Wind Turbine Feasibility Study

CURLE STREET FLATS,

DRCET - Dumbarton Road Corridor Environment Trust

MEARU - Mackintosh Environmental Architecture Research Unit

Whiteinch & Scotstoun Housing Association Ltd

Funded by: KTTBE AWARD

Context

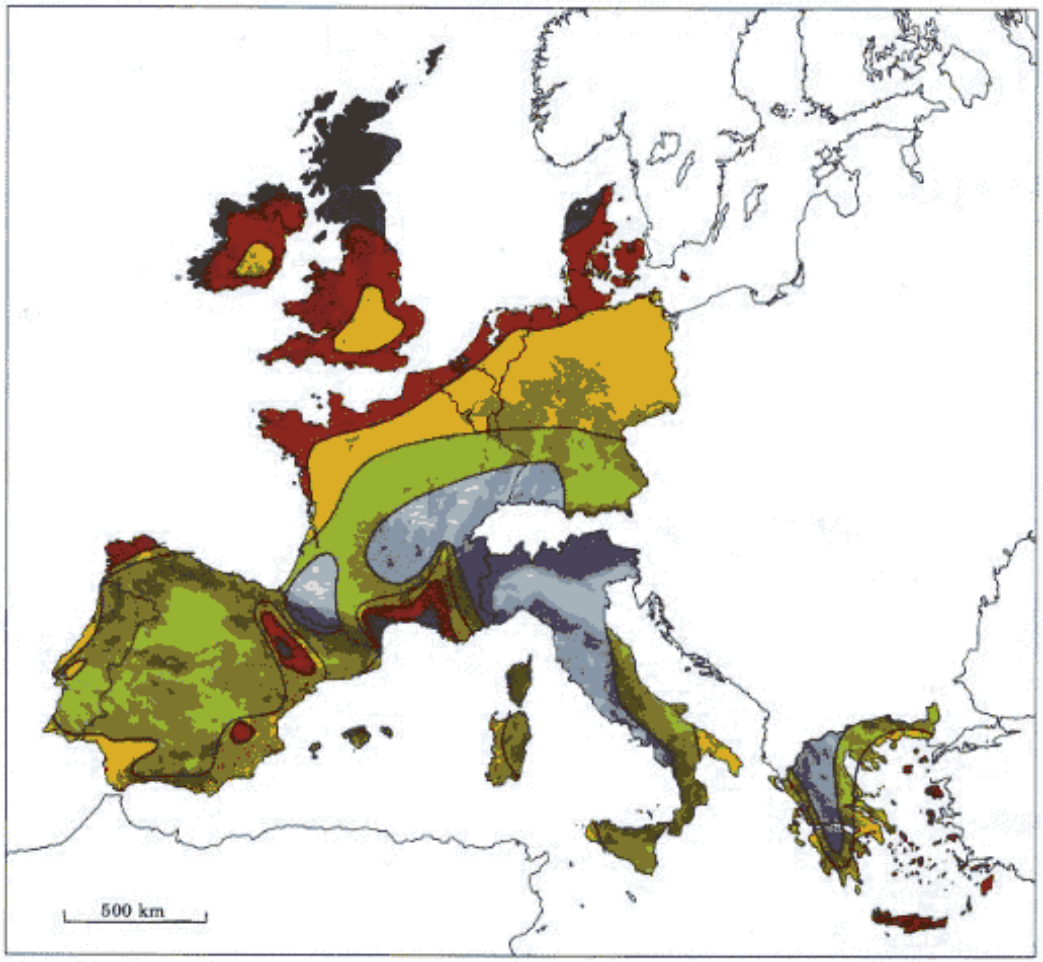
•Kyoto Protocol, by 2008-2012 the UK must reduce it's baseline emissions of six major greenhouse gases by 12.5 per cent from a baseline target set in 1990.

•UK government aims to generate 10% of UK electricity supplies from renewable sources by 2010

•Approx 52% of the UK's carbon dioxide emissions come from creating or using buildings

Location- Glasgow

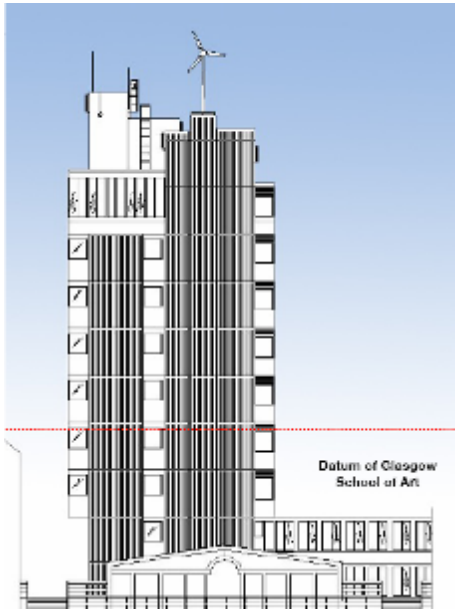
High wind resource
Number of high-rise buildings



Wind resources[1] at 50 metres above ground level for five different topographic conditions

	Sheltered terrain[2]		Open plain[3]		At a sea coast[4]		Open sea[5]		Hills and ridges[6]	
	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}
	> 6.0	> 250	> 7.5	> 500	> 8.5	> 700	> 9.0	> 800	> 11.5	> 1800
	5.0-6.0	150-250	6.5-7.5	300-500	7.0-8.5	400-700	8.0-9.0	600-800	10.0-11.5	1200-1800
	4.5-5.0	100-150	5.5-6.5	200-300	6.0-7.0	250-400	7.0-8.0	400-600	8.5-10.0	700-1200
	3.5-4.5	50-100	4.5-5.5	100-200	5.0-6.0	150-250	5.5-7.0	200-400	7.0- 8.5	400- 700
	< 3.5	< 50	< 4.5	< 100	< 5.0	< 150	< 5.5	< 200	< 7.0	< 400

Location- Garnethill



Location- Newbery Tower

- Exposure to wind and rain
- Increased wind-speed with elevation
- Thermal mass
- Robust structure
- Services infrastructure and grid connections
- Flat roof -easy access for installation, maintenance and monitoring


27/05/2007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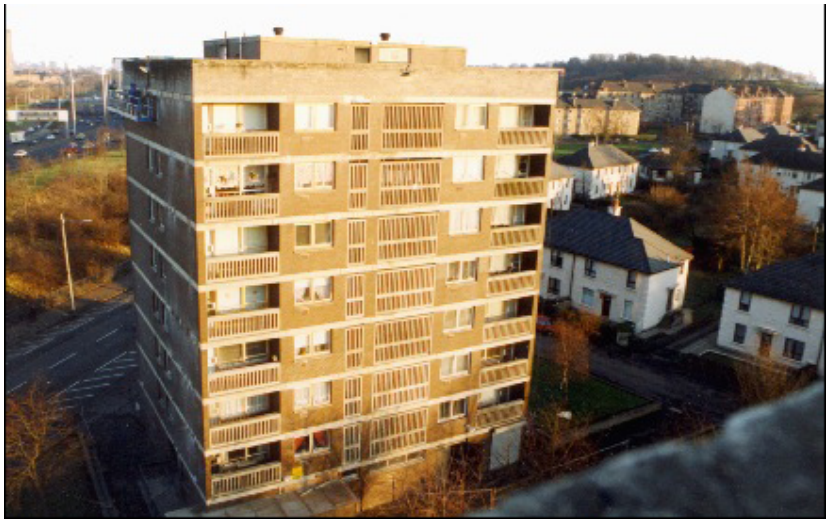
High Rise Housing

Context

- Mass housing of 60s and 70s
- No insulation
- Expensive heating
- Poor thermal performance
- Thermal discomfort
- Condensation
- Mould growth
- High Rise Blocks



Feasibility

Form and construction of the blocks - useful features

- Height
- Structure
- Distribution efficiency
- Infrastructure
- Flat roof

Curle St High-Rise

•Standard type built by George Wimpey in the 1970's in Glasgow

•21 storey block - maximise wind exposure

•Only building of that height in the surrounding area

•Structural capacity - solid concrete frame with a solid concrete roof slab

Aims of the study

•Estimate the energy demands of the building, for all domestic and common supplies.

•Estimate the potential energy generation capacity for the building based on measurements and average wind speed, and the capacity for the roof to accommodate installation of wind turbines.

•Assess the most fair and efficient way to integrate generating capacity with existing supply and demand infrastructure within the building.

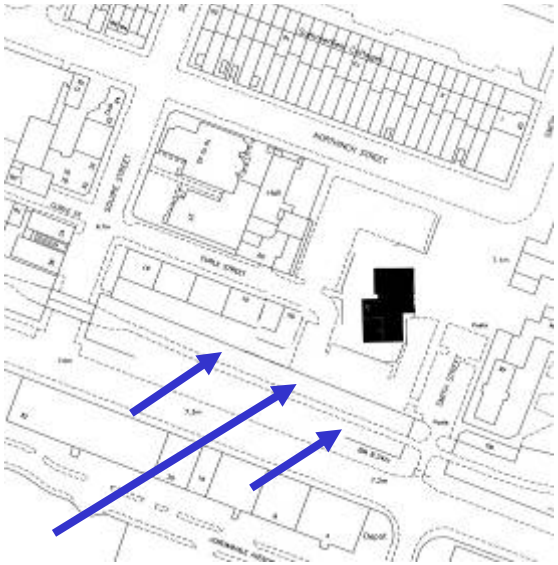
•Estimate economic feasibility of implementing the above measures, including capital cost, management / maintenance cost, and payback period.

•Identify necessary technical information and design work required before the scheme can be implemented

Location- 64 Curle St, Whiteinch

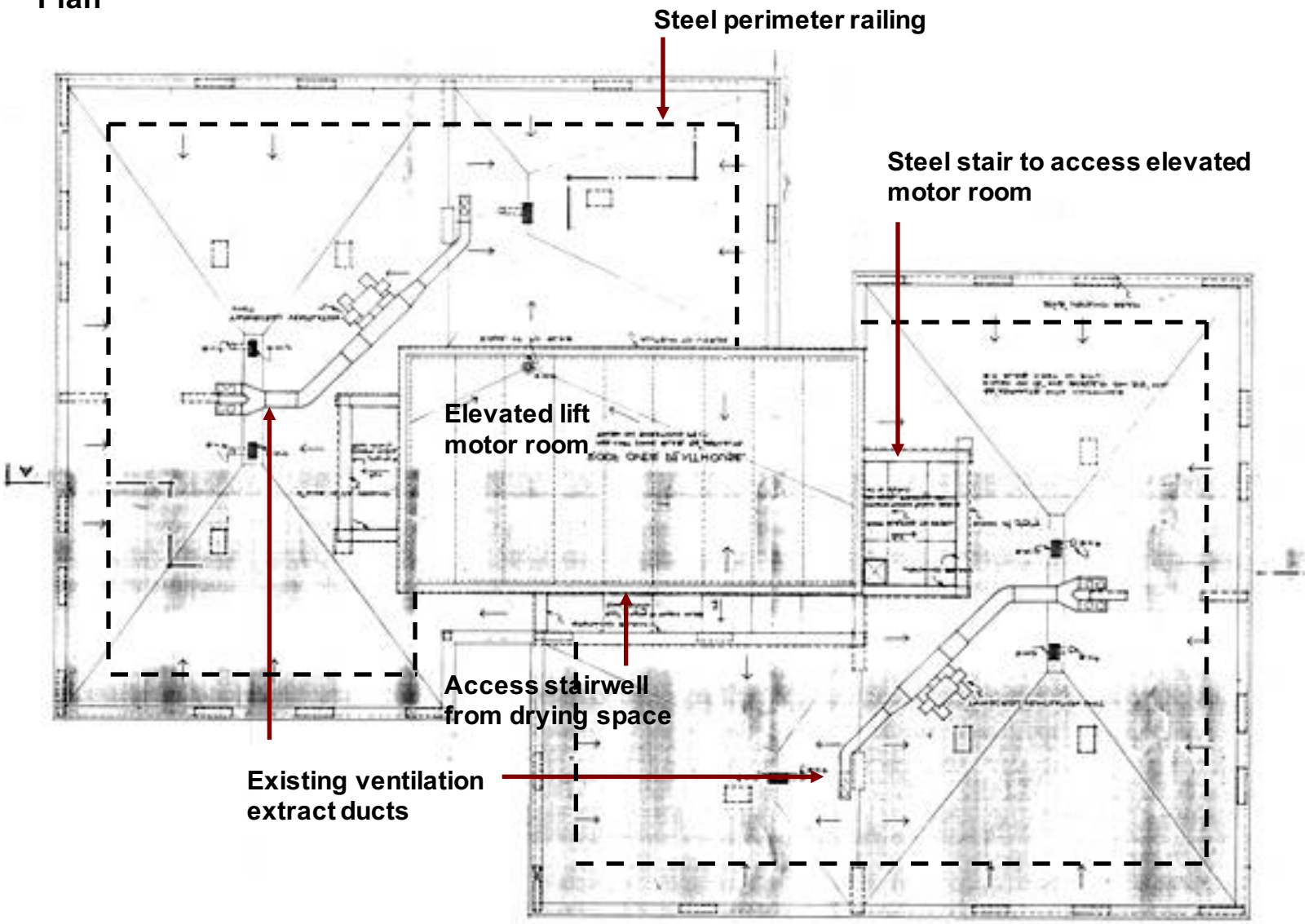
- West side of Glasgow in close proximity to the River Clyde
- Mix of both residential and industrial development
- Predominantly low rise development
- Tallest building of its type in the surrounding area
- Allows South Westerly winds to be maximised

Ariel view



Location plan

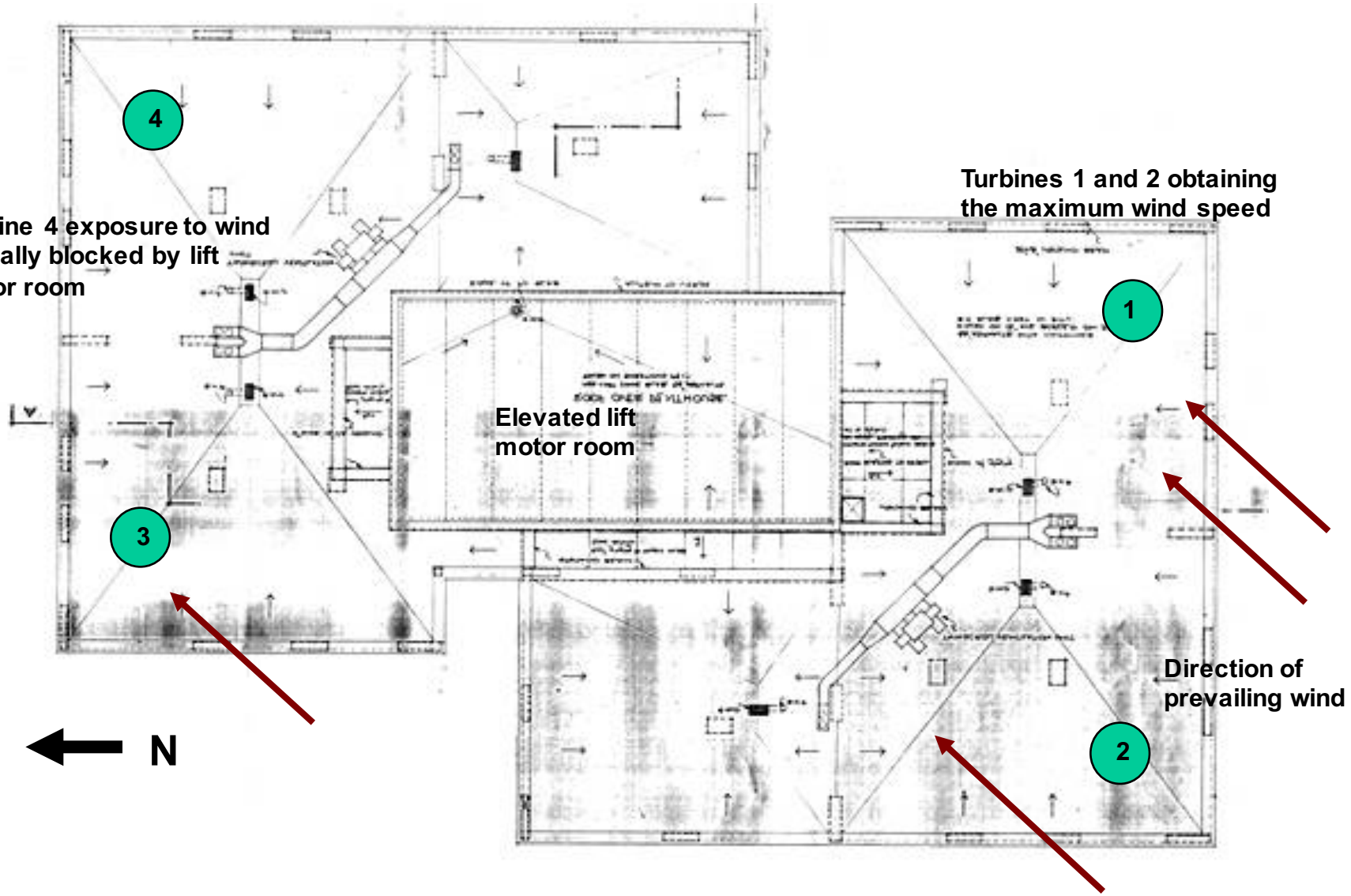
Roof Plan


Steel perimeter railing
Steel stair to access elevated motor room
Elevated lift motor room
Access stairwell from drying space
Existing ventilation extract ducts

Looking North West

A galvanised steel deck and ladder have been installed to allow safe access to the roof top plant room

Proposed location of wind turbines on roof slab
Option 1 - 4no 2.5 KWh, estimated output is 20,000kWh
Option 2 - 4no 6 KWh, estimated output is 48,000kWh



Technical Specification of Proposed Wind Turbines

Proven Turbines
•Flexible Blade System
•Quietest of the market

Proven 2.5kW
Rated Output: - 2500W (2.5kW)
Annual Output - 2,500-5,000 kWh
Rotor Diameter: - 3.5m
Hub Height: - 6.5m / 11m
Weight- 190kg

Proven 6kW
Rated Output: - 6000W (6kW)
Annual Output - 6,000-12,000 kWh*
Rotor Diameter: - 5.5m
Hub Height: - 9m / 15m
Weight- 400kg

Power Consumption within Dwellings

Average annual fuel consumption (for a 2 bedroom flat) is approx 7,500-8,000kWh per year.

SAP calculations indicate that this is theoretically 3,500kWh per year. If the overall energy consumption is 7,500-8,000kWh per year (for a 2 bedroom flat) then the typical electrical costs of lighting and small power appliances is 4,000-4,500kWh- which is slightly higher than expected.

Communal Area Power Consumption

Communal areas include:

•Lighting to the emergency stairs (24hrs).
•Lighting to the lift core and corridor (at night otherwise naturally lit).
•Power for the lift workings and motor room
•Lighting to the lift car
•Lighting to concierge and plant rooms

It is estimated that this will be approximately 38,000kWh annually.

Economic Feasibility of Installing Wind Turbines

Capital Cost
Prepared by Rooftop Turbine ltd/ Proven- October 2007

No. of Turbines	Power (kW)	Potential Output (kWh) based on 5m/s	Cost (including installation)
1	2.5	2,500-5,000	£27,500
4	2.5	10,000-20,000	£81,000
1	6	6,000- 12,000	£37,000
4	6	24,000- 48,000	£119,000
6	6	36,000- 72,000	£164,000

Benefits of the scheme

- Enough electricity (non-heating sources) for approximately 15 flats (4 x 6kW turbines)
- Displacement of approximately 21 tonnes of CO2 per annum
- Less reliance on traditional forms of fuel
- Or all communal electrical demands met (lift workings and lighting)
- All electrical demands of community flat are met
- Estimated cost reductions: £34/flat per annum. To vulnerable households: £135/flat/annum
- Substantially reduce fuel poverty by around 50% if savings can be passed onto tenants directly
- Innovative community-owned energy scheme
- Eligibility for grant support to meet capital costs
- Environmental education, energy awareness & energy-saving campaign
- Fits with Environment Vision 2002 (Whiteinch, Scotstoun and Yoker)