

# Energy Efficiency in industry, a holistic and integrated strategy from policy to results

ECEEE Summer School  
9<sup>th</sup> June 2011

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SEAI



## Policy drivers

- Energy Services Directive
- Transposed into law in Ireland S.I. 542 2009
- NEEAP – National Energy Efficiency Action Plan 2009

***Large industry specific actions under the NEEAP***

*Action 16. We are supporting the networking and exchange of best energy efficiency practice by the largest industrial energy users through the Large Industry Energy Network.*

*Action 17. We are supporting businesses in maximising their energy efficiency through adoption of IS393, the Irish Standard for Energy Management.*

## Scope of paper

- SEAI Programmes for Large Industry and Business users
- >€1M/annum energy expenditure
- 12% of Irish organisations account for 90% of energy-related CO<sub>2</sub> emissions

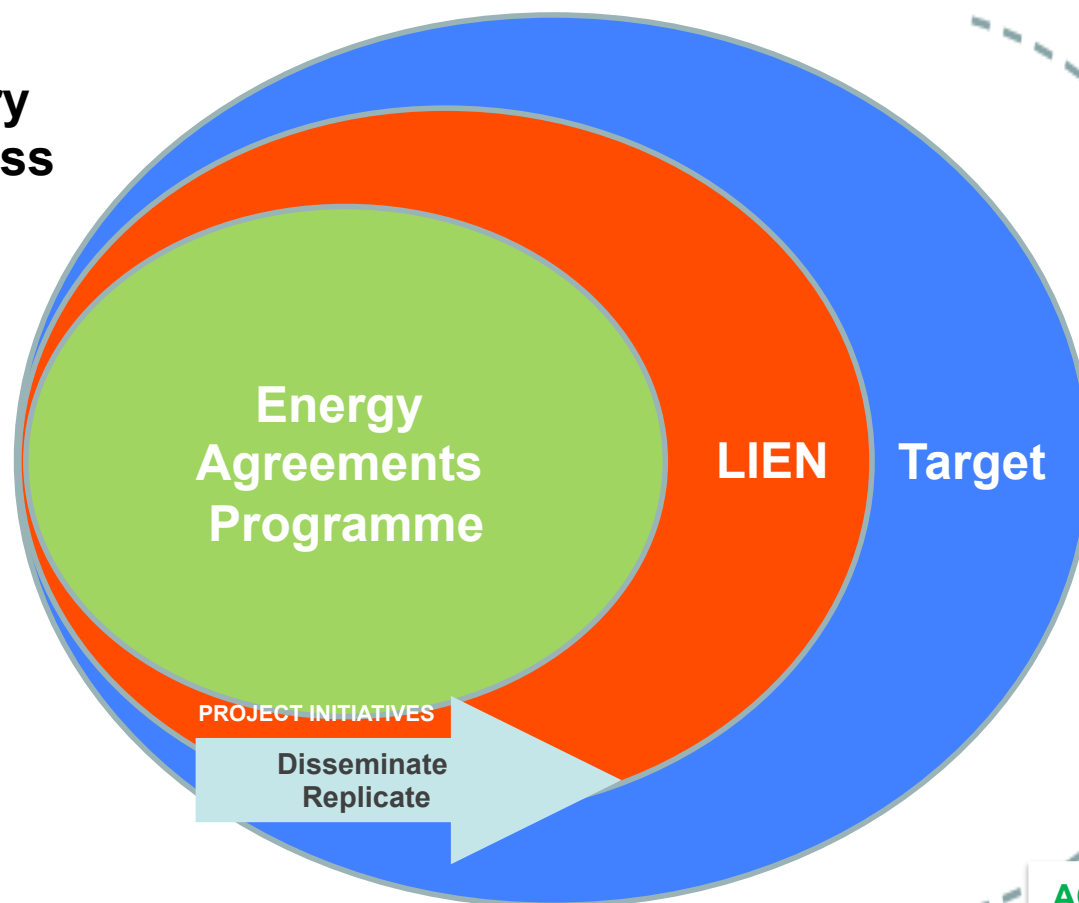
# SEAI Large Industry Programmes

**Table 1: Outline of programme elements**

Large Industry Energy Network (LIEN)	
Member commitment	SEAI support
Energy Management Programme Sets objectives and targets Undertakes annual energy review Returns data annually to SEAI	Relationship manager Energy seminars LIEN Annual Report Runs networking forum

## Programme target audiences

**Large Industry  
Large Business**



**SME's  
Public Sector**

### **ACCELERATE ACTIVITY**

- EN16001 Management Systems
- Energy Management Programmes
- Special Investigations
- Concrete projects

## Large Business Programmes

- **Large Industry Energy Network - LIEN**

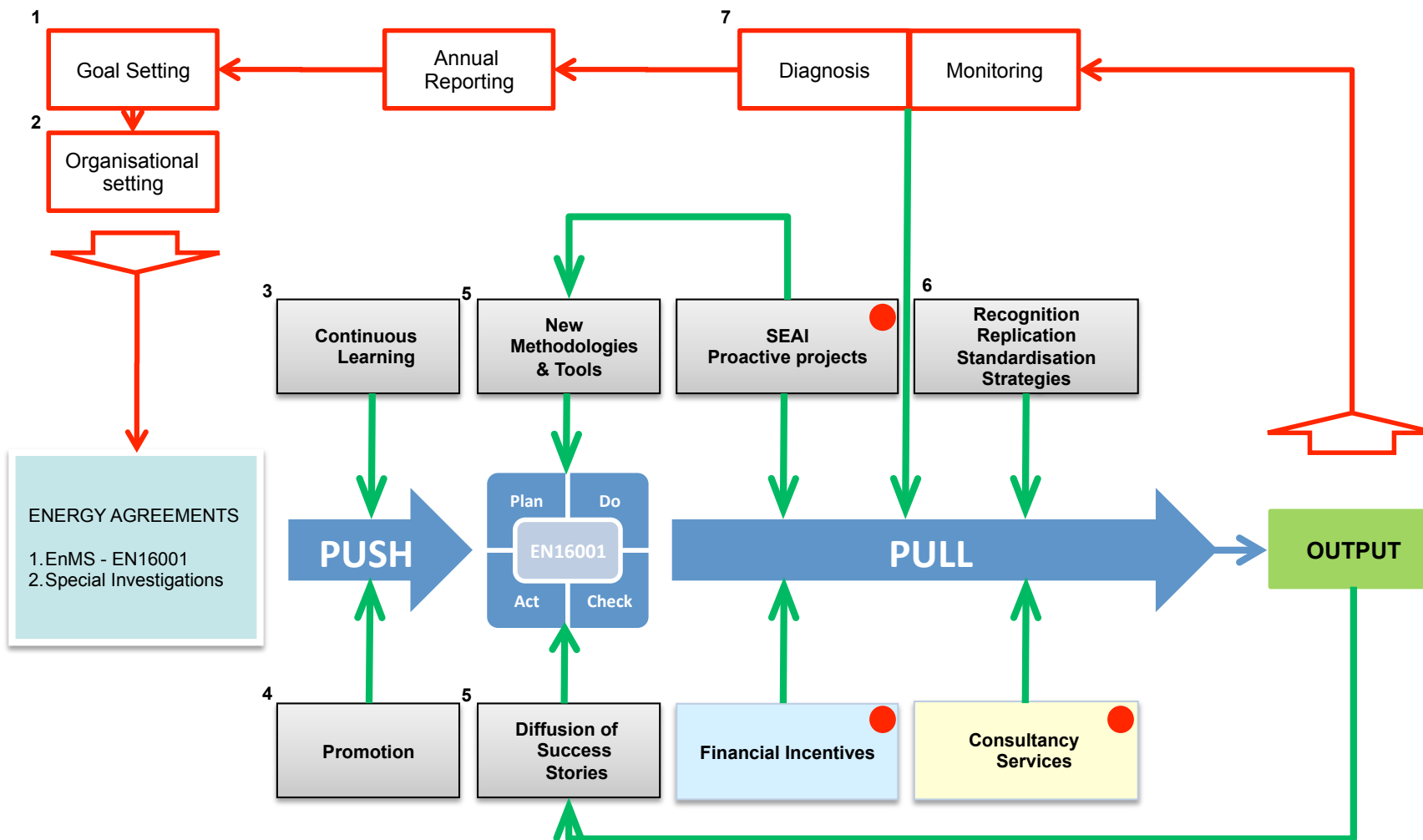
- Currently 155 Companies
- Representing €1Bn energy spend
- 68% of Total Industrial energy requirement, (14% TPER Ireland)
- Coverage across all sectors

Large Industry  
Energy Network networking, Knowledge sharing, Experiences Sharing, Access  
**seai** relationships, Disseminating, Replicating, Test Population

- **Energy Agreements Programme - EAP**

- Subset of LIEN
- Currently 80 Members, 100 Sites EN 16001

Large Industry  
Energy Network Higher commitment, EN 16001 EnMS, Rigorous, More support  
**seai** Test bed to pilot new Initiatives, greater level of interaction, higher performance expectation, Standardising solutions



**Table 2: Programme model elements**

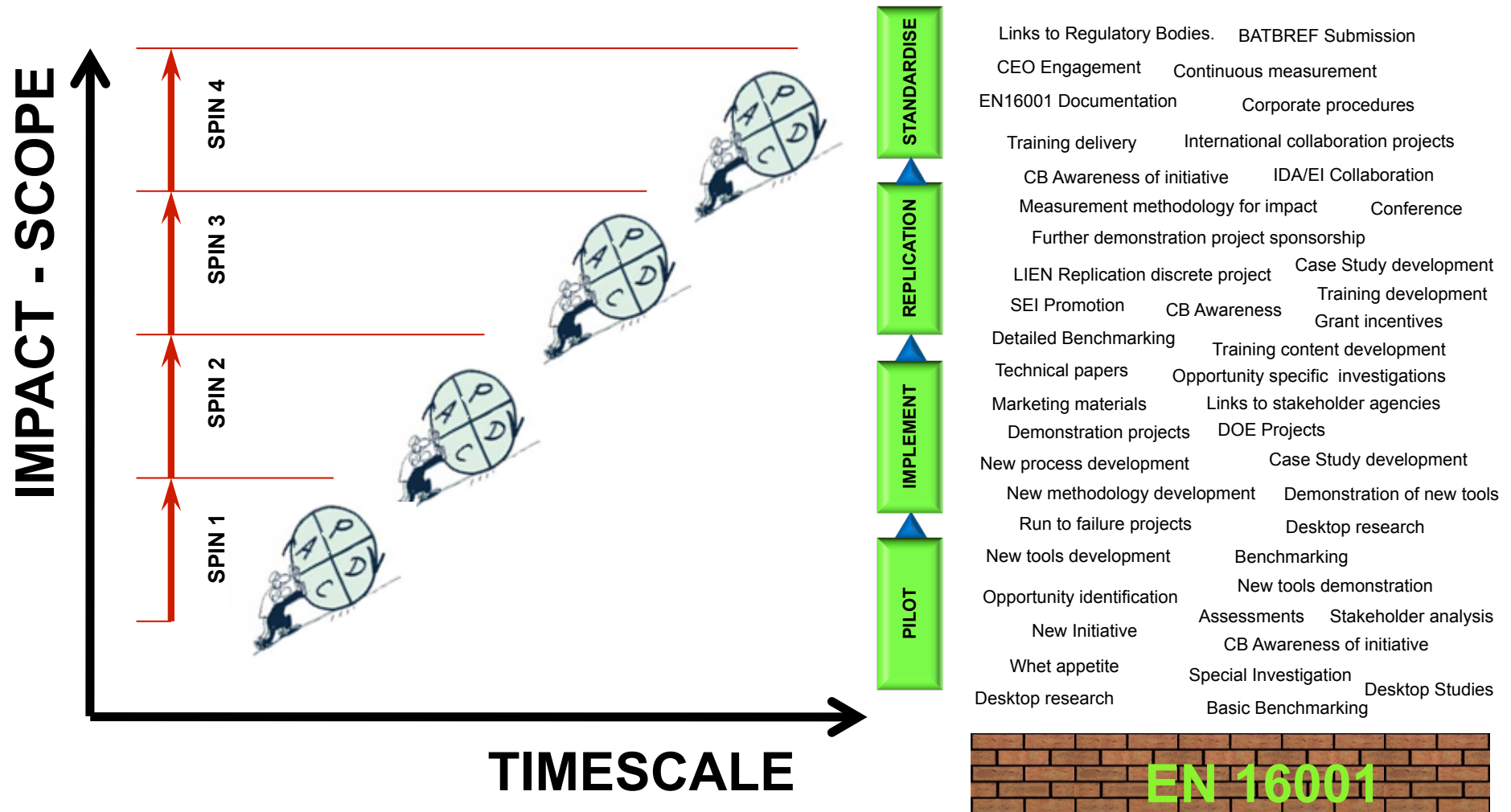
Infrastructure	Push/Pull	Relevance
1. Goal setting	Push	The Energy Agreement requires a commitment to the EnMS and to invest in continual Special Investigation activity. The programme establishes goals on savings impacts and membership for the LIEN and Energy Agreements. The Agreements Support Managers are assigned goals in line with programme objectives.
2. Organisational setting	Push	Organisational supports are put in place for the fundamental programme commitments and project initiatives, in particular the Agreements Support Manager Role.
3. Continuous learning	Push	Lessons learned through the processes are integrated into new phases of the Energy Agreement and projects.
4. Promotion	Push	Successes are promoted through a variety of methods, to confirm the efficacy of the EnMS approach.
5. Diffusion of success stories	Pull & Push	The effectiveness of new methodologies, tools and techniques are tested and adopted as new best practices within the programme. Successes by external interventions and market actors are embedded and standardised as best practices.
6. Recognition	Pull	Achievements are recognised through a variety of methods including annual report and cases studies. Recognition is also provided when replicating and standardising projects as best practice.
7. Monitoring and diagnosis	Pull	The results of the programme are monitored and diagnosed for weaknesses and new areas of focus.
<b>Additional Stimulus</b>		
- SEAI proactive projects	Pull	Special Project Initiatives that define and instigate special investigations that otherwise may not happen or not at the same pace.
- New methodologies and tools	Pull & Push	New methodologies and tools are developed that can be used within the programme or as additional services offered by the services market.
- Consultancy services	Pull	Energy and mainstream business consultancy services. New methodologies and tools developed by the programme can develop new business opportunities to be exploited.
- Financial interventions	Pull	e.g. EAP Special Investigation grant support. SEAI capital grants where available Enterprise development agency grants, where available. Renewable heat, Renewable Energy RD&D grants. Accelerated Capital Allowances (offsetting corporation taxes). Energy Efficiency Fund.

## Special Project Initiatives

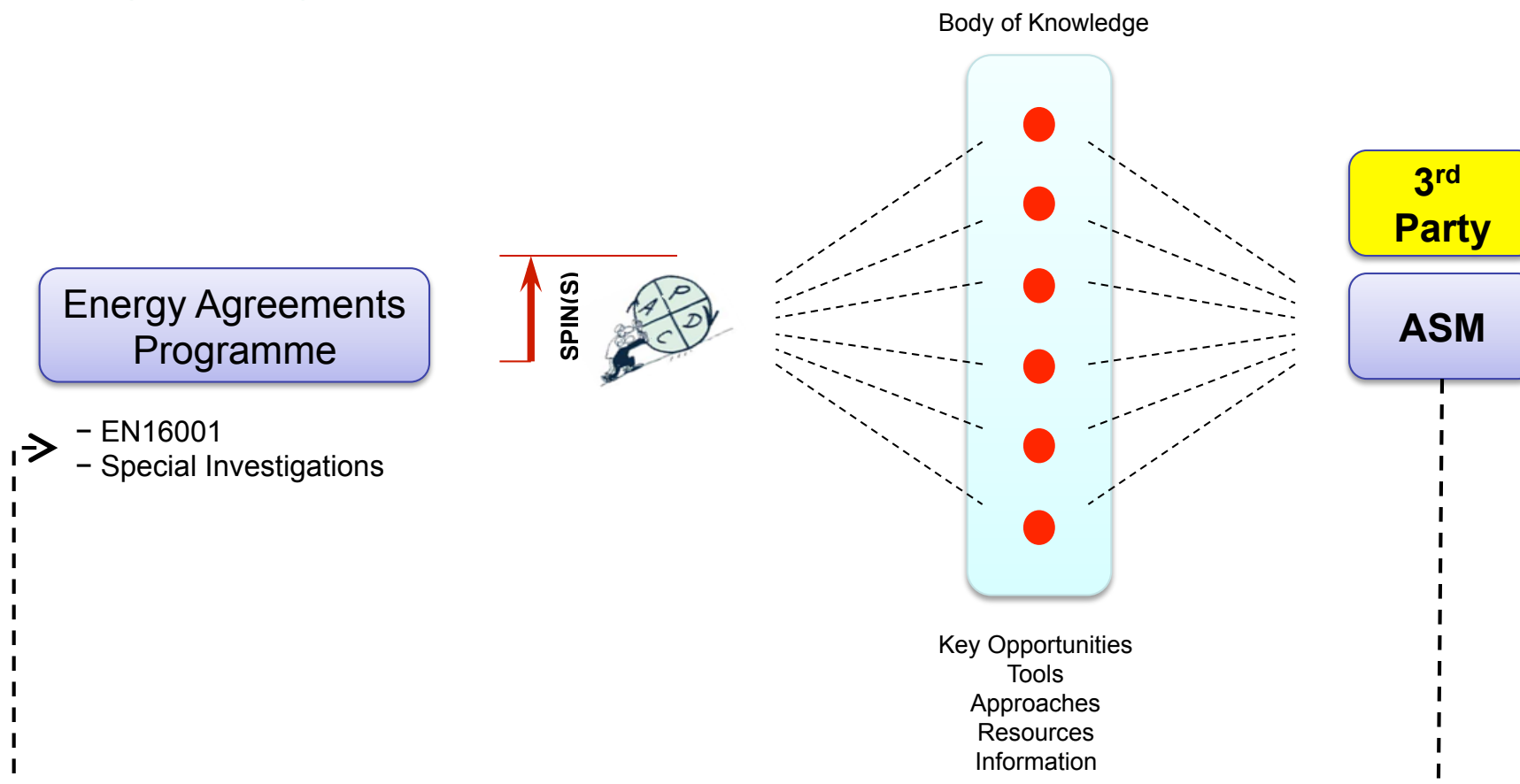
**Table 3: SEAI Energy Agreements project initiatives**

PROJECT INITIATIVE CATEGORY				
Year	Technology	Methodology	Sector Focus	Grant Scheme
<b>2007</b>	<ul style="list-style-type: none"> <li>- HVAC SWG Spin I</li> <li>- Compressed Air SWG Spin I</li> </ul>	<ul style="list-style-type: none"> <li>- EED Workshop &amp; diagnosis</li> </ul>		Industrial Best Practice Initiative
<b>2008-2009</b>	<ul style="list-style-type: none"> <li>- HVAC SWG Spin II</li> <li>- Refrigeration SWG Spin I</li> </ul> <hr/> Benchmarking Projects <ul style="list-style-type: none"> <li>- Compressed Air</li> <li>- HVAC</li> </ul>	<ul style="list-style-type: none"> <li>- EED SWG Spin I</li> <li>- Alternative Methodologies SWG Spin I</li> </ul>		Supports for Exemplar Energy Efficiency Projects (SEEEP) 2009
<b>2009-2010</b>	Special Working Groups <ul style="list-style-type: none"> <li>- HVAC SWG Spin III</li> </ul>	<ul style="list-style-type: none"> <li>- EED SWG Spin II</li> <li>- Alternative Methodologies SWG Spin II</li> </ul>	<ul style="list-style-type: none"> <li>- Food and Dairy SWG Spin I</li> <li>- Data Centres SWG Spin I</li> <li>- Commercial Buildings SWG Spin I</li> </ul>	Energy Efficiency Fund (EERF)





# Integrating



## Technology – HVAC Project



Assessments and audits  
Scale of opportunity sized  
Benchmarking across LIEN  
Desktop studies  
Standards comparison  
Ireland – Denmark Workshop

Further assessments  
Demonstration projects  
Guideline and Resources  
Case Study development  
Energy Service Challenge  
Data driven – Risk management  
processes  
Design of Experiment (DoE)  
Desktop studies

Integrate into EN16001  
Resource linkage to EN16001  
Best practice EPI's for HVAC  
Operational Control Checklist  
Operational Control Special Inv.  
Demonstration projects  
Links to other methodologies  
Case Studies  
Special Investigation prompts

Mentoring for more Demo. Projects.  
*EN16001 integration*  
*EED for new or retrofit design*  
*Operational Control Checklist*  
*AHU Control Strategies*  
*ACPH Reduction*  
*AHU Weekend shutdown*  
*EPI Review*  
*Design For Energy Management*  
EN16001 Processes  
Dissemination to wide audience  
Presentations  
Outputs directed at Energy  
Competency Centre (I2E2)

## Technology – HVAC Project

**Table 5: HVAC energy-saving identified within direct project members**

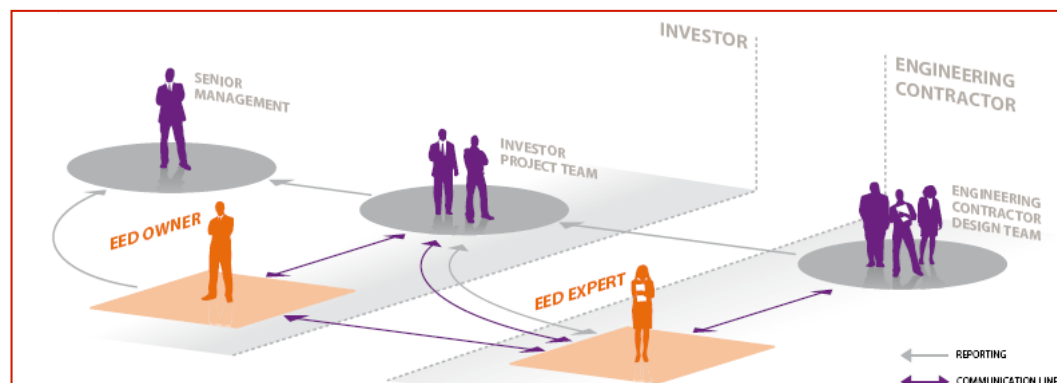
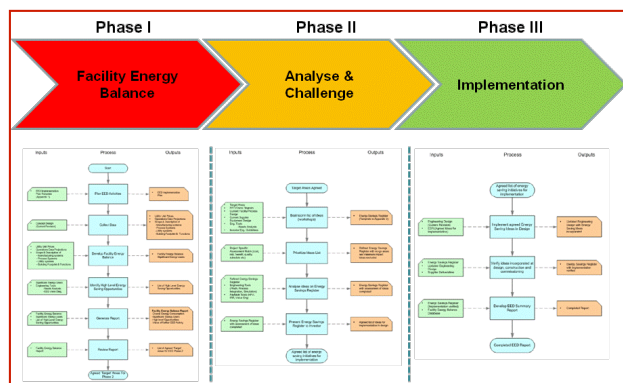
Spin	No. companies in SWG	Total Sites Energy		Total HVAC Energy		Total site savings from HVAC	CO <sub>2</sub> Abatement (tCO <sub>2</sub> )	Cost Saving (€M)
		Electrical (GWh)	Thermal (GWh)	Electrical (GWh)	Thermal (GWh)			
I	14	1000	726	356	322	16%	110,000	€15.8
II	13	842	521	336	249	16%	98,000	€17.9
III	9	227	219	89	142	20%	15,500	€2.44

# Methodology – EED Methodology

- EED Methodology
  - Large investments
  - Smaller projects
- Design for Energy Management (DfEM)
- Operations Optimisation Review using EED Methodology
- EED Training Syllabus
- EED User Manual

## EXAMPLE SUCCESS STORIES

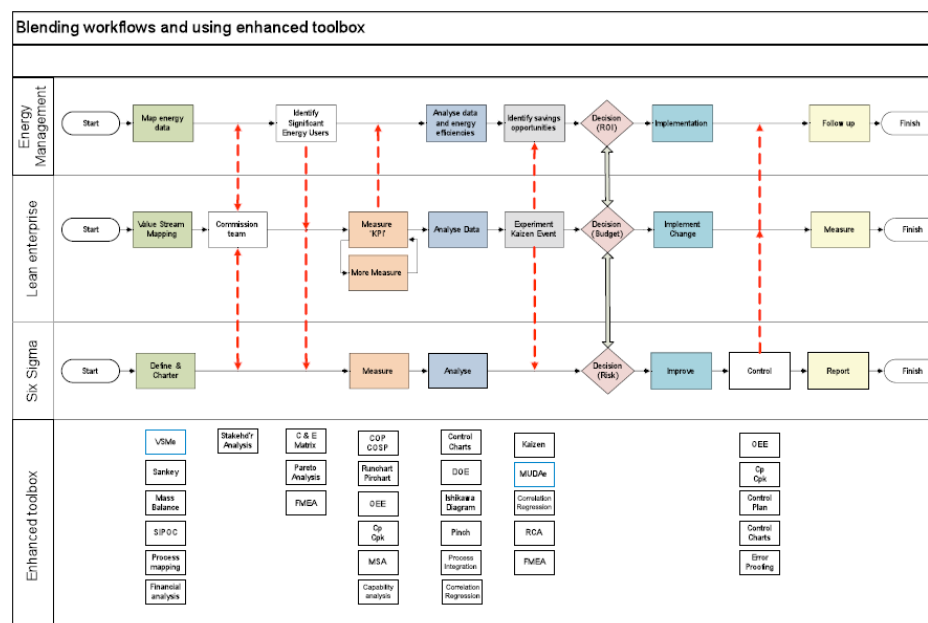
- Pfizer Inc. has recent adopted it as their Corporate Standard for all new Design project worldwide.
- GSK Biologics New Vaccines facility in Belgium is active
- Pfizer plant in Ireland realised 53% of annual energy cost from detailed design baseline
- Eli Lilly saved 22% of annual energy cost from concept design baseline
- PM Group, Irish multinational Engineering design company using it as EED Strategy

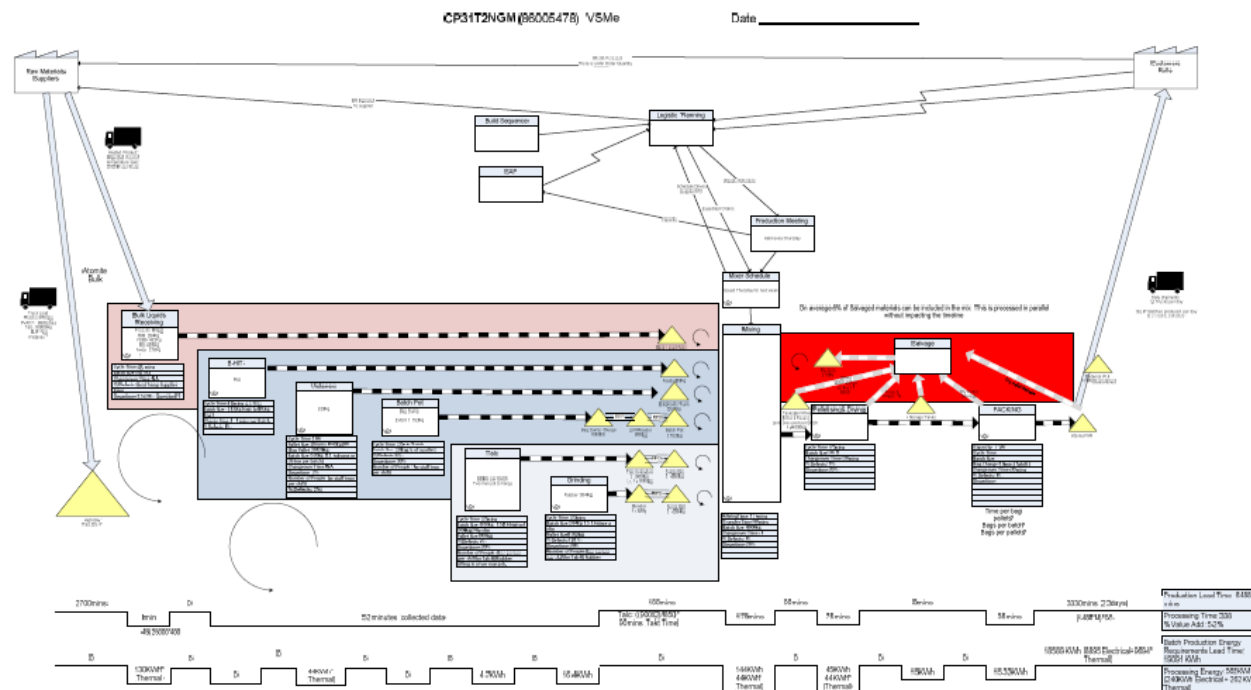


## Alternative Methodologies – Example of new initiatives

- Synergies between Energy Manager, Engineering & Operations
  - Lean Manufacturing, Six Sigma, Kaizen
- New Tool Value Stream Mapping with Energy (VSMe)
- OEE applicability as an Energy EPI
- Concept of MUDaE
- Blended Process

**1+1=3**





**Table 9: Alternative Methodologies – examples of SWG member projects**

Example projects	
<b>Astellas</b>	<b>HVAC improvement in production plant.</b> Tools used were Affinity Diagram, Structured Brainstorming and DMAIC project. Consensus-building among stakeholders was critical. DoE conducted to ensure no adverse side-effects. Resultant improvements of 230,000kWh electrical and 340,000kWh thermal energy reduction – savings of approx €40,000 per annum.
<b>Bulmers</b>	<b>Reduction in energy in wastewater treatment plant.</b> Value Stream Mapping (incorporating Energy) (VSMe) and Identification of Waste Energy MUDaE tools used to identify and reduce energy used in the process. Identified Low/no cost improvements calculated to save 186,341kWh p.a.
<b>Cadbury</b>	<b>VSMe used to identify opportunities for energy reduction.</b> Identified inventory requiring controlled temperature and humidity as a significant energy user. Batch mixing time identified as a bottleneck. Team used Kaizen techniques to reduce Finished Goods inventory by 26% and to reduce Batch Mixing Cycle Time by 12%.
<b>Connacht Gold</b>	<b>OEE analysis of separators and evaporators in dairy process.</b> The development of OEE uncovered an opportunity to use OEE as an EPI for the EnMS. Savings were realised by reducing variation in separator run-times and CIP operating times, and ensuring increasing availability of evaporator, leading to <i>substantial</i> energy savings.
<b>HJ Heinz</b>	<b>Reduction in water consumption.</b> Cross-functional team performed DMAIC project to map all water flows in the facility and to determine areas for improvement – 33 improvement opportunities were identified, including temperature and flow-rate adjustments and recovery/reuse of water. Overall reduction of 7% in water usage and 10% in energy consumption for this process.
<b>LEO Pharma</b>	<b>Energy reduction in generation and use of highly purified water (HPW).</b> Blended (Energy and Lean/Six Sigma) tools used to form a detailed process map of the generation/distribution and usage of HPW. The mapping identified restrictions in capacity; correction led to capital project avoidance of €100,000. The process also uncovered another project with potential savings of 187,500kWh electrical.
<b>Molex</b>	<b>Reduction in energy used by compressed air.</b> DMAIC project to identify opportunities for improvement. Savings of €45,000 p.a. achieved. EPIs improved to reflect production variations. Units produced/kWh has demonstrated a 30% improvement since the project was completed.
<b>Roadstone</b>	<b>VSMe analysis of ‘black-top’ (tar macadam road surface material).</b> The VSMe diagnosis developed special-investigation opportunities: <ul style="list-style-type: none"> <li>- Reduce the energy requirement in dry-and-heat processes</li> <li>- Reduce work-in-progress in the quarry</li> <li>- Reject material to be reworked</li> </ul>



## New Tool – Energy Management Maturity Model

- Assessment of Maturity of Energy Management Programme
- Leading to roadmap for Energy Management System improvement

Table 8: Energy Management Maturity Model – level descriptions

Level	Characteristics
<b>1. Emerging</b>	Contemplating an EnMS. Might have elements of EnMS deployed. Unstructured or informal approach in place. Very few participating in energy management, with limited or no tools.
<b>2. Defining</b>	Structured system in place. Management aware of energy policy; at least one senior manager has formal responsibility. There is an energy management team in place. Management system reflects requirements of Energy Management Standard.
<b>3. Integrating</b>	Energy management is now <u>mainstream</u> across organisation. Proactive management of significant energy users. Energy considerations span functional interests, with evidence of tangible site benefits.
<b>4. Optimising</b>	Energy managed very effectively, leveraging all functions, processes and infrastructure. Culture of energy management embedded. Evidence of existing practices challenged and some state-of-the-art solutions deployed. Evidence of collaboration with other participants in the value chain or other corporate functions.
<b>5. Innovating</b>	Innovative promotion of energy-management practices. Proactive energy-management culture. External resources leveraged to develop state-of-the-art industry practices and solutions. Advocating energy management to external audiences and forming new energy-management partnerships for innovation and R&D.

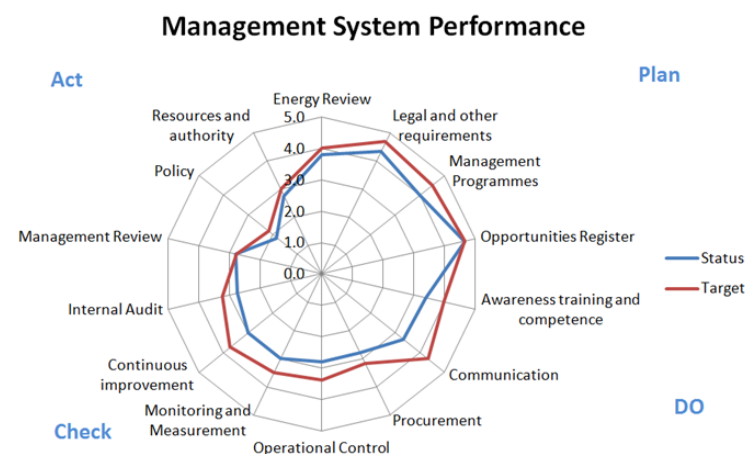
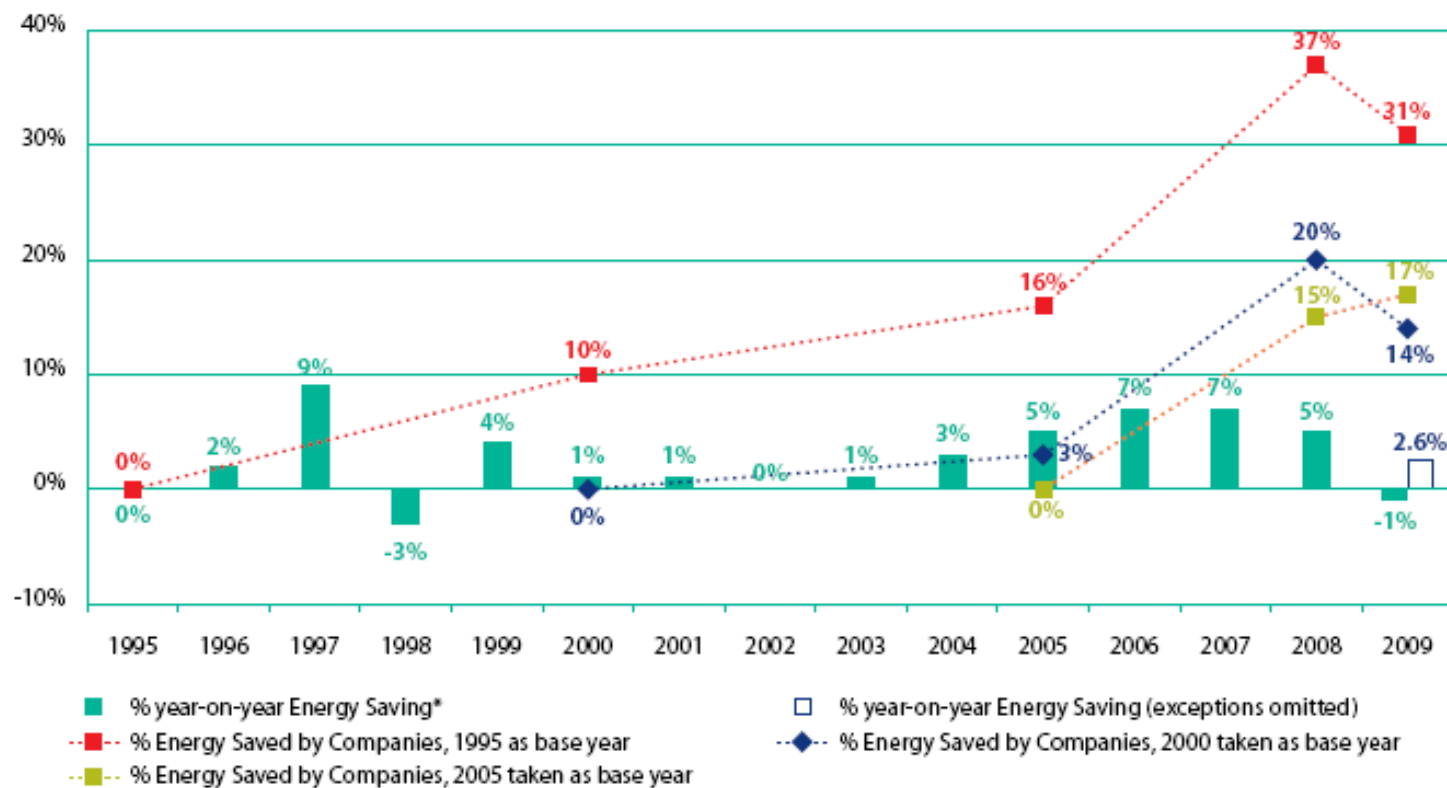


Figure 5: Energy Management Maturity Model – output example

# Large Industry Historical Performance

LIEN Historic Energy Performance

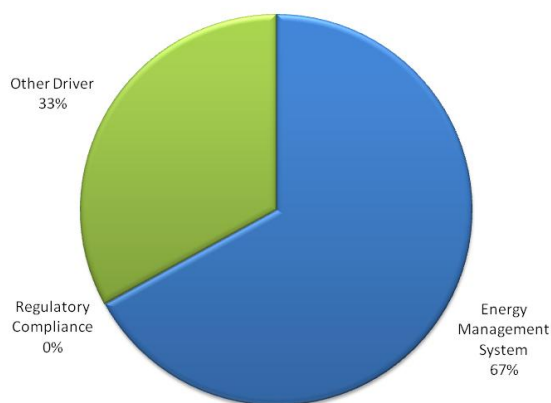


# 2009 Energy Performance - Analysis

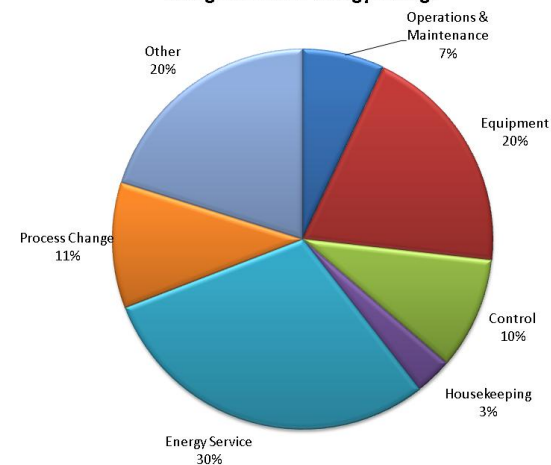
Energy Venn Diagram



Driver for Energy-saving Projects  
(kWh)

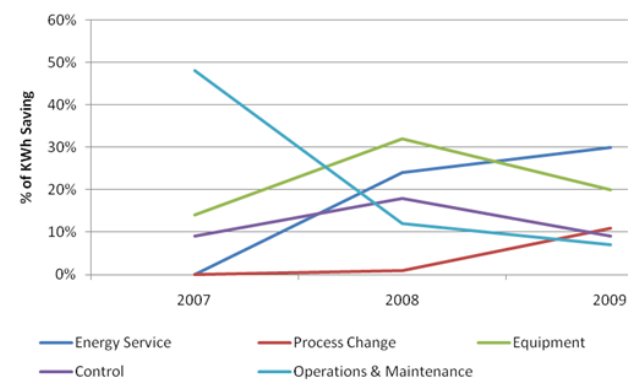


Categorisation of Energy Savings



Project Category	2007	% Projects	2008	% Projects2	2009	% Projects3
Energy Service	0%	0%	24%	10%	30%	15%
Process Change	0%	0%	1%	8%	11%	5%
Equipment	14%	30%	32%	20%	20%	20%
Control	9%	15%	18%	22%	9%	21%
Operations & Maintenance	48%	37%	12%	25%	7%	13%
Housekeeping	1%	6%	3%	8%	3%	5%
Other	28%	12%	9%	7%	20%	21%

Categorisation of Energy Savings Projects



## Discussion

- Energy Management Programmes and Strategies for large energy users will **benefit a much wider audience** including SME's and public sector. (80:20 Rule)
- Companies that have a long history of energy management are **still improving energy performance**
- Energy Management Standard with Programme support has **accelerated the pace of improvement** in recent years
- Special Investigations are critical to feed the improvement process.
- **Methods to 'dredge' for new opportunities** and initiatives are critical, energy agencies and energy services market has a role
- How can Energy Management Systems mature? will there be a **correlation** between the maturity and continuous improvement of an Energy Management System and energy performance?

Thank You !

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