent of existing vegetation that will block views of the wind turbine from the creek area.

The land falls away from Roberts Street (from the north-east corner to the south-west) and as a result the base of the wind turbine will be 1.5m below the kerb at Roberts Street and generally at the same level as Lee Street. The total height of the wind turbine (from base to the maximum rotar tip) will be 21.5 metres and will be visible beyond the site. This is considered appropriate for the following reasons:

- The wind turbine is to be located within the Origin Energy Park which is characterised by environmentally sustainable or 'green' technology such as solar panels. The use of a wind turbine to generate energy is considered environmentally sustainable, as it does not have environmentally destructive by-products. The wind turbine is characteristic of the other uses in the Origin Energy Park and its location is therefore appropriate.
- The wind turbine will be located above the vegetation and buildings within the Origin Energy Park. It is likely that the turbine will be visible from some vantage points beyond the constraints of the site but this is minimised given the extent of vegetation on the site.

9.2 Impacts on Surrounding Area

Noise

The noise from wind turbines is generally in two forms, aerodynamic and mechanical.

Aerodynamic Noise

When the wind passes through the blades of the turbine aerodynamic noise is created. The level of aerodynamic noise is assessed against the existing background noise in the area. The Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria, 2003 states that a wind energy facility should comply with the noise levels recommended in New Zealand Standard NZ6808:1998 Acoustics – The Assessment and Measurement of Sound from Wind Turbine Generators.

The applicant has advised that the manufacturer has not measured the noise generated from this particular type of wind turbine. It is considered that a condition of permit can be placed on the permit to require measurement of background noise prior to the wind turbine being erected and after construction. The noise generated from the wind turbine must not exceed the standard NZ6808:1998 and a report will be required to confirm this.

Mechanical Noise

The secondary type of noise is associated with the mechanisms within the wind turbine, more so when these mechanisms are not maintained. This can be alleviated with appropriate upkeep of the wind turbine and regular lubrication of the parts. An appropriate condition will form part of the permit.

Blade Glint

Blade glint can result from reflection of the sun from the wind turbine blades. In order to minimise the effects of blade glint a permit condition will require that the blades have a surface treatment with low reflectivity.

Shadow Flicker

Shadow flicker results from the position of the sun in relation to the blades of the wind turbine as they rotate. Under certain combinations of geographical position and time of day the sun may pass behind the wind turbine causes a flickering effect. This is particularly an issue for turbines located to the east or west of a dwelling.

The proposed wind turbine will not be fixed to face any particular direction, the blades will rotate to capture the wind in any direction. Given the height of the wind turbine, shadow flicker may be experienced by the dwellings to the west of the site in the morning (sunrise). A condition of permit will require shadow flicker experienced at any dwelling in the surrounding area must not exceed 30 hours per year as a result of the operation of the wind turbine. This limit is recommended in the Policy and planning guidelines for development of wind energy facilities in Victoria.

Electromagnetic Interference

Wind turbines can affect electromagnetic waves such as telecommunications and television reception. This is caused by the blades interaction with the signals, resulting in fluctuating reception. The effect on electromagnetic waves is generally limited and in the case of the proposed wind turbine the potential impact is minimal. The height of the wind turbine and the blade length is significantly smaller than those found in commercial wind farms. In addition, as wind turbine has been operating on the site in a similar location, it is not likely to interact with the 'line of sight' between transmitters and receivers in the locality.

9.3 Impact upon nearby airfields (within a 30km radius)

Airfields within a 30km radius can be impacted upon as a result of the height of wind turbines. The Civil Aviation Safety Authority need to be consulted and wind turbines should not protrude into any obstacle limitation surface for any airfield.

The proposed wind turbine is within 30km of Essendon Airport.

The applicant has submitted written consent from the Airport Management Centre at Essendon Airport stating that the proposed wind turbine will not protrude within the obstacle limitation surface.

9.4 Impact on any avifauna (Birdstrike)

Literature on the construction of wind turbines and farms has indicated that Australian Birds tend not to follow set migratory routes and tend to avoid wind turbines. The potential for bird strike is increased in areas surrounding wetlands.

The applicant has not provided any information relating to the presence of avifauna and in particular any migratory birds. The application was referred to the Merri Creek Management Committee and no objections to the location of the wind turbine were raised.

10 CONCLUSIONS

The proposed Wind Energy Facility replaces an existing wind turbine. The new Wind Energy Facility will be sited in a more appropriate location within the Origin Energy Park. The use and development of the land as a Wind Energy Facility is complimentary to the operations of the Origin Energy Park which forms part of the CERES Community Environment Park. The following comments are provided in respect of the development:

- The wind turbine is to be located approximately 180 metres from Merri Creek and is not likely to have a detrimental visual impact.

- The use of the land for a Wind Energy Facility is in keeping with the purpose of CERES .
- The noise associated with the wind turbine will be required to meet the New Zealand Standard NZ6808:1998 Acoustics – The Assessment and Measurement of South from Wind Turbine Generators as a condition of permit.
- A condition of permit will require maintenance of the wind turbine to limit impacts as a result of mechanical noise.
- A condition of permit will require the blades of the turbine to have a low reflective surface to reduce blade glint.
- A condition of permit will require shadow flicker experienced at any dwelling in the surrounding area must not exceed 30 hours per year as a result of the operation of the wind turbine.
- Given the height and blade length of the wind turbine it is not likely to interact with the 'line of sight' between electromagnetic transmitters and receivers in the locality.
- The height of the wind turbine is within the obstacle limitation surface for Essendon Airport.
- The application was referred to the Merri Creek management Committee and no concerns in relation to the impact on avifauna were raised.
- No significant vegetation is to be removed as a result of the construction of the turbine.

In this context therefore, the proposed development meets the requirements of:

- State Planning Policy Framework
- Local Planning Policy Framework
- Objectives, requirements and assessment guidelines as contained at Clause 36.02, 42.01 and 52.32 of the Moreland Planning Scheme.

11 RECOMMENDATION

It is recommended that a Planning Permit be issued to allow the Use and development of land for the construction of a Wind Energy Facility comprising a single turbine to replace the existing at CERES 6-8 LEE STREET BRUNSWICK EAST VIC 3057. This recommendation is subject to the attached list of conditions.

PLANNING OFFICER **DATE: 27 AUGUST 2004**

CO-SIGNATORY **DATE :**

Appendix 9

Relevant standards

Relevant Standards

IEC wind turbine standards

IEC 61400-1 Wind Turbine Safety and Design
IEC 61400-1 *Ed2* Wind Turbine Safety and Design Revision
IEC 61400-2 Small Wind Turbine Safety
IEC 61400-12 Power Performance
IEC 61400-11 Noise Measurement
IEC 61400-13 Mechanical Load Measurements
IEC 61400-22 Wind Turbine Certification
IEC 61400-23 Blade Structural Testing
IEC 61400-21 Power Quality

Australian Standards

AS 1170 – Minimum design loads on structures (known as the SAA Loading Code). Dead and live loads and load combinations.
AS 1170 – Minimum design loads on structures (known as the SAA Loading Code). Part 2: Wind loads
AS 1170 – Minimum design loads on structures (known as the SAA Loading Code). Snow loads
AS 3995 – Design of steel lattice towers and masts
AS3100 – Approval and test specification - General requirements for electrical equipment
AS4777 – Grid connection of energy systems via inverters - Installation requirements

Appendix 10

Customer guidelines for grid connection

Process to connect AS4777 compliant inverter based generation to the CitiPower Distribution Network

Solar photovoltaic (PV) and Wind

Date: November 2006
Version: 1

Author: Scott Thomson,
Connections Technical Team Leader

Service Truck Appointments

These charges apply to customer services requiring work to be undertaken at or adjacent to the customer's premises.

Description		7.30am to 4.30pm Mon-Fri	All other times (incl. public holidays)
3.1.1	Service truck call-out (includes the first 15 minutes)	$143.90	$351.50
3.1.2	On site rate (for each additional 15 minutes)	$31.90	$40.25

Regulated charges – approved by the Office of the Regulator General.

Notes:

- All prices include GST.
- Refer to the CitiPower Website for information of the service charges applicable to new connections. www.citipower.com.au

Step 1 – System preliminary design

- Determine type of generation system such as solar photovoltaic or wind etc.

Step 2 – Apply for PVRP rebate if eligible

- To encourage the installation of photovoltaic solar energy generating systems the Australian Greenhouse Office (AGO) provides cash rebates of up to $4,000. The program is known as the photovoltaic rebate program (PVRP).
- In Victoria the PVRP is managed by Sustainability Victoria. Additional information can be obtained from their website: http://www.sustainability.vic.gov.au/www/html/1517-home-page.asp

Step 3 – Customer to contact electricity retailer(s) and negotiate suitable tariff

- Obtain information from retailers on the electricity tariffs available for the sale of electricity generated and for the purchase of energy consumed.
- Select a retailer and tariff.

Step 4 – Obtain distributor reasonable technical requirements

- Obtain a copy of the CitiPower Grid Connected Renewable Energy System Technical Standard CP 4742.
- Refer to Clause 6.8 of the 2005 Victorian Service and Installation Rules (VSIR) which can be viewed at the following website: www.victoriansir.org.au. Hard copies are commonly available from electrical wholesalers. Any questions relating to VSIR clarifications can be directed to:
  - CitiPower Connection Technical Advisors 1300 132 894
- CitiPower reserves the right to inspect the electrical installation for compliance with the above documents.
- The installation must be compliant with the applicable Wiring Rules, Acts and Regulations, including, these standards prior to connection.

Step 5 – Design and construction

Step 6 – Intent to connect

- The customer must send a letter to the CitiPower Connection Technical Advisor advising of their intention to connect their generator to the CitiPower electricity network. The customer should provide an overview of the system that has been installed.
- The CitiPower Connection Technical Advisor will reply sending a letter confirming agreement to connect the system to the CitiPower electricity network.
- The CitiPower postal address is as follows:

  Connection Technical Advisor
  Connection Services Group
  Locked Bag 14031
  Melbourne
  Vic 8001

Step 7 – Construction

Step 8 – Do Not Connect

- Permission to connect the system to the CitiPower electricity network will be granted following confirmation of compliance with the relevant CitiPower technical standard and the VSIR by a CitiPower representative.

Step 9 – N/A

Step 10 – Sign retailer agreement if applicable

Step 11 – REC to submit an EWR to upgrade metering

- If a new network connection is required (for example a new connection incorporating a solar generator) then the appropriate electricity meter will be installed. The CES must be submitted with the EWR for new connections.
- If the generating system is to be connected to an existing installation, then a meter alteration shall be required and the registered electrical contractor (REC) shall submit an electrical works request (EWR) to the retailer. If any part of the electrical installation, including the meter panel does not satisfy the VSIR, then it will also need to be modified to meet current standards. Step 12 explains the process.

Step 12 – Meter Alteration

<u>Step 12a – Arrange for supply disconnection and new meter alteration</u>

- The Registered Electrical Contractor responsible for the work shall contact CitiPower and arrange a date and time for a “truck appointment” to complete the meter alteration.

<u>Step 12b – Meter alteration</u>

- The Registered Electrical Contractor responsible for the installation of the system shall provide the Electricity Supplier copy of the CES to the CitiPower representative before commencement of the meter alteration work.

Step 13 – System switch on and final tests

- Once the new electricity meter is installed and network connection is restored the generating system can be switched on and final testing completed.
- The person representing the Registered Electrical Contractor is responsible for ensuring all necessary tests are undertaken however a CitiPower representative will also inspect the installation and undertake tests.

Step 15 – Notify retailer

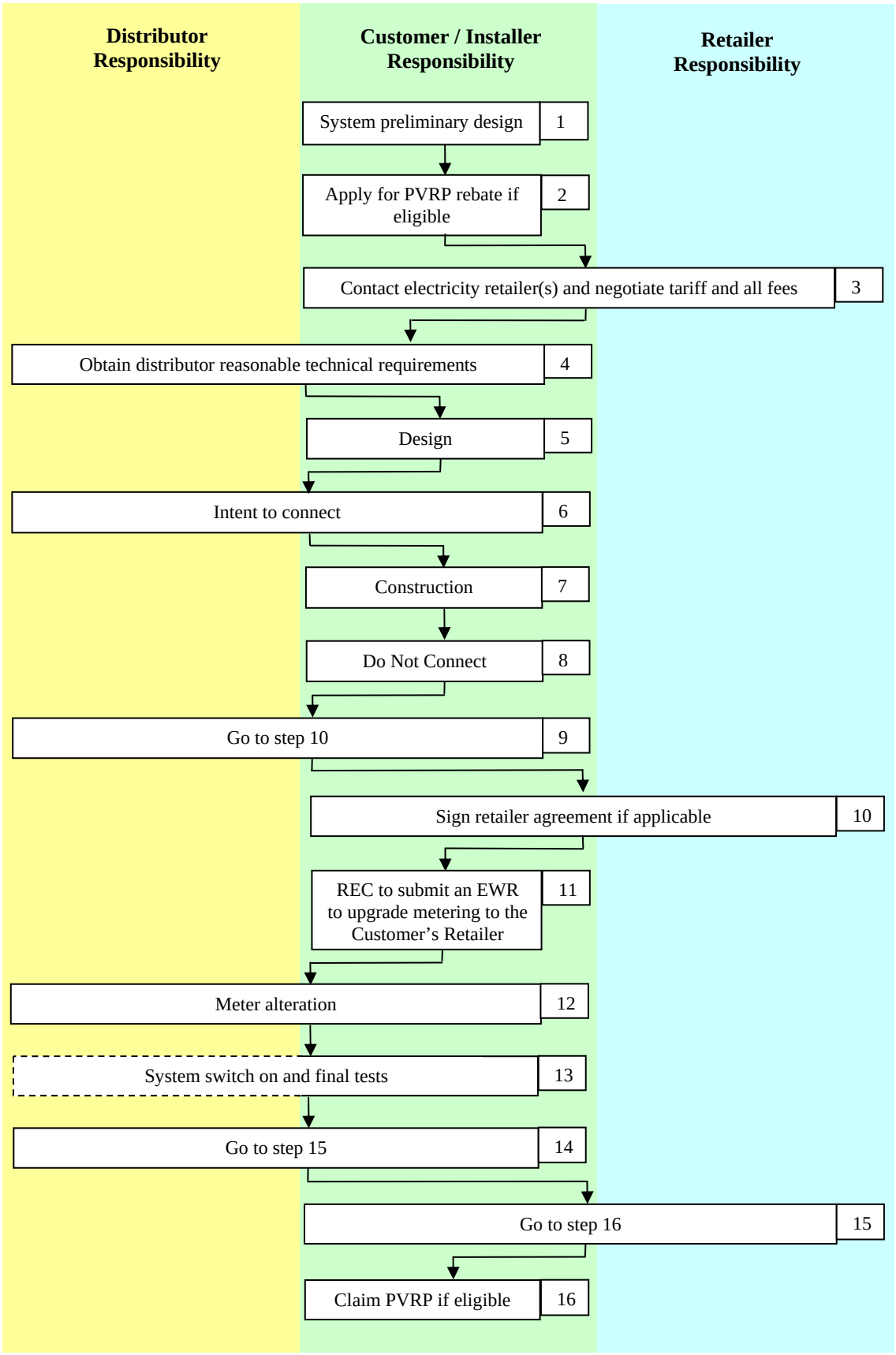
- The customer should notify the retailer once the new generator system is operational.

Step 16 – Claim PVRP if eligible

- If eligible the customer (system owner) can send the appropriate forms to Sustainability Victoria to claim their rebate.

CitiPower Distribution

Inverter based generation grid connection



Customer Guidelines for Grid Connection of Inverter Power Sources up to 20 kW

September 2006

Introduction and Purpose

These guidelines are intended to cover the installation of small private generating sources of capacity up to 20 kilowatts (kW) which customers wish to connect to the Powercor grid via electronic dc/ac inverters. The guidelines do not cover engine-driven generators.

It is intended that such renewable energy generating sources up 20 kW be allowed to be connected to the grid on the basis that:

- The purpose of the source is to reduce the customer's electricity bills.
- The customer still requires a supply of electricity from the Powercor grid.(ie Not Stand-alone System)

The guidelines have been prepared in order to:

- Promote customer installations which are safe for both the customer and for Powercor line maintenance personnel.
- Protect customer installations against damage under fault conditions.
- Ensure that other Powercor customers are not exposed to hazards or to disruptions of supply.

The primary concern of Powercor is with the mains wiring and inverter, which provide the interface with the Powercor grid, and which must be approved by Powercor. The DC wiring of the renewable energy system and any batteries are the customer's responsibility.

Sister documents provide guidelines for larger plant, up to one megawatt (1.0 MW = 1000 kW), and Above 1 MW in capacity, which are intended to export electricity into the Powercor grid.

Powercor Policy

Powercor recognises that many environmentally – conscious customers wish to play their part in the reduction of the nation's greenhouse gas emissions, much of which are attributable to large coal-burning power stations. One way that some customers seek to contribute is by the installation of small renewable electricity generating sources at their residences or premises. In order to obtain maximum utilisation of such sources, these customers often wish to connect their generating sources to the Powercor grid via a grid interactive inverter.

Powercor is supportive of such initiatives and will allow such installations to be interconnected with the grid provided that:

- Reliability and quality of the grid supply to other customers is not adversely affected.
- The safety of other customers and of Powercor employees and contractors is not put at risk.

Retailer's have already introduced various programs through which customers may support the use of renewable resources on a larger scale for the generation of electricity.

Customer Equipment Types

The types of generating equipment covered by these guidelines includes:

- Solar (photovoltaic) arrays.
- Small wind generators.

- Micro hydro generators.
- Fuel cells.

All of these generally produce direct current (DC) electricity and must transmit their generated electricity via DC to alternating current (AC) sine wave inverters.

When you are operating your generating equipment to reduce your power bills, a storage battery may not be necessary. However, you may install one for independent operation.

Inverter Requirements

The electronic sine wave inverter should be of the grid-interactive type, be of good quality and performance in order to avoid mal-operation or damage to your household electrical appliances. Your inverter must generate an AC voltage having a good quality sinusoidal wave form with low harmonic distortion. Only Powercor approved models which satisfy the Australian Standard AS 4777. Grid Connection of Energy Systems via Inverters may be connected to the grid. Information on models of inverter which satisfy these guidelines are available from the Business Council for Sustainable Energy(BCSE).

http://www.bcse.org.au/InstallingRenewables/Standards/GridConnected Inverters

An important safety requirement for the inverter is that it must be prevented from back-feeding the Powercor network if the grid supply is externally de-energised. It should also be capable of restarting within a short period after the external grid supply is restored.

Planning and Selection

Powercor's main involvement with local generation is with the mains wiring and the sine wave inverter, which provides the interface with the grid. Powercor is not able to offer assistance in the planning and selection of your proposed generating equipment other than the inverter.

The Business Council for Sustainable Energy has details of Accredited Installers, Suppliers, and Consultants who are experienced in this area.

Relevant Standards and Guidelines are as follows:

- Electrical Safety(Installations Regulations) 1999.
- AS/NZS 3000:2000 – SAA Wiring Rules, published by Standards Australia.
- The Australian Standard AS 4777 Grid Connection of Energy Systems via Inverters, published by Standards Australia.
- The Business Council for Sustainable Energy(BCSE)

Installation and Connection to Grid

- The installation of the renewable energy generating sources should always be carried out strictly in accordance with the manufacturer's recommendations, and must meet the requirements of your local council's planning and building departments.
- The electrical cabling and connection to your switchboard

must be carried out by a registered electrical contractor. The wiring and equipment must be in accordance with the Wiring Rules(AS/NZ 3000:2000), the Electrical Safety Regulations and the Service and Installation Rules.

- Your new installation must be checked by a licenced electrical inspector prior to connection to your main switchboard.

- The customer's inverter must be connected to a dedicated circuit on your main switchboard via a lockable isolating switch, protective device and cables which are suitably rated for at least the short time rating of the inverter. The switchboard busbar rating should also be checked by your registered electrical contractor.

- The switchboard must be clearly and permanently labelled as having an inverter energy system connected to it. The circuit breaker, fuse or switch must also be clearly labelled.

- Surge protection is also needed to prevent external network surges from damaging your renewable energy generating source.

- In order that maintenance work can be carried out on your equipment and on the grid connection, a manually-operated switch or circuit breaker must be provided in an accessible location and have the ability to be locked on and off.

- In order to limit an in-rush of damaging current from the grid if a fault develops in your equipment, a fuse or circuit breaker is required for automatic disconnection. These are most conveniently fitted at your main switchboard where the mains connection is made, or at the inverter.

Installation Approvals

Information on models of inverter which satisfy the Australian Standard are available from the Business Council for Sustainable Energy.

The electrical wiring will need to be approved by a licensed electrical inspector(S Class). The Office of the Chief Electrical Inspector maintains a listing of licensed electrical inspectors. For any further information please telephone the Powercor Call Centre or the local customer connection officer.

Powercor and Customer Responsibilities

Powercor Responsibilities

- Powercor is responsible for the reliable transport of electricity to your premises and to the premises of all its other customers.

- Powercor must safeguard the safety of its employees and others who carry out work on its distribution network. Powercor therefore reserves the right to inspect your installation by prior arrangement, to ensure that it does not pose a hazard.

Customer Responsibilities

- The customer is responsible for the safe installation, operation and maintenance of the renewable energy generating source. The installation must conform to Australian standards(AS/NZ 3000:2000).

- Your equipment should be regularly inspected and maintained in accordance with the manufacturer's instructions.

- The customer is responsible for the safety of any person operating or maintaining generating equipment and accessories which are on the premises.

- The customer is responsible for fitting adequate protective devices to prevent damage to their renewable energy generating equipment under conditions of short circuit, voltage surge or other faults.

Energy Pricing

The value to the customer of kilowatt hours (kWh) electricity generated by their power source will be determined by the relevant Electricity Retailer.

The Retailer likewise should be contacted on tariffs for a supply of electricity from the Powercor Grid.

Fees

A project fee will need to be paid to Powercor and contact needs to be made to your Retailer regarding Metering fees.. The standard Service to Property charge still applies. The information sheet enclosed with these guidelines gives contact details for Powercor customer connection officers who can provide some advice on fees.

Metering

For existing premises your meter will need to be replaced. Ask your Retailer to arrange for a new electronic meter. The Retailer is also responsible for arranging the Metering for new installations.

Insurance

Most household insurance policies do not cover the failure of electrical devices such as inverters. The generation equipment may need to be separately specified on your insurance policy.

You are advised to contact your own insurance company to check coverage.

Application Form

Customers seeking to install inverter-connected generating sources must fill out the Application Form attached.

Please provide all relevant details requested on the form in order to avoid delays in approval.

You will also be asked for a sketch of the electrical wiring changes proposed by your registered electrical contractor (see the attached example).

For customers residing within Powercor's boundaries the name of the retailer must be stated. Powercor will forward a copy of its Notice of Approval to the nominated retailer.

Information and Queries

Refer Information Sheet.

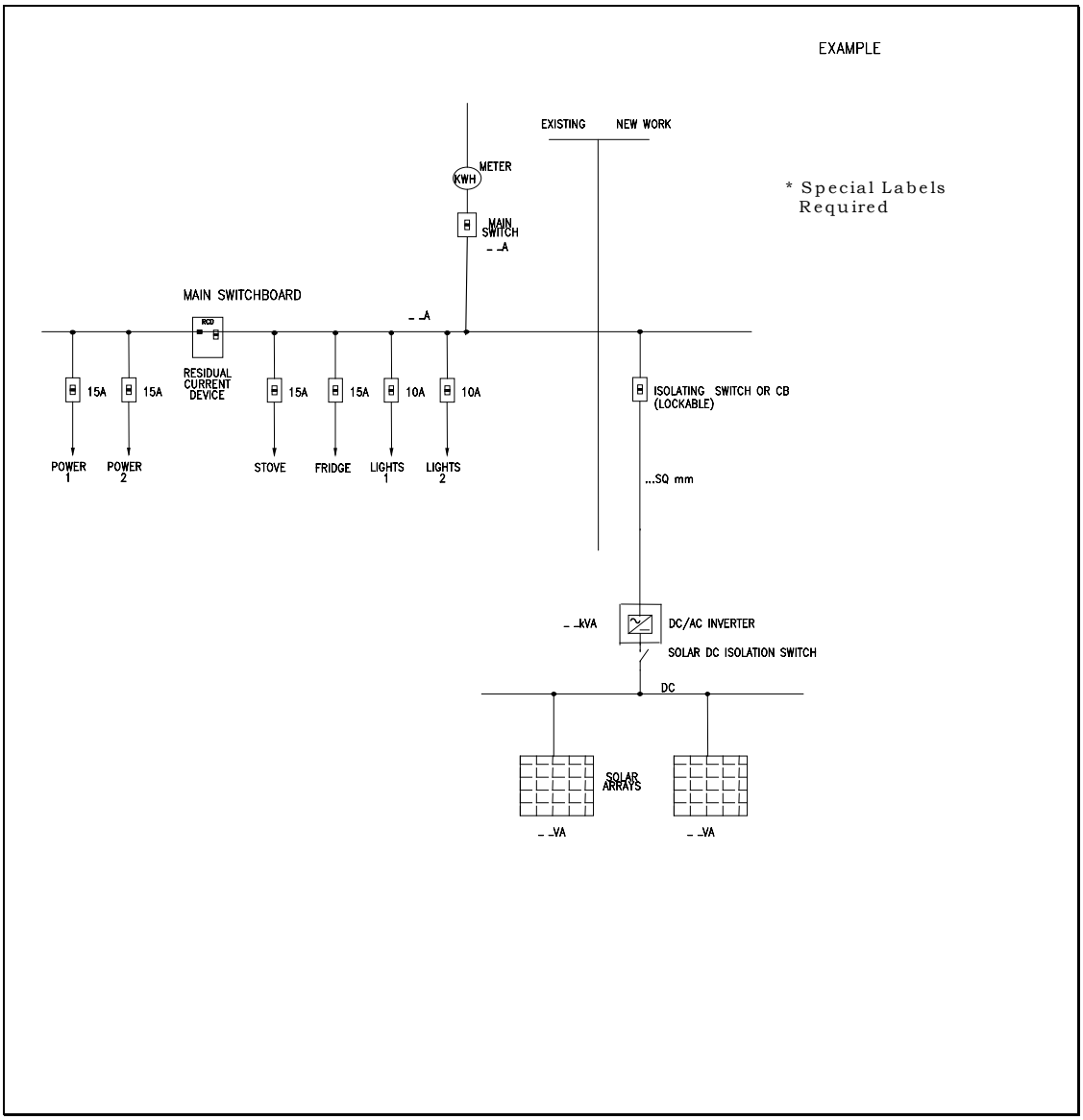
Disclaimer

While Powercor makes efforts to ensure that this information and material is current and accurate, the information and material is provided to you on the understanding that:

- Powercor makes no warranty, guarantee or promise, express or implied, in relation to the content or accuracy of this information and material.
- You will seek verification and/or professional advice from an independent source before relying on or acting upon any of this information and material.
- Powercor is not liable or responsible in any way for the results of any actions taken on the basis of this information and material.

To the fullest extent permitted by law, Powercor expressly excludes any and all liability whatsoever and responsibility to any person arising in connection with their use or reliance of the information and material in whole or in part.

Customer's Installation(Circuit Diagram)



Typical label to be installed at Main Switchboard or Distribution Board where the inverter energy system is connected

WARNING

DUAL SUPPLY

ISOLATE BOTH NORMAL AND INVERTER SUPPLIES BEFORE WORKING ON THIS DISTRIBUTION BOARD

Typical labels to be installed adjacent to isolating switches at Main Switchboard or Distribution Board where the inverter energy system is connected

NORMAL SUPPLY MAIN SWITCH

INVERTER SUPPLY MAIN SWITCH

Information Sheet

For general advice and information on Accredited Installers, Suppliers, and Consultants for grid connection and stand-alone systems please contact the Business Council for Sustainable Energy(BCSE) on **03 93493077.**

To Contact Powercor
(For Grid Connection)

Customer Enquiries:	**132 206**
Service Difficulties & Faults:	132 412
New Connections:	1300 360 410
Interpreter Service:	131 450

Head Office

Powercor Australia Ltd
40 Market Street
Melbourne
Victoria Australia 3000
Ph: +61 3 9683 4444
Fax: +61 3 9683 4499

Postal Address:
Locked Bag 14090 MCMC
Melbourne Victoria 8001

Other Powercor offices are located at:

Ballarat	Norman Street, Ballarat
Bendigo	601-611 Napier Street, Bendigo
Geelong	Roseneath Street, North Geelong
Horsham	17 McLachlan Street, Horsham
Mildura	Eleventh Street, Mildura
Shepparton	8–10 Wheeler Street, Shepparton
Sunshine	20 Hertford Road, Sunshine
Warrnambool	7 Strong Street, Warrnambool

Electrical Measurement Units

Quantity	*Unit*	*Unit Symbol*
Current	ampere	A
Potential Difference	volt	V
Power	kilowatt	kW
Apparent Power	kilovoltampere	kVA
Frequency	hertz	Hz
Energy	kilowatthour	kWh

Glossary of Terms

grid	the electrical distribution network
DC	Direct current
AC	Alternating current. The grid operates at 50 Hz.
Inverter	An electronic device that converts DC power to AC power
Renewable electricity	Power that comes from a renewable source such as solar, hydro and wind.
Voltage Regulation	The drop in voltage between no load and full load.
Efficiency	Output power divided by input power.

Connecting an Inverter to the Powercor Grid

1/

Contact Powercor and request a copy of the "Customer Guidelines for Grid Connection of Inverter Power Sources" to be mailed to you. Alternately, this can be found on the Powercor Web Site www.powercor.com.au This document contains all the information you will need to know in order to arrange for the connection of your system to the Grid.

2/

Complete the application form for grid connection and return this to Powercor. Note, this form is contained in the back of the Customer Guidelines. You will need to have chosen your Retailer in order to complete this form.

3/

Powercor will complete a Connection Agreement based on the information you provided in your application form. The Connection Agreement contains the terms and conditions under which Powercor will connect your installation to the Grid.

4/

Please sign the Connection Agreement and return both copies to Powercor. If you have any questions about the agreement, please contact Powercor for clarification.

You will need to arrange for your Retailer to forward to Powercor, a metering request for Powercor to meter your installation.

5/

Powercor will meter your installation once it has the following documents:

- **Both Copies of the Connection Agreement**
- **A metering request from your Retailer**
- **A Certificate of Electrical Safety from your Registered Electrical Contractor**

Note, the installation will require inspection by an Electrical Inspector (S class) prior to energisation.

6/

Powercor will forward to you a counter-signed copy of the Connection Agreement for your use.

Application Form :- Grid Connection

(Renewable Energy Generation Source- Inverter System)

Name: Telephone No:

Address:

Crown Allotment: Section Parish:

Account No: Electricity Retailer:

Nearest Powercor pole adjacent to and/or in front of your property has a pole number, either plastic black numbers on a yellow background or a strip of aluminium with numbers stamped into it. Please record this number.

POLE NUMBER

Existing Meter Details:

National Metering Identifier No.(NMI) (found on your electricity account)

NMI: Tariff:

Light & Power Meter No: Number of phases:

Renewable Energy Generation Source:
(Eg Solar, Wind, etc)

Installer's Details:

Installation Company :	
Contact Name :	
Address :	
Telephone No:	
SEIA (Aust) Accreditation No :	
REC Name :	REC Licence No :

Equipment Details:

Total rating of all PV panels connected to inverter in watts :	
Inverter Manufacturer :	Rating (W) :
Inverter Model Name :	Model No :
Compliance No :	
DC Solar Isolation Type & size :	
Surge protection :	

Please attach documentation demonstrating that the inverter is an approved Inverter.

Proposed Point of Connection(Eg @Switchboard)

Proposed Protective Device at Point of Connection:

Other Installation Details: (Additional Sheets if necessary)

Circuit Diagram(Refer Example)

Show the main switchboard and any internal sub-panels to which the inverter will be connected, the location of all fuses and switches between the grid and the Inverter and brief details of the DC-side connections of the Inverter.

Process to connect AS4777 compliant inverter based generation to the United Energy Distribution Network

Solar photovoltaic (PV) and Wind

Date: September 2006
Version: 1

Author: David Wilkinson,
Senior Planning Engineer, Alinta.

Summary of connection charges

United Energy Distribution (UED) will invoice the customer's retailer the following fees which are approved standard service prices as approved by the ESC:

Works	**Price**
Service appointment (or "truck appointment") to disconnect and reconnect the electricity supply (with about 1 hour interruption) within normal business hours.	$109.75
Service appointment (or "truck appointment") to disconnect and reconnect the electricity supply (with about 1 hour interruption) outside normal business hours.	$636.55
Cost of meter	$0.00

Notes:

- All prices include GST.
- If more than one hour is required between connection and disconnection of supply it will be necessary to arrange for two truck appointments and fees are incurred for each.
- For new installations without a recent electricity supply connection new connection fees apply. Refer to the standard fees for new connections on the UED website.
- The prices above do not necessarily relate to the fees payable by the customer. The customer should contract their retailer.

Step 1 – System preliminary design

- Determine type of generation system such as solar photovoltaic or wind etc.
- Obtain preliminary information from Sustainability Victoria.
- Obtain information from the United Energy Distribution (UED) website: www.unitedenergy.com.au/customers/cust_cogensolar.htm
- Obtain information from Retailers on tariffs available.
- Determine approximate power output in kW.
- Determine if the generator output will be single phase or multi phase.
- Contact system installer(s) and confirm scope and supply arrangements. Negotiate installation service with system installer. System owners should

note that they will only be able to claim a cash rebate under the Photovoltaic Rebate Program (PVRP) if their system is installed by a business approved by the Business Council for Sustainable Energy (BCSE).

Step 2 – Apply for PVRP rebate if eligible

- To encourage the installation of photovoltaic solar energy generating systems the Australian Greenhouse Office (AGO) provides cash rebates of up to $4,000. The program is known as the photovoltaic rebate program (PVRP).
- In Victoria the PVRP is managed by Sustainability Victoria. Additional information can be obtained from their website: www.sustainability.vic.gov.au/www/html/1388-what-are-photovoltaic-systems.asp

Step 3 – Customer to contact electricity retailer(s) and negotiate suitable tariff

- Obtain information from retailers on the electricity tariffs available for the sale of electricity generated and for the purchase of energy consumed.
- Select a retailer and tariff.
- Retailer to send customer agreement to sign.
- Determine if Gross or Nett metering is required. This will depend upon the electricity tariff selected from your retailer.

Step 4 – Obtain distributor reasonable technical requirements

- The technical standards and connection agreement (to be made between the customer and UED) are available on the UED website: www.unitedenergy.com.au/customers/cust_cogensolar.htm
- Refer to Clause 6.8 of the 2005 Victorian Service and Installation Rules (SIR) which can be viewed at the following website: www.victoriansir.org.au. Hard copies are commonly available from electrical wholesalers. Any questions relating to SIR clarifications can be directed to:
  - Moorabbin and Burwood: 9552 2714
  - Mornington: 5970 2210
- Additionally you can e-mail UED at: recnew@ue.com.au or call new connections and speak to a new connections officer on 1300 131 689.
- The installation must be compliant with the applicable Wiring Rules, Acts and Regulations, including, these standards prior to connection.

Step 5 – Design and construction

- System installer to undertake electrical and civil design.
- Planning and building permits to be obtained if required before installation commences.

Step 6 – Intent to connect

- The customer must send a letter to the distribution business (UED) advising of their intention to connect their generator to the electricity network. The customer should provide an overview of the system that has been installed.
- The distribution business (UED) will reply sending a letter confirming that the generator can be connected and will send a connection agreement to be signed.
- The customer shall compile the requested information, sign the connection agreement and send both back to the distribution business (UED).
- The UED postal address is as follows:

  Alinta New Connections
  Locked Bag 7000
  Mount Waverley
  VIC, 3149

Step 7 – Construction

- The system shall be installed and preliminary testing undertaken.
- A registered electrical contractor (REC) will be required to do all fixed wiring.

Step 8 – Lock isolating switch

- Following installation the isolating switch must be locked in the open position to prevent the generator from connecting to the network until a certificate of electrical safety (CES) is obtained and the metering has been upgraded.

Step 9 – Sign distribution company agreement

- The distribution company shall send the customer a copy of the signed connection agreement. Connection of the generator to the electricity network can proceed with the provision of all applicable paperwork including a signed CES.

Step 10 – Sign retailer agreement

- The customer shall sign the agreement sent by the retailer for energy sold and purchased and send back to the retailer.

Step 11 – REC to submit an EWR to upgrade metering and REC to obtain CES

- If a new network connection is required (for example a new home with solar generator) then the appropriate electricity meter will be installed. The

distribution business (UED) will be advised by the retailer if gross or nett metering is required. Following installation of the generator system the installation will need to be inspected by an 'S' class licensed electrical inspector who must sign a CES.

- If the generating system is to be connected to an existing installation, then a metering upgrade shall be required and the registered electrical contractor (REC) shall submit an electrical works request (EWR) to the distributor. If any part of the installation, including the meter panel does not satisfy the SIR, then it will also need to be modified to meet current standards. Step 12 explains the process.

Step 12 – Upgrade metering panel and replace meter as required

Step 12a – Arrange for supply disconnection and new meter to be installed

- If the metering panel needs to be upgraded, the system installer shall contact the customer's retailer and arrange for the distributor's representative (UED) to disconnect the electricity supply to allow the metering enclosure to be safely upgraded. The system installer shall also request for the electricity meter to be exchanged. Details shall be submitted as part of the Electrical Works Request (EWR) by the system installer.
- The distributor's representative shall contact the system installer to arrange a date and time for a "truck appointment" to disconnect the electricity supply if required and to arrange a suitable date and time for installation of the new meter.

Step 12b – Disconnect existing supply

- The distributor's representative shall disconnect the electricity supply at the agreed time so that the system installer can upgrade the metering panel.

Step 12c – Upgrade meter panel if required

- The system installer shall upgrade the electrical installation ensuring compliance with the SIR.

Step 12d – Obtain CES

- The electrical installation shall be inspected by an "S" class licensed electrical inspector who must sign a certificate of electrical safety (CES).

Step 12e – Install a new electricity meter

- Upon receipt of the CES, the new electricity meter shall be installed at the time agreed between the system installer and the distributor's metering representative. UED's metering representative installs the meter on behalf of the customer's retailer.

Step 12f – Restore electricity supply

- Once the new electricity meter is installed, the electricity supply shall be restored by the distributor's representative. The system installer shall arrange a time to restore the electricity supply with the UED representative during step 12b when the supply was disconnected. The system installer must show the CES to the distributor's representative (if not already done so) before the electricity supply is restored.

Step 13 – System switch on and final tests

- Once the new electricity meter is installed and network connection is restored the generating system can be switched on and final testing completed.
- The system installer is responsible for ensuring all necessary tests are undertaken however the distribution company may also inspect the installation and undertake tests.

Step 14 – Copy of CES to be sent to distributor

- The customer (system owner) must send a copy of the CES to the distributor at the following address: Alinta New Connections
  Locked Bag 7000
  Mount Waverley
  VIC, 3149

  Failure to provide a copy of the CES will render to connection agreement void.

Step 15 – Notify retailer

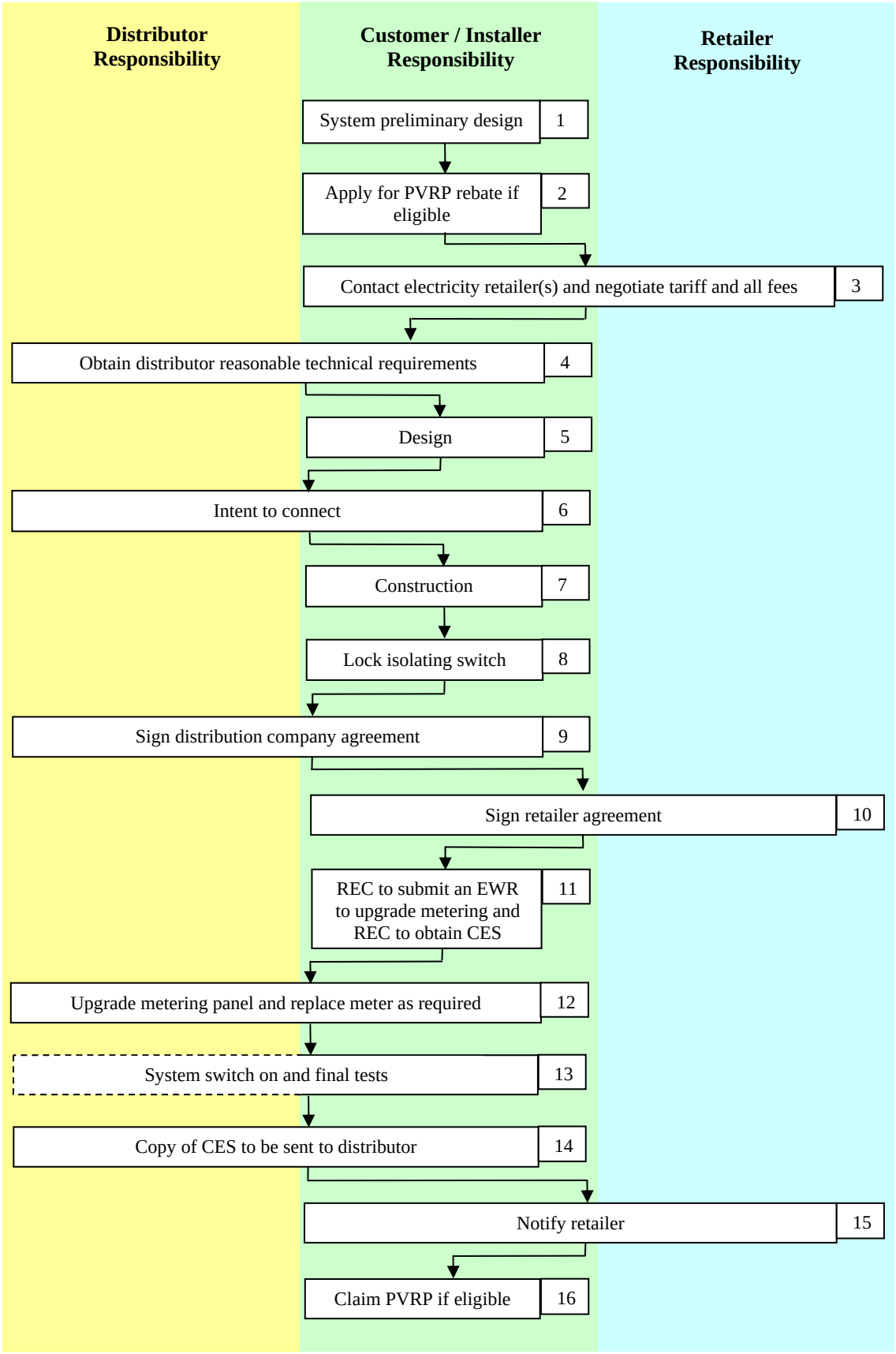
- The customer should notify the retailer once the new generator system is operational.

Step 16 – Claim PVRP if eligible

- If eligible the customer (system owner) can send the appropriate forms to Sustainability Victoria to claim their rebate. The customer may be required to send a copy of the CES confirming that the solar PV system was connected to the distribution network

United Energy Distribution

Inverter based generation grid connection



Appendix 11

Retailer renewable energy purchase prices from the Government Gazette

Electricity Retailer Prices

The Electricity Industry Act (2000) mandates the purchase of electricity by retailers from small wind facilities (<100kW). The relevant excerpt is below:

'Sub-section (3)
A licence to sell electricity held by a relevant licensee is deemed to include a condition requiring the licensee to publish, in the Government Gazette, an offer comprising the prices at, and terms and conditions on, which the licensee will purchase non-pool electricity supplied from a relevant generation facility'.

This indicates that the prices on offer for PV might be different to those for small wind.

The gazetted prices are below:

Powerdirect Pty Ltd[1] $15/MWh.
Origin Energy[2] $20/MWh
Victoria Electricity[3] of $19/MWh exc GST

[1] No. G 33 Thursday 18 August 2005 – www.gazette.vic.gov.au
[2] No. S 126 Friday 1 July 2005 – www.gazette.vic.gov.au
[3] No. G 5 Thursday 2 February 2006 – www.gazette.vic.gov.au

Appendix 12

Distributor call-out charges for grid connection

Costs of Grid connection and Meter

The BCSE website[1] links the grid connection instructions and flowcharts for the following distributors.

Powercor[2]

Project fee – labels on their system and lines etc. $299.20
Bidirectional meter. Installation truck included. $170.20

Citipower

7.30am to 4.30pm Mon-Fri
Service truck call-out (includes the first 15 minutes) $143.90
On site rate (for each additional 15 minutes) $31.90

All other times (incl. public holidays)
Service truck call-out (includes the first 15 minutes) $351.50
On site rate (for each additional 15 minutes) $40.25

United Energy

Service appointment (or "truck appointment") to disconnect and reconnect the electricity supply (with about 1 hour interruption) within normal business hours. $109.75
Service appointment (or "truck appointment") to disconnect and reconnect the electricity supply (with about 1 hour interruption) outside normal business hours. $636.55
Cost of meter $0.00

[1] http://www.bcse.org.au/default.asp?id=305
[2] http://powercor.com.au/actions/fs_connect_network.html

Appendix 13

Table of international tariffs

Table 3.3: Level and duration of support for RES-E plants commissioned in 2006

		Tariff level in 2006 [€ Cents/kWh] and duration of support for different technologies[1)]						
Country		Small hydro	Wind onshore	Wind offshore	Solid biomass	Biogas	PV	Geothermal
Austria		3.8 - 6.3 *13 years*	7.8 *13 years*	-	10.2 - 16.0 *13 years*	3.0 - 16.5 *13 years*	47.0 - 60.0 *13 years*	7.0 *13 years*
Cyprus		6.5 *no limit*	9.5 *15 years*	9.5 *15 years*	6.5 *no limit*	6.5 *no limit*	21.1 - 39.3 *15 years*	-
Czech Republic	**fix**	8.1 *15 years*	8.5 *15 years*	-	7.9 - 10.1 *15 years*	7.7 - 10.3 *15 years*	45.5 *15 years*	15.5 *15 years*
	premium	10.5 *15 years*	12.5 *15 years*	-	10.0 - 12.0 *15 years*	9.9 - 12.5 *15 years*	49.0 *15 years*	18.0 *15 years*
Denmark		-	7.2 *20 years*	-	8.0 *20 years*	8.0 *20 years*	8.0 *20 years*	6.9 *20 years*
Estonia		5.2 *7 years*	5.2 *12 years*	5.2 *12 years*	5.2 *7 years*	5.2 *12 years*	5.2 *12 years*	5.2 *12 years*
France		5.5 – 7.6 *20 years*	8.2 *15 years*	13.0 *20 years*	4.9 – 6.1 *15 years*	4.5 - 14.0 *15 years*	30.0 – 55.0 *20 years*	12.0 – 15.0 *15 years*
Germany		6.7 - 9.7 *30 years*	8.4 *20 years*	9.1 *20 years*	3.8 - 21.2 *20 years*	6.5 – 21.2[2)] *20 years*	40.6 – 56.8 *20 years*	7.2 – 15.0 *20 years*
Greece		7.3 - 8.5 *12 years*	7.3 - 8.5 *12 years*	9.0 *12 years*	7.3 - 8.5 *12 years*	7.3 - 8.5 *12 years*	40.0 – 50.0 *12 years*	7.3 - 8.5 *12 years*
Hungary		9.4 *no limit*	9.4 *no limit*	-	9.4 *no limit*	9.4 *no limit*	9.4 *no limit*	9.4 *no limit*
Ireland		7.2 *15 years*	5.7 - 5.9 *15 years*	5.7 - 5.9 *15 years*	7.2 *15 years*	7.0 - 7.2 *15 years*	-	-
Italy		-	-	-	-	-	44.5 – 49.0 *20 years*	-
Lithuania		5.8 *10 years*	6.4 *10 years*	6.4 *10 years*	5.8 *10 years*	5.8 *10 years*	-	-
Luxembourg		7.9 – 10.3 *10 years*	7.9 - 10.3 *10 years*	-	10.4 - 12.8 *10 years*	10.4 - 12.8 *10 years*	28.0 - 56.0 *10 years*	-
Netherlands		14.7 *10 years*	12.7 *10 years*	14.7 *10 years*	12.0 - 14.7 *10 years*	7.1 - 14.7 *10 years*	14.7 *10 years*	-
Portugal		7.5 *15 years*	7.4 *15 years*	7.4 *15 years*	11.0 *15 years*	10.2 *15 years*	31 - 45 *15 years*	-
Slovakia		6.1 *1 year*	7.4 *1 year*	-	7.2 - 8.0 *1 year*	6.6 *1 year*	21.2 *1 year*	9.3 *1 year*
Slovenia	**fix**	6.0 - 6.2 *10 years*	5.9 - 6.1 *10 years*	-	6.8 - 7.0 *10 years*	5.0 - 12.1 *10 years*	6.5 - 37.5 *10 years*	5.9 *10 years*
	premium	8.2 - 8.4 *10 years*	8.1 - 8.3 *10 years*	-	9.0 - 9.2 *10 years*	6.7 - 14.3 *10 years*	8.7 - 39.7 *10 years*	8.1 *10 years*
Spain	**fix**	6.1 - 6.9 *no limit*	6.9 *no limit*	6.9 *no limit*	6.1 - 6.9 *no limit*	6.1 - 6.9 *no limit*	23.0 - 44.0 *no limit*	6.9 *no limit*
	premium	8.6 - 9.4 *no limit*	9.4 *no limit*	9.4 *no limit*	8.6 - 9.4 *no limit*	9.4 *no limit*	25.5 *no limit*	9.4 *no limit*

1) For the countries using a different currency than Euro, the exchange rate of the 1st of January 2006 is used [OANDA Corporation 2006].
2) The maximum value given for Germany is only available if all premiums are cumulated. This combines the enhanced use of innovative technologies, CHP generation and sustainable biomass use.

Appendix 14

Turbine noise study results

Summary of Small Wind Turbine Noise Measurements at Wulf Test Field in dBA

Turbine Tested	Hub Height H m	Reference Position Ro m	Slant Distance Ri m	SPL @ 8 m/s LAeq, ref	SPL @ 10 m/s LAeq, ref	Sound Power @ 8 m/s LWA, ref	Sound Power @ 10 m/s LWA, ref	Projected 100 @ 8 m/s LAeq	Projected 100 @ 10 m/s LAeq	Projected to 45 dBA @ 8 m/s m	Projected to 45 dBA @ 10 m/s m
Ampair 100											
Charging	13.4	13.9	19.3	44	51	na	na	na	na	na	na
Unloaded	13.4	13.9	19.3	49	56	80	86	32	38	50	75
Air 403	13.4	14	19.4	57	60	88	91	39	43	50	75
BWC 850											
Charging	19.2	20.4	28	48	53	82	87	34	39	22	45
Unloaded	19.2	20.4	28	58	64	92	97	44	49	80	150

Ln= ambient, turbine parked.
Ls+n= ambient plus wind turbine operating.
Ls= wind turbine noise alone at reference postion Ro
Ls= LAeq, ref, corrected level
Atmospheric absorption=0.005 dB/m

Table from:
http://www.wind-works.org/articles/noisesummary.html

Appendix 15

Capital costs of some turbine system components

Capital Costs

Wind Turbines

The turbines below are available in Australia and are listed in order of rated power output:

Brand/Made In	Model	Rated (W)	RRP (inc GST)
Forgen	500	10	1100
Rutland (UK)	503	25	
Forgen	1000	30	1450
LVM (UK)	212	48	1190
Rutland (UK)	913	90	1305
Ampair (UK)	Pacific 100	100	1969
EnviroWind (China)	200W	200	589
LVM (UK)	412	228	1786.4
LVM (UK)	424	228	1966.8
EnviroWind (China)	Phoenix	300	890
Ampair (UK)	Pacific 300	300	3520
LVM (UK)	612	360	2860
LVM (UK)	624	360	3128.4
Southwest Windpower (USA)	Air X Land	400	1210
Southwest Windpower (USA)	Air X Marine	400	1485
Southwest Windpower (USA)	Air X Industrial	400	2057
Soma (Australia)	Soma400	400	4900
EnviroWind (China)	500W	500	1795
Ampair (UK)	Pacific 600	698	4950
Rutland (UK)	1803	720	
Aeromax (USA)	Lakota Land	900	3025
Aeromax (USA)	Lakota Marine	900	3566.2
Southwest Windpower (USA)	Whisper 100	900	3670
EnviroWind (China)	1000W	1000	2980
Southwest Windpower (USA)	Whisper 200	1000	4532
Bergey (USA)	XL.1	1000	4790
Soma (Australia)	Soma1000	1000	6250
Southwest Windpower (USA)	Skystream	1800	11000
Westwind (Northern Ireland)	3kW	3000	9619
Southwest Windpower (USA)	Whisper 500	3000	12615
Westwind (Northern Ireland)	5kW	5000	15466
Westwind (Northern Ireland)	10kW	10000	27566
Westwind (Northern Ireland)	20kW	20000	53196

Controller/ Regulator
The Whisper and Air Machines above include controller costs.
The latest Conergy price document lists regulators for the Ampair Generators:

Ampair Pacific 600 Regulator	$1,540.00
Ampair Pacific 300 Regulator	$979.00
LVM Controller for 212 and 412	$350.35
LVM Controller for 224 and 424	$378.95
LVM Controller for 612	$492.80
LVM Controller for 624	$492.80
Westwind controller and load dump	$4,200.00

Inverter
There are 8 different brands manufacturing 32 models of inverters on the latest BCSE approved grid-connect inverters list. These range in price from around $2000 - $7000
As an example, the Fronius IG30 inverter is $3,700

Cabling
Cabling for a domestic wind turbine is not a major contributor to cost and will generally be less than $100.

Installation
Energy matters estimates installation costs for a domestic wind turbine at ~$2000.
Stephen Cook, an accredited BCSE installer estimates $3000 to $4000.
Energy Matters will charge $5000 to install a Westwind 3kW on a 24m tower

Tower
The price of a tower depends greatly on its height. The 24m tower included in Energy Matters' Westwind package is $10,000 purchased separately.

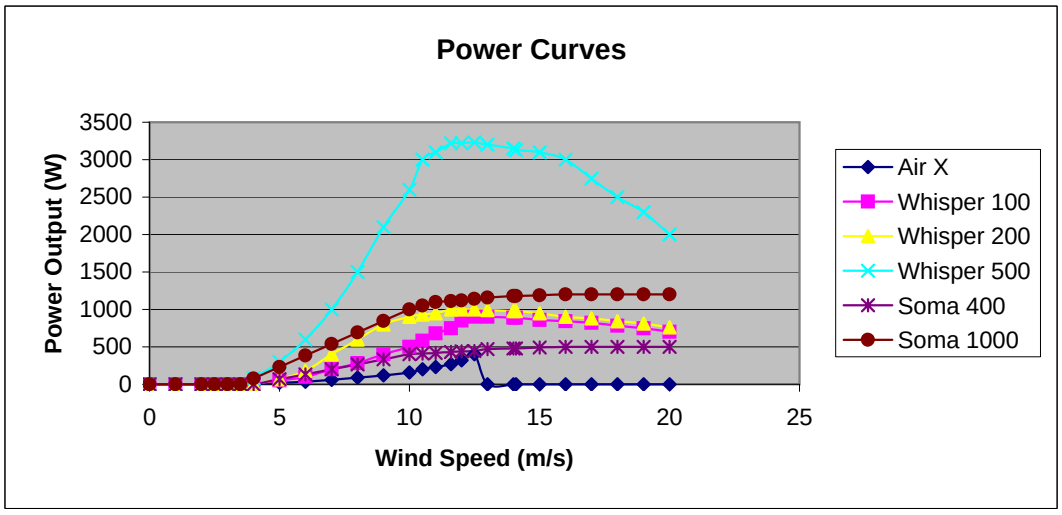
Appendix 16

Extended economic analysis tables

Approximated Power Curves, from manufacturer images

	Power Output in Watts					
Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	0	0	0	0
2.5	0	0	0	0	0	0
3	0	0	0	0	0	0
3.5	0	0	0	0	0	0
4	10	10	10	80	0	77
5	20	50	70	300	67	231
6	35	100	180	600	133	385
7	60	200	400	1000	200	540
8	90	280	600	1500	267	693
9	120	400	800	2100	333	847
10	160	500	900	2600	400	1000
10.5	200	580	930	3000	410	1050
11	230	680	950	3100	420	1100
11.6	270	750	1000	3220	430	1110
12	320	850	1000	3220	440	1120
12.5	400	900	1000	3230	445	1140
13	0	900	990	3200	470	1160
14	0	890	980	3150	480	1180
14.1	0	890	980	3130	480	1180
15	0	860	950	3100	490	1190
16	0	840	900	3000	500	1200
17	0	820	880	2750	500	1200
18	0	780	840	2500	500	1200
19	0	750	810	2300	500	1200
20	0	700	760	2000	500	1200

RATED



Instantaneous Power (W)

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	10	10	10	80	0	77
5	20	50	70	300	67	231
6	35	100	180	600	133	385
7	60	200	400	1000	200	540
8	90	280	600	1500	267	693
9	120	400	800	2100	333	847
10	160	500	900	2600	400	1000

Daily output (kWhs)

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
3	0	0	0	0	0	0
4	0	0	0	2	0	2
5	0	1	2	7	2	6
6	1	2	4	14	3	9
7	1	5	10	24	5	13
8	2	7	14	36	6	17
9	3	10	19	50	8	20
10	4	12	22	62	10	24

Annual output (kWhs)

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
3	0	0	0	0	0	0
4	88	88	88	701	0	675
5	175	438	613	2628	587	2024
6	307	876	1577	5256	1165	3373
7	526	1752	3504	8760	1752	4730
8	788	2453	5256	13140	2339	6071
9	1051	3504	7008	18396	2917	7420
10	1402	4380	7884	22776	3504	8760

Annual Value of Power @ 14c/kWh

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
3	0	0	0	0	0	0
4	12	12	12	98	0	94
5	25	61	86	368	82	283
6	43	123	221	736	163	472
7	74	245	491	1226	245	662
8	110	343	736	1840	327	850
9	147	491	981	2575	408	1039
10	196	613	1104	3189	491	1226

Turbine	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
Estimated price	11000	14500	15000	22000	15000	16500

Payback in Years @ 14c/kWh

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
4m/s	897	1182	1223	224	inf	175
5m/s	448	236	175	60	183	58
6m/s	256	118	68	30	92	35
7m/s	149	59	31	18	61	25
8m/s	100	42	20	12	46	19
9m/s	75	30	15	9	37	16
10m/s	56	24	14	7	31	13

Annual output (kWhs)

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
3	0	0	0	0	0	0
4	88	88	88	701	0	675
5	175	438	613	2628	587	2024
6	307	876	1577	5256	1165	3373
7	526	1752	3504	8760	1752	4730
8	788	2453	5256	13140	2339	6071
9	1051	3504	7008	18396	2917	7420
10	1402	4380	7884	22776	3504	8760

Annual Value of Power @ 56.8Euroc/kWh or 90c Australian

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
3	0	0	0	0	0	0
4	79	79	79	631	0	607
5	158	394	552	2365	528	1821
6	276	788	1419	4730	1049	3035
7	473	1577	3154	7884	1577	4257
8	710	2208	4730	11826	2105	5464
9	946	3154	6307	16556	2625	6678
10	1261	3942	7096	20498	3154	7884

Payback in Years @ 90c Australian/kWh

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
4m/s	140	184	190	35	na	27
5m/s	70	37	27	9	28	9
6m/s	40	18	11	5	14	5
7m/s	23	9	5	3	10	4
8m/s	16	7	3	2	7	3
9m/s	12	5	2	1	6	2
10m/s	9	4	2	1	5	2

Annual output (kWhs)

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
3	0	0	0	0	0	0
4	88	88	88	701	0	675
5	175	438	613	2628	587	2024
6	307	876	1577	5256	1165	3373
7	526	1752	3504	8760	1752	4730
8	788	2453	5256	13140	2339	6071
9	1051	3504	7008	18396	2917	7420
10	1402	4380	7884	22776	3504	8760

Annual Value of Power @ 40c Australian/kWh

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
4	35	35	35	280	0	270
5	70	175	245	1051	235	809
6	123	350	631	2102	466	1349
7	210	701	1402	3504	701	1892
8	315	981	2102	5256	936	2428
9	420	1402	2803	7358	1167	2968
10	561	1752	3154	9110	1402	3504

Payback in Years @ 40c Australian/kWh

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
4m/s	314	414	428	78	na	61
5m/s	157	83	61	21	64	20
6m/s	90	41	24	10	32	12
7m/s	52	21	11	6	21	9
8m/s	35	15	7	4	16	7
9m/s	26	10	5	3	13	6
10m/s	20	8	5	2	11	5

Annual Value of Power @ 60c Australian/kWh

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
4	53	53	53	420	0	405
5	105	263	368	1577	352	1214
6	184	526	946	3154	699	2024
7	315	1051	2102	5256	1051	2838
8	473	1472	3154	7884	1403	3642
9	631	2102	4205	11038	1750	4452
10	841	2628	4730	13666	2102	5256

Payback in Years @ 60c Australian/kWh

Wind Speed (m/s)	Air X	Whisper 100	Whisper 200	Whisper 500	Soma 400	Soma 1000
4m/s	209	276	285	52	na	41
5m/s	105	55	41	14	43	14
6m/s	60	28	16	7	21	8
7m/s	35	14	7	4	14	6
8m/s	23	10	5	3	11	5
9m/s	17	7	4	2	9	4
10m/s	13	6	3	2	7	3

Comparison - Domestic Wind to PV

SOLAR PV			
kW	installed cost	kWh/day	cost/kWh/day
1	16400	3.15	5206
1.6	23200	5.04	4603
2	26700	6.3	4238

	Whisper 200		
Wind Speed	Power (W)	kWh/day	Cost/kWh/day
4	10	0.2	60417
5	70	1.7	8631
6	180	4.3	3356
7	400	9.6	1510
8	600	14.4	1007

	Soma 400		
Wind Speed	Power	kWh/day	cost/kWh/day
4	0	0.0	0
5	67	1.6	9328
6	133	3.2	4699
7	200	4.8	3125
8	267	6.4	2341

	Soma 1000		
Wind Speed	Power	kWh/day	cost/kWh/day
4	77	1.8	8929
5	231	5.5	2976
6	385	9.2	1786
7	540	13.0	1273
8	693	16.6	992

WIND			
Type	Rotor Diameter (m)	rated kW	installed cost
Soma 400	2	0.4	15000
Ampair Pacific 600	1.7	0.7	15000
Soma 1000	2.7	1.0	16500
Whisper 200	2.7	1.0	14500
Hush 1kW (theory)	1.1	1.0	12000

Appendix 17

Renewable Energy Certificate calculations

Australian Government
Office of the Renewable Energy Regulator

FACT SHEET

CALCULATING RENEWABLE ENERGY CERTIFICATES (RECS) FOR SMALL WIND TURBINES[1]

Version 1 as Updated in March 2006

The *Renewable Energy (Electricity) Act 2000* (the Act) and the *Renewable Energy (Electricity) Regulations 2001* (the Regulations) allow owners of small generation units (SGUs) to create and sell renewable energy certificates (RECs). RECs are purchased by liable parties, such as electricity retailers, seeking to offset their liability under the Act so that they meet their renewable energy percentage targets. One REC represents one Mega Watt hour (MWh) of renewable energy generation.

Owners of SGUs can either create RECs themselves, or assign their RECs to a registered agent in return for a financial benefit. A list of registered agents can be found from the Publication page of the Office of the Renewable Energy Regulator (ORER) website.

In order to use the REC calculation method provided below, a SGU must be installed on or after 1 April 2001. If the SGU was installed before 1 April 2001 it may still be eligible for RECs as an accredited power station but the owner must apply to the ORER for it to become an accredited power station. Application forms to become an accredited power station are available from the Power Stations page of the ORER website.

The REC calculation method provided below applies to systems with a rated output of not more than 10 kilowatts or a total annual output less than 25 MWh. If a system has an output greater than 10 kilowatts, or annual output of 25 MWh or more, the owner must apply to ORER for the system to become an accredited power station.

[1] Note: The information provided in this document may be subject to change with amendments to the *Renewable Energy (Electricity) Act 2000*, the *Renewable Energy (Electricity) Regulations 2001*, and the administrative processes adopted by the Office of the Renewable Energy Regulator.

CALCULATING RECS FOR SMALL WIND TURBINES

The number of RECs that you are eligible to create for your wind turbine is determined by the rated capacity of the system and the number of hours the wind turbine can operate at that capacity (wind resource availability).

To establish how many RECs you may be eligible to create from your wind turbine you should undertake the following steps:

1. Establish your wind resource availability in terms of hours per year. If you do not know the actual resource availability, then you must claim for the default amount of 2000 hours per year.

   If you claim wind resource availability above the default amount, then you must provide and retain copies of site-specific audit reports and advise the ORER of the name and contact details of the person or company that conducted the audit.

2. Establish the rated output of your wind turbine in kilowatts (kW). You can find the rated power output of your system in the specifications provided by the system manufacturer. Please ensure that you use the exact figure that applies to your particular model.

3. To calculate the annual number of RECs your system is eligible for you must multiply the rated power output (in kW) of your system by 0.00095, multiplied by the wind resource availability of your system (eg. 8kw x 0.00095 x 2000 hours/year).

0.00095	X	The rated power output (in kW) of your wind turbine(s)	X	Wind resource availability of the system (hours per annum)	=	Annual number of eligible RECs

4. If you calculate that you are entitled to more than 25 RECs per year your system is classified as a wind power station and you must apply to the ORER to become an accredited power station. If you are a power station, you cannot assign RECs to an agent.

5. You have the option of claiming RECs in regular one-year or five-year periods. Multiply the annual number of eligible RECs by one year or five years depending on the period you wish to claim RECs.

6. If your calculated number of eligible RECs, over a one-year or five-year period, is:

    - greater than 1 MWh you must round down the calculated number to the nearest whole number of RECs.

    - between 0.5 MWh and l MWh you are allowed to round up the calculated decimal number to 1 REC.

Example 1

If you wished to create RECs on a 5-year basis for a system that has a rating of 2.9 kW and a wind resource availability of 3,600 hours, you must:

1. Multiply 0.00095 by the kW capacity and the wind resource availability:

    0.00095 x 2.9 x 3600 = **9.918 MWh**

2. Multiply the annual electricity output by the number of years:

    9.918 x 5 = **49.59 MWh**

3. Round down the total electricity output to the last whole MWh to determine the number of RECs you are eligible to create:

    49.59 = **49 RECs**

4. As a wind resource availability in excess of the default amount has been claimed you must provide and retain copies of a site-specific audit report to support your claim. If you cannot provide such a report then you may only claim for the default amount.

5. This wind turbine has a total annual output of less than 25 MWh, it does <u>not</u> need to be accredited as a power station.

Example 2

If you wished to create RECs on an annual basis for a system that has a rating of 2.9 kW and a wind resource availability of 3,600 hours, you must:

1. Multiply 0.00095 by the kW capacity and the wind resource availability:

   0.00095 x 2.9 x 3600 = **9.918 MWh**

2. Multiply the annual electricity output by the number of years:

   9.918 x 1 = **9.918 MWh**

3. Round down the total electricity output to the last whole MWh to determine the number of RECs you are eligible to create::

   9.918 MWh equates to **9 RECs**

4. As a wind resource availability in excess of the default amount has been claimed you must provide and retain copies of a site-specific audit report to support your claim. If you cannot provide such a report then you may only claim for the default amount.

5. This wind turbine has a total annual output of less than 25 MWh, it does not need to be accredited as a power station.