LIMERICK CLARE energy agency

RURAL RESOURCE DEVELOPMENT

Energy Solutions for Sustainable Development

Energy Management for SME's

#4 – Energy Audit

Shannon Region

June 2007

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- Benchmarking your Energy Performance
- Micro Audits
- Target your Resources
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Macro Energy Audit

- Big Picture – Over view
- Need all your energy bills going back at least two years, preferably three
- Need to determine a gross performance indicator
- Takes about 2 – 3 days
- This alone can identify substantial savings

Energy Standard Units

Energy is sold in many different units.

To make sense of your energy you need to convert all forms to a standard unit – kWh.

Natural gas		Therms	×	29.31	=	kWh
		Cubic feet	×	0.303	=	kWh
		Cubic metres	×		=	kWh
		kWh	×	1	=	kWh
Liquid petroleum gas (LPG)		Litres	×	7	=	kWh
		Tonnes	×	13900	=	kWh
Gas oil (35 sec)		Litres	×	10.6	=	kWh
Light fuel oil (290 sec)		Litres	×	11.2	=	kWh
Medium fuel oil (950 sec)		Litres	×	11.3	=	kWh
Heavy fuel oil (3500 sec)		Litres	×	11.4	=	kWh
Coal		Tonnes	×	7600	=	kWh
Anthracite		Tonnes	×	9200	=	kWh
Wood chip (Moisture content 35%-50%)		Tonnes	×	3500	=	kWh
Wood chip (Moisture content >50%)		Tonnes	×	2800	=	kWh
Wood pellets		Tonnes	×	4800	=	kWh
Electricity		kWh	×	1	=	kWh
Total energy use for the year					-	kWh

Energy Standard Unit

Identify for Space Heating Load

2. Find your space-heating energy use. Apply (A) **OR** (B)

(A) If you can identify any of the fuels above used ***only*** for space heating, enter the total energy use in kWh

	Description	kWh
1.		
2.		
3.		
	Total =	kWh **B**

(B) For fuels used for space heating *and* hot water, where they not separetly metered, use 60% of thermal energy used. This figure may also be used for all electrically heated buildings

Enter total thermal energy by fuel type:-	a.		kWh			
	b.					
Enter total thermal energy by fuel type:-	c.		kWh			
	Total =		kWh	x	0.60	kWh **C**
	Annual space heating energy (B or C) =					kWh **D**
	Annual non-space heating enegy (A-D) =					kWh **E**

Energy Standard Unit

Your heating energy use is “normalised” to Shannon Region, Degree Days - 2100

3. Space heating energy adjusted for Shannon Region weather

Adjust the space-heating energy to standard conditions (D × G) = kWh **F**

4. Normalised annual energy use

Your annual energy use normalised for weather is = kWh **G**

Degree days are a technical method of calculating the duration that outside air temperature falls below a “base level”. For dwellings and hotels this base level is taken as 15.5 °C. For hospitals and nursing homes the base level is 17 °C.

Energy Standard Unit

You will want to express your energy use to a useful performance indicator.

5. Performance Parameter (Treated Floor Area etc.)			
Treated Floor area	=		m^2 η_t
Your Performance Parameter	=		X η_x
6. Find the Normalised Performance Indicator (NPI)			
(A) Floor area	$NPI = \frac{L}{M}$		kWh / m2
(B) 0	$NPI = \frac{L}{N}$		kWh / X

The common Energy Performance Indicators (EPI) are treated floor area, or units of production. You may use both methods on this spread sheet.

Standard Unit Calculator

Excel Spreadsheet

Prepared by LCEA

Download from Web site

WWW.lcea.ie

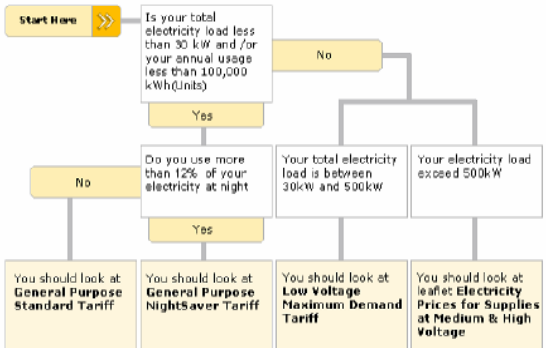
Energy Costs

- Energy cost is usually your first indicator of energy performance
- Energy cost can be deceiving as an indicator
- Energy costs are sometimes difficult to get (direct debit, filing by period / cost code)
- Important that you have a clear understanding of all energy costs
- Energy will have environmental costs attached in the near future.
- Need at least two years energy bills to begin energy management (three is better)
- Must gather performance indicator data for the same period.

Energy Selection - Thermal

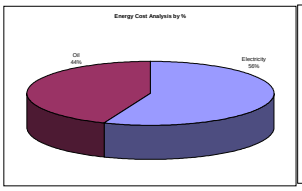
- The decision on the type of energy you use for space heating was most likely made for you by the person that designed the heating system originally.
- The original decision may have been the correct one, but things do change, does it still make sense.
- Do you need a specific fuel for any process (catering, medical equipment, table ware etc.)
- Can your space heating and / or hot water needs be met by any fuel.
- Can you switch fuels reasonably easily in the event of one particular fuel not being available / expensive.
- What space do you have in plant rooms and outside to modify your heating systems / fuel storage.

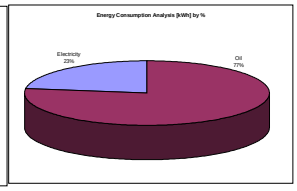
Energy Selection - Electricity



Energy Consumption & Cost Analysis

Fuel	Qty	Units	Unit cost	Total Cost	Qty - kWh	CO_2 Tonnes
Oil	210,000	Litres	€0.269	€ 56,341	2,215,500	584.67
Electricity	655,080	kWh	€0.103	€ 67,114	655,080	506.26
Totals				€ 123,455	2,870,580	1,090.93





Energy Benchmarking

- Petrol Consumption - MPG of a car at 56 mph
- Electricity / Gas - kWh / bedroom / M^2 / annum
- Electricity / Gas - kWh / M^2 / annum
- Water - Litres / guest / day
- Electricity / Gas - kWh / units of production / annum

Benefits of Benchmarking

- Assess your performance against other similar businesses
- Compare like with like
- Benchmarks look to the future not the past
- Assess potential savings for Gas / Electricity and water
- Set realistic targets for energy reduction (not a % reduction)
- Avoids over-investment
- Targets Poor performance and identifies areas for investment / staff training

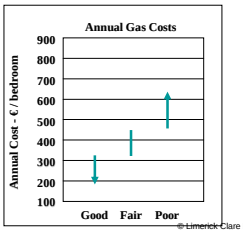
Benchmarking Comparison

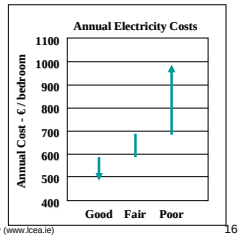
- Having determined your own energy efficiency benchmark the next thing you will want to know is how does it compare.
- First you will have to make sure you are comparing like with like.
- Offices and hotels come in several classes and types.
- Leisure centres have different size of pools, with or without gyms or outdoor courts.
- Production processes differ greatly

Benchmarking Hotel Example

- Small Hotel Benchmarks

	Annual Gas Consumption kWh per sq. meter	Annual Electricity Consumption kWh per sq. meter
Good	95 - 230	50 - 80
Fair	230 - 360	80 - 140
Poor	360 - 540	140 - 205





Benchmarking Pool & Gym

- Leisure Centre Benchmarks

Heating Energy Performance Indicators

EPI KWh / m² / yr.	"Good" EPI KWh / m² / yr.	"Typical" EPI KWh / m² / yr.
831	420	960

Electricity 1 – Building Services, Energy Performance Indicators

EPI KWh / m² / yr.	"Good" EPI KWh / m² / yr.	"Typical" EPI KWh / m² / yr.
197	110	170

Electricity 2 – External Services & Equipment, Energy Performance Indicators

EPI KWh / m² / yr.	"Good" EPI KWh / m² / yr.	"Typical" EPI KWh / m² / yr.
49	35	55

Benchmarking Pool & Gym

- Summary of Potential Savings

Item	Saving Potential "Good" EPI		Saving Potential "Typical" EPI	
	KWh / Yr.	**€ / Yr.**	**KWh / Yr.**	**€ / Yr.**
Heating	1,093,671	€ 27,990	-	-
Electricity 1 (indoor)	231,500	€ 23,845	71,847	€ 7,400.24
Electricity 2 (outdoor)	37,250	€ 3,837	-	-
Totals	***1,362,421***	***€ 55,672***	***71,847***	***€ 7,400.24***

Micro Energy Audit

- Need more detail
- Analysis of energy use by area / purpose
- Need to determine a specific performance indicators
- Takes about 5 – 7 days
- Identifies key area that require attention, and the specific recommendation for improvement

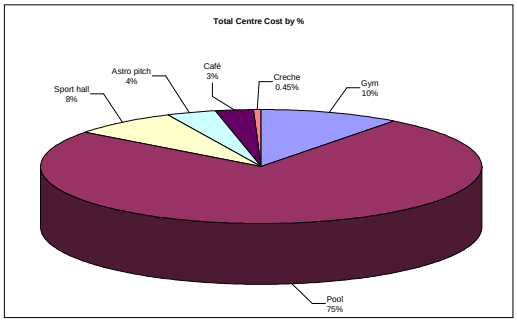
Energy Audit Pool & Gym

- Leisure Centre – Pool, Gym, Canteen, Crèche

Summary	Electricity Total kWh	Electricity Total €	Oil Total Litres	Oil Total €	Energy Total €
Gym	80,537	€8,859	16,480	€4,421	€13,280
Pool	451,479	€49,663	173,331	€46,503	€96,166
Sport hall	57,766	€6,354	12,825	€3,441	€9,795
Astro pitch	34,509	€3,758	4,030	€1,081	€4,839
Café	24,490	€2,694	3,065	€822	€3,516
Crèche	3,794	€417	610	€164	€581
	652,574	€71,745	210,340	€56,432	€128,178

Energy Audit Pool & Gym

- Leisure Centre – Pool, Gym, Canteen, Crèche



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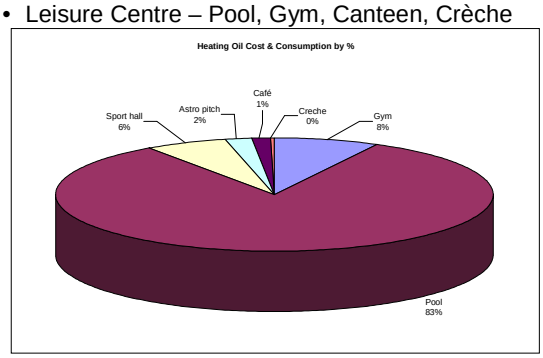

Energy Audit Pool & Gym

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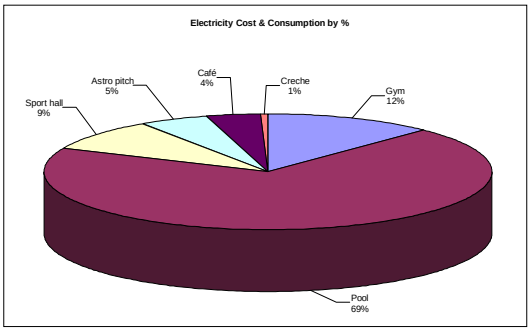


Energy Audit Pool & Gym

- Leisure Centre – Pool, Gym, Canteen, Crèche

Total Cost - €	Pool	Gym	Sport Hall	Astro Pitch	Café	Crèche
Hall	€ 65,650	€ 5,054	€ 4,057			
Changing	€ 10,889	€ 3,677	€ 3,677	€ 1,839		
Spectator	€ 3,453					
Steam / Sauna	€ 3,300					
Jacuzzi	€ 330					
Gym Equipment		€ 1,375				
Flood lit Court / pitch				€ 1,650		
Common Areas	€ 4,576	€ 1,197	€ 704	€ 493		
Plant & Store	€ 3,676	€ 855	€ 697	€ 396		
Car Parks	€ 4,290	€ 1,122	€ 660	€ 462		
Café					€ 3,516	
Crèches						€ 581
Totals	**€ 96,166**	**€ 13,280**	**€ 9,795**	**€ 4,839**	**€ 3,516**	**€ 581**

Energy Audit Pool & Gym

- Leisure Centre – Pool, Gym, Canteen, Crèche

Electricity Cost - €	Pool	Gym	Sport Hall	Astro Pitch	Café	Crèche
Hall	€ 29,182	€ 2,915	€ 2,750			
Changing	€ 4,738	€ 2,074	€ 2,074	€ 1,037		
Spectator	€ 2,168					
Steam / Sauna	€ 3,300					
Jacuzzi	€ 330					
Gym Equipment		€ 1,375				
Flood lit Court / pitch				€ 1,650		
Common Areas	€ 3,196	€ 836	€ 492	€ 344		
Plant & Store	€ 2,458	€ 537	€ 378	€ 265		
Car Parks	€ 4,290	€ 1,122	€ 660	€ 462		
Café					€ 2,694	
Crèche						€ 417
Totals	**€49,663**	**€ 8,859**	**€ 6,354**	**€ 3,758**	**€ 2,694**	**€ 417**

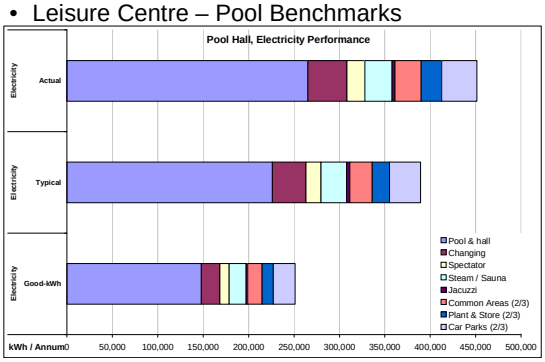
Energy Audit Pool & Gym

- Leisure Centre – Pool, Gym, Canteen, Crèche

Heating Oil Cost - €	Pool	Gym	Sport Hall	Astro Pitch	Café	Crèche
Hall	€ 36,469	€ 2,139	€ 1,307			
Changing	€ 6,151	€ 1,603	€ 1,603	€ 801		
Spectator	€ 1,286					
Common Areas	€ 1,380	€ 361	€ 212	€ 149		
Plant & Store	€ 1,218	€ 319	€ 319	€ 131		
Café					€ 822	
Crèche						€ 164
Totals	€ 46,503	€ 4,421	€ 3,441	€ 1,081	€ 822	€ 164

Benchmarking Pool & Gym

- Leisure Centre – Pool Benchmarks



Benchmarking Pool & Gym

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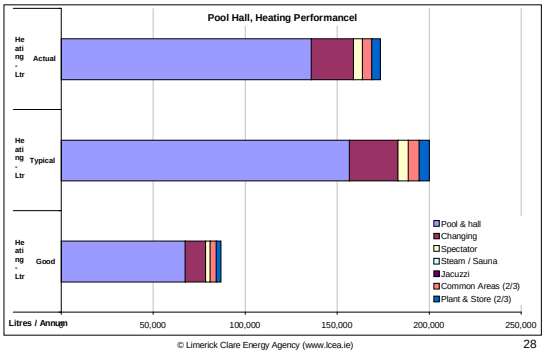
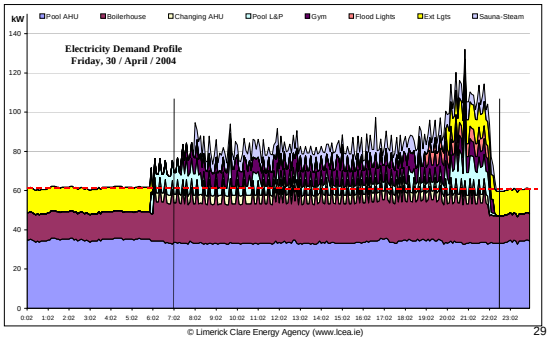


Electricity Profile

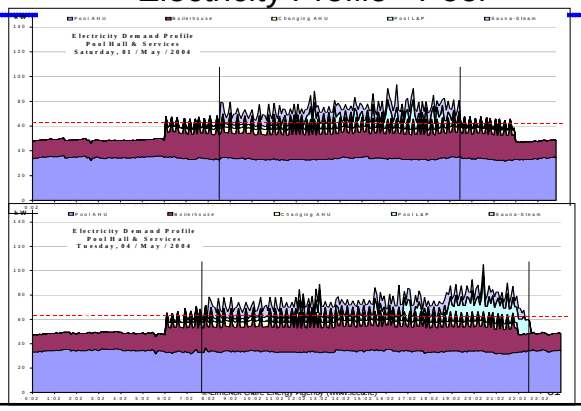
Electricity Profile for Pool & Gym



Target Your Resources

- From this example it is clear that the Pool hall should be targeted
- Savings made in the Pool hall / largest energy user, can often be used as leverage for investment in other areas
- Always look for the easy savings with low pay back in the largest energy use areas

Electricity Profile - Pool



Pool Hall - Recommendations

Electricity Account – Maximum Import Capacity

Item	Tariff	Annual Cost - €	Annual Saving - €
6.1.1a	Non Domestic – Night Saver	€ 67,114	-
6.1.1b	Maximum Demand – Low Voltage (***MIC 65 kVA***)	€ 62,008	***€ 5,006***
6.1.1c	Maximum Demand – Low Voltage (***MIC 150 kVA***)	€ 61,069	***€ 6,045***

Power Factor Correction

Item	Cost	Saving kWh / Yr.	Saving € / Yr.	Simple Pay Back – Yrs.	Saving – CO_2 Tonnes / Yr.
6.1.3	€ 6,000	0	€ 3,940	1.52	0

Pool Hall - Recommendations

Air Handling Unit, fan speed control via RH sensor

Item	Cost	Saving kWh / Yr.	Saving € / Yr.	Simple Pay Back – Yrs.	Saving – CO_2 Tonnes / Yr.
8.4.Ci	€ 500	44,700	€ 2,010	0.25	34.69

Air Handling Unit – Pool Hall Temp. Adjust - BMS

Item	Cost	Saving Litres / Yr.	Saving € / Yr.	Simple Pay Back – Yrs.	Saving – CO2 Tonnes / Yr.
8.7.A	€ 100	3,000	€ 900	0.10	8.35

Air Handling Unit – Recover heat from exhaust air – h.p.

Item	Cost	Saving Litres / Yr.	Saving € / Yr.	Simple Pay Back – Yrs.	Saving – CO_2 Tonnes / Yr.
8.7.B	€ 18,000	40,000	€ 6,185	3.00	66.00

Remember

- Energy is a controllable cost but only if it is managed
- Savings from energy conservation go straight on the bottom line – that means more profit
- A 10-20% saving is generally achievable by simple no or low cost measures
- The longer you wait the more you waste

Energy Audit Services

- The Commission for Energy Regulation (CER) requires that all utility companies offer energy efficiency services.
- ESB, Bord Gas, Energia, Airtricity all offer energy audits.
- Typical cost of Audits are:-
  - Scoping surveys - € 1,500
  - Full audits - € 1,200 / day
  - Typically 3 – 4 days on site for full audit

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#4 – Energy Audit

Thank You