



*Streamline Enterprises*

**Energy Efficiency in Retail Refrigeration**

# Foreword

The management & control of operating costs is critical to the competitiveness & sustainability of a viable business.

In food retailing, not only is energy required to chill & heat food but it is also needed to cool & heat the premises, provide lighting & hot water, dispose of waste, etc.

Energy consumption whilst necessary, is expensive and therefore proper & efficient use of it will positively benefit the challenge of operating a business.

This brief presentation will show the existence of effective ways in reducing the running cost of the biggest consumer of energy in a retail grocery store – **REFRIGERATION**.

These methods are not only available to new retail business ventures but also to existing, established ones.

Please note that the values in the running cost examples are approximate & indicative only of equipment supplied by *Streamline Enterprises*. Site survey & assessment will be necessary in most cases.



## Items to Consider

- Low energy (EC) fans.
- Light Emitting Diode (L.E.D.) lighting.
  - Cabinet Deep Cleaning.
  - Nightblinds / Nightcovers.
  - Glass Doors & Lids.
  - Timeclocks (load shedding).
  - Coldroom Door Switches.
- Compressor Mini-Pack versus Condensing Units.
  - Digital Scroll Compressors.
- Variable Speed Drive / Inverter Technology.
  - Heat Recovery for Hot Water.
    - Air Curtains.



## Low Energy (EC) Fans

Cabinet Description	Standard Fans (w)	Daily Cost (€)	Annual Cost (€)	Low Energy Fans (w)	Daily Cost (€)	Annual Cost (€)
2.5m Dairywall	3,648	0.55	199.73	864	0.13	47.30
3.75m Prepack	5,472	0.82	299.59	1,296	0.19	70.96
	Energy Reduction (%)	Daily Saving (€)	Annual Saving (€)	Capital Cost (€)	Payback Period (yrs)	
	76	0.42	153.30	360.00	2.3	
	76	0.63	229.95	540.00	2.3	
Notes:	Standard fan power is 38 watts.					
	Low energy fan power is 9 watts.					
	Fan runtime is 24 hours & estimated ESB KWHr rate is €0.15.					



- EC fan motors have an energy efficiency rate as much as *65%* compared to *18%* for standard shaded pole motors.
- This greatly reduces the waste heat generated by the motor which of course is absorbed by the refrigeration process.
- Operating on DC current, this also allows for quieter operation.

# L.E.D. Lighting

Cabinet Description	Standard Lights (w)	Daily Cost (€)	Annual Cost (€)	L.E.D. Lights (w)	Daily Cost (€)	Annual Cost (€)
2.5m Dairywall	7,452	1.12	408.00	570	0.09	31.21
3.75m Prepack	11,178	1.68	612.00	855	0.13	46.81
	<b>Energy Reduction (%)</b>	<b>Daily Saving (€)</b>	<b>Annual Saving (€)</b>	<b>Capital Cost (€)</b>	<b>Payback Period (yrs)</b>	
	92	1.03	376.79	150.00	0.4	
	92	1.55	565.18	225.00	0.4	
Notes:	Standard fluorescent light power is 36 watts + 15% for ballast consumption.					
	L.E.D. light power is 19 watts for equivalent 1200mm fitting.					
	Light runtime is based on 15 hours & estimated ESB KWHr rate is €0.15.					
	<b>Cabinets have canopy L.E.D. light fittings only.</b>					

- L.E.D. lighting has a higher quality light source which improves display, increasing sales.
- A 50,000 hour lifespan is not uncommon.
- No maintenance is required.
- No UV radiation & minimal heat gain to be absorbed by refrigeration.



## Deep Cleaning

- This involves the removal of all dust, food debris & unwanted matter which builds up in the cabinet over its operational lifespan, hindering air circulation, defrosting and condensate drainage.
- This action will improve the temperature performance of the cabinet and reduce the runtime of compressors.
- Savings on energy consumption of up to *15%* can be realised with payback possible within 12 months.

## Nightblinds / Nightcovers

- Fitted to chill multidecks & freezer islands / wells, these will minimise the ingress of warm ambient air during store closing hours.
- This enables the cabinet to reach its temperature setpoint quicker and thereby reduce the need for compressors to operate for longer periods.
- Running costs can be reduced by up to *10%* with payback in most instances, before 2 years.

# Glass Doors & Lids

- Open refrigerated units account for about 40% of the energy consumption that is wasted in the food industry. The difference between the ambient air temperature & the interior of a refrigerated unit is so big that a lot of energy is needed to support it. The most effective way of saving considerable amounts of energy is to cover the refrigerated units.
- Convection (transfer of warm air) & Radiation are the main reasons for cooling losses. The energy used for necessary and regular defrosting of the units is also high. With glass doors / lids fitted, defrost energy consumption can be reduced by up to seven fold.
- With plant optimisation, refrigerating energy savings of between 40% & 60% are achievable.
- Additional benefits of using glass doors & lids extend to: longer shelf life of product, fewer defrost cycles, improved temperature consistency, less power used to ensure cooling performance, reduced compressor starts/stops which extends compressor lifespan, extended inherent product safety in the event of a power cut.





## Multideck Glass Doors

Cabinet without Glass Doors	Total Energy Consumption	Daily Cost (€)	Annual Cost (€)		
2.5m Dairywall	27.80	4.17	1,522.05		
3.75m Prepack	41.70	6.26	2,283.08		
Cabinet with Glass Doors	Total Energy Consumption	Daily Cost (€)	Annual Cost (€)	Capital Cost (€)	Payback Period (Yrs)
2.5m Dairywall	15.09	2.26	826.18	1,560.00	1.9
3.75m Prepack	22.64	3.40	1,239.54	2,340.00	1.9
Notes:	<b>Annual operational savings of 46% when utilising Glass Doors.</b>				
	Estimated ESB KWHr rate is €0.15.				





## Timeclocks (Load Shedding)

- The use of mechanical timers to shut down refrigerated cabinets during store closing hours offers the potential to save between *10% & 15%* on the energy used, and will typically provide a payback within 12 to 18 months.
- Used only on non-critical items such as Minerals & Beers, the period of shutdown can be tailored to suit the retailer's trade. Refrigerated cabinets which are emptied of product @ the end of the day, e.g. serveovers, can also be turned off, why waste energy refrigerating air ?
- A refrigeration monitor, in most instances, can also perform this function automatically via the built in timer.

## Coldroom Door Switches

- This device reacts to the open & close action of the coldroom door and can control the operation of the cooling process, the fan air flow and even the interior lighting.
- Energy savings of up to *10%* can be achieved with payback typically in the first year.

## Digital Scroll Technology



- Digital scroll technology is up to *30%* more efficient than traditional methods of compressor modulation.
- By offering a stepless capacity range of *10%* to *100%*, the compressor doesn't need to start / stop as often as a traditional one. By matching output to actual demand, this provides enhanced system performance, reliability and less maintenance because of the reduced wear and tear on the compressor.
- The higher the quantity of evaporators in the refrigeration system, the greater the benefits. Additionally, with a range available from 3HP to 10HP, this can reduce the number of compressors required to deliver the capacity in a multi-compressor pack situation.

## Variable Speed Drive / Inverter Technology

- A VSD or Inverter is a device that is used to control the speed of an induction motor. In compressor applications, energy use can be reduced considerably if the speed of the motor varies in response to the changing process conditions. A VSD makes this possible.
- The reduction in energy consumed will relate to the specific site conditions but can typically contribute up to *20%* in savings, with payback between 2 & 3 years, especially when retro-fitted to multi-compressor packs with large semi-hermetic compressors.

# Compressor Mini-Pack

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- The mini-pack is a close-coupled packaged unit c/w compressors (typically two), air cooled condenser, refrigerant receiver, oil system, control panel & plant controller.
- It has a much smaller footprint when compared to multiple condensing units, and also helps to reduce noise emissions.
- Digital scroll or Inverter technology can also be included, providing further energy savings.



## Heat Recovery

- Refrigeration is the process of extracting heat to help achieve a desired cooler temperature, e.g. for preserving food. This heat is usually lost to atmosphere, but can be recovered. With the use of a PHE (plate heat exchanger) connected to the compressor plant, this heat can be utilised for the retailer's hot water needs.
- Water supply to a holding vessel can be pre-heated by the refrigeration plant, thereby reducing the burden on the primary water heating source, e.g. electric element, gas burner.
- Depending on plant size, recovered heat could be as much as  $40^{\circ}\text{C}$ .



## Air Curtain



- The purpose of this unit is to separate the internal store temperature from the external ambient. Mounted over the head of the door, the forced downward air flow creates an invisible curtain which helps to minimise the effects of drafts & preserve the climatized condition of the store. Air conditioning costs are reduced to efficient working levels with energy savings up to  $15\%$  in return.

# Conclusions

- Controlling the overhead cost of energy consumption is advantageous to the sustained competitiveness of a business.
- Through awareness, forethought & consultation it is possible to achieve a highly efficient solution for the refrigeration requirements of a retail grocery store.
- Equally, it is never too late to implement similar measures to reduce significantly the existing consumption levels in established businesses.
- The capital investment of procuring the means of reducing refrigeration running costs are not prohibitive when considered alongside the immediate & longterm benefits and associated payback periods.
- As a by-product of energy efficiency, a reduction in carbon footprint is also realised which positively benefits the business & the environment as a whole.
- It is also worth noting that the Sustainable Energy Authority of Ireland (SEAI) support many of the initiatives mentioned previously and offer financial assistance to retailers by way of grant schemes and revenue incentives.



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