RECP Training

1. RECP Concept & Practice
2. RECP Assessment
3. Motivation, Commitment & Team
4. RECP Indicators
5. Initial Assessment
6. Detailed Assessment

Module 2

RECP Assessment

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Plan-Do-Check-Act

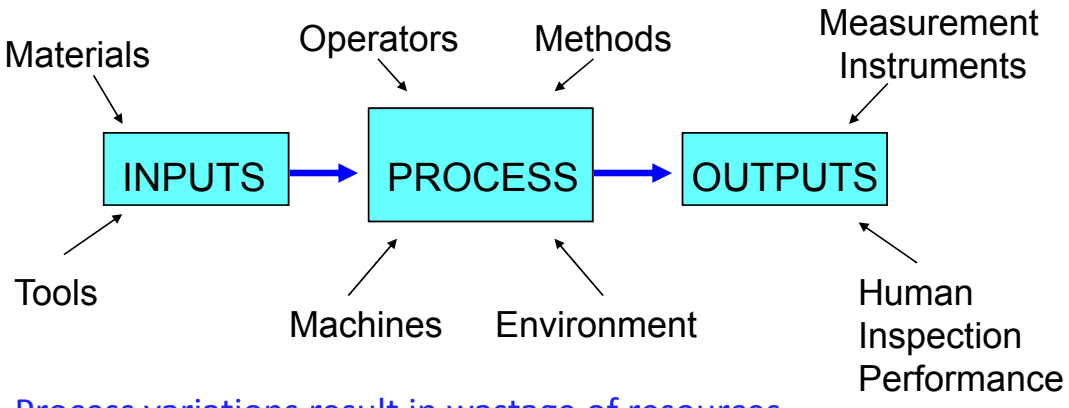
RECP should be implemented in a systematic manner to achieve optimal outcomes using solutions that are tailored to the company's operations, processes, products, management and organizational culture, and therefore fits optimally into established quality PDCA frameworks.

RECP Assessment

– Systematic planned procedure with the objective of

- Identifying ways to reduce or eliminate the generation of waste and emissions and increase process efficiencies
  - and/or ?
- Installing a system of continual environmental improvement for the company's products, services and processes

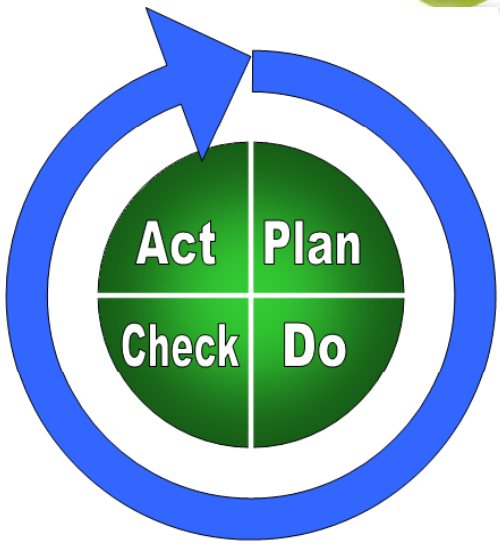
Sources of Variation in Processes



Process variations result in wastage of resources

Plan-Do-Check-Act

- Systematic procedure for controlling processes can be applied for RECP implementation



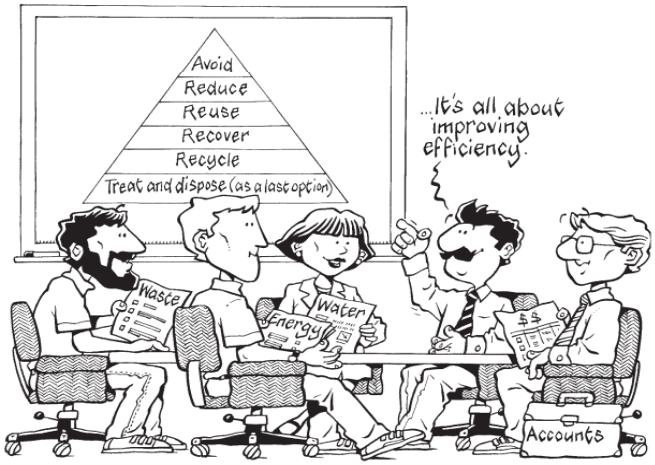
Plan

Eco-Efficiency Toolkit for Queensland Food Processing Industry, Gov of Queensland, Brisbane, 2004

Do

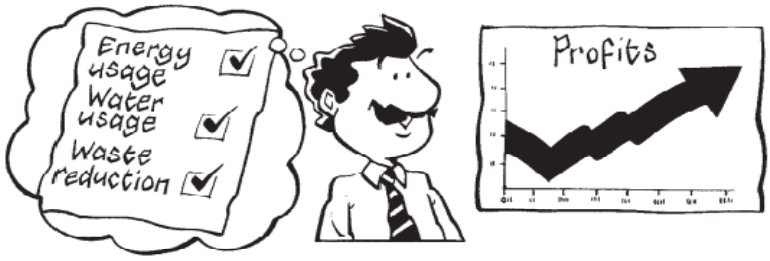
Eco-Efficiency Toolkit for Queensland Food Processing Industry, Gov of Queensland, Brisbane, 2004

Check



Eco-Efficiency Toolkit for Queensland Food Processing Industry, Gov of Queensland, Brisbane, 2004

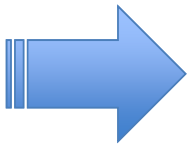
Act



Eco-Efficiency Toolkit for Queensland Food Processing Industry, Gov of Queensland, Brisbane, 2004

The Dilemma

- **P**lan
- **D**o
- **C**heck
- **A**ct

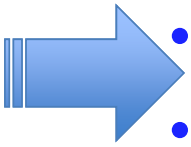


- **P**lan
- **D**efer
- **C**ancel
- **A**bandon

A phenomen often observed when benefits are intangible, drivers external, expectations fuzzy and implementation difficult

PDCA for RECP

- **P**lan
- **D**o
- **C**heck
- **A**ct



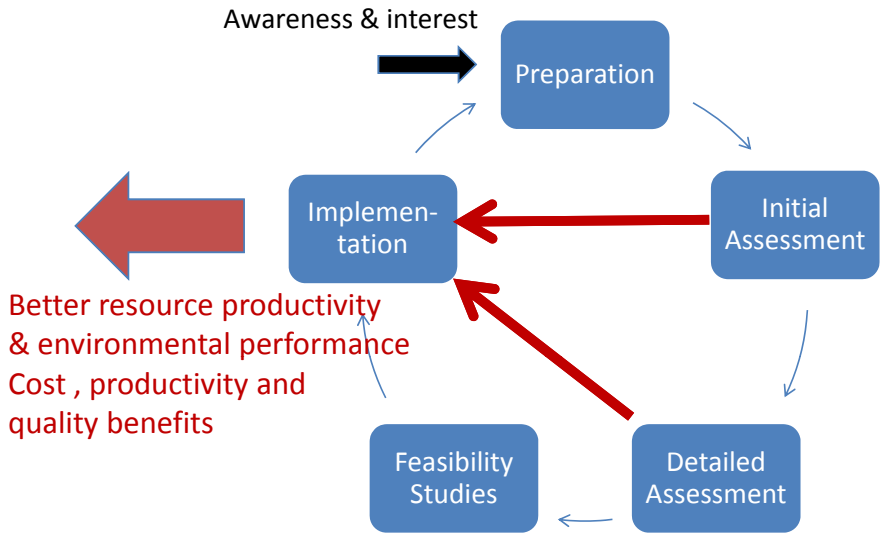
- **RECP** assessment
- **RECP** Implementation
- **RECP** indicators
- **RECP** management

Focus on business case to build momentum for RECP and integrate RECP concepts and practices into day to day management & operations

RECP Procedure

RECP procedure specifies the logical steps to be taken for the assessment of resource use and waste generation in a company, and the identification, evaluation and implementation of appropriate RECP opportunities.

Assessment Procedure



Preparation

Initial interest in RECP

PREPARATION

1. Secure management commitment
2. Organize project team
3. Establish baseline RECP profile

1. Management commitment
2. Operational project team
3. Confirmed baseline

1.1 Secure Management Commitment

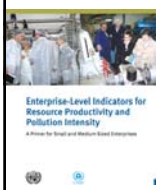
- Success of RECP assessment is contingent on
  - Determination of baseline and monitoring of impacts
  - Root source and cause analysis for resource inefficiencies and waste and emission generation
  - Option identification and factual determination of their feasibility
  - Focus on quick wins to galvanize support for mainstreaming of RECP in management, operations and investments
  - This requires data, staff time and other resources that need to be agreed to and supported by management

1.2 Organize Project Team

- Responsibility for RECP assessment is best assigned to internal team(s)
  - One Team Leader (senior staff member)
  - 2-3 team members (contributing expertise and data from different areas)
  - External advisors cannot perform RECP assessment without full participation of an internal team
    - External advisors guide the company team to success

1.3 Establish RECP Baseline

- Resource Efficiency
  - Productive output per unit of resource consumption
    - Total energy use
    - Total water use
    - Total materials use
- Pollution Intensity
  - Waste and emission generation per unit of productive output
    - Air emissions
    - Waste water volume
    - Waste quantity



Initial Assessment

Completed Preparations

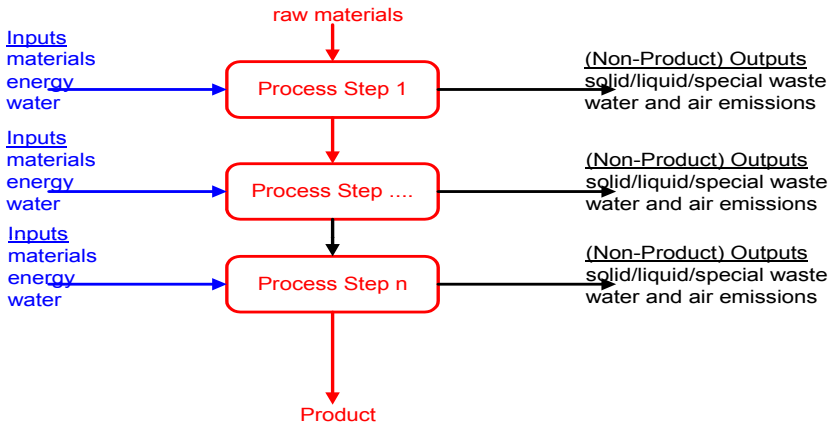
INITIAL ASSESSMENT

1. Develop flow diagram & eco-map
2. Do plant walk-through
3. Establish actions & priorities

1. Immediate RECP actions
2. Factory-wide RECP assessment focus

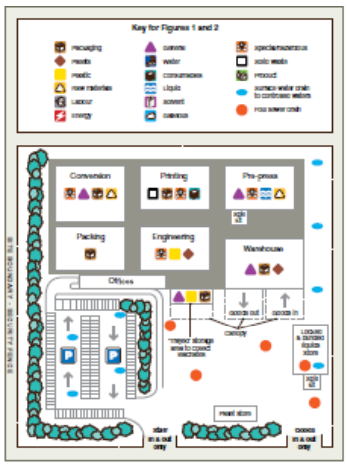
2.1 Develop Process Flow Diagram

– Use process flow diagram to identify where materials are used *(or wasted)*



2.1 Develop Eco-Map

- Using a ground plan of the factory's premises identify:
  - Where wastes are generated and stored?
  - Where air emissions occur?
  - Where waste water originates and is discharged?
  - Where chemical products are stored and used?
  - How surrounding areas could impact on company's operations (and vice-versa)?



2.2 Do Plant Walk Through

- Inspection of the plant's operations by the team:
  - Observe location and scale of waste/pollution sources
  - Observe usage of energy, materials and water
  - Appraise status of equipment and operations
  - Note general factory appearance and staff and management attitudes
  - Identify quick fixes, through e.g. improved housekeeping

2.3 Establish Actions and Priorities

- Immediate actions:
  - Low/no cost RECP options:
    - Fix leaks and spills
    - Improve switch on/off procedures
    - Improve inventory controls
    - Standardizaton of procedures
  - →Ensure immediate implementation and record benefits achieved
- Factory-wide assessment focus
  - Most significant environmental and resource issues
    - Quantity, volume and hazard
    - Associated costs
    - Risks to employees, consumers, community, etc.
  - Marked in process flow chart and factory map
  - →Recommend for detailed assessment

Take stock of achievements, lessons learned and next steps, and inform management and staff

Detailed Assessment

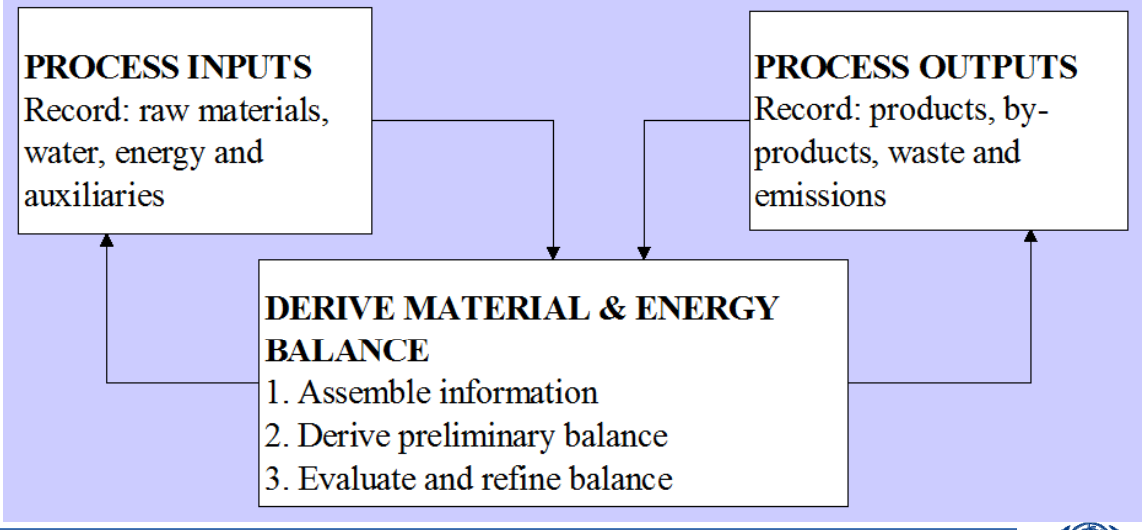
Initial Assessment Completed

DETAILED ASSESSMENT

1. Develop material and energy balances
2. Assess root causes of inefficiencies and wastes
3. Generate RECP options
4. Screen RECP options

1. Process-based quantification of wastes & inefficiencies
2. Set of potential solutions

3.1 Develop Material & Energy Balances



3.2 Assess Root Causes of Wastes and Inefficiencies

- Use standard '*cause categories*' to explore their potential impact on process efficiency and waste generation:
  - Product specifications
  - Choice and quality of input materials
  - Selection and design of technology
  - Selection and design of equipment
  - Status of process control/standard operating practices
  - Material handling, operation and maintenance procedures
  - Internal values of - components - of waste streams
  - External values of - components - of waste streams

3.3 Generate RECP Options

- Apply standard 'RECP practices' to all waste and emissions causes and process inefficiencies
  - Product Modification
  - Input Material Substitution
  - Technology Change
  - Equipment Modification
  - Better Process Control
  - Good Housekeeping
  - On Site Recycling
  - Useful By-Product

3.4 Screen RECP Options

- Organise RECP options in consistent packages
  - Organise options per unit operation
  - Evaluate obvious mutual interferences
  - Implement obviously feasible options
  - Remove obviously non-feasible options
- Preliminary evaluation of remaining options
  - Expected reduction of waste/emissions
  - Expected economic feasibility
  - Expected technical feasibility
  - Impact on operability, quality and staff
- Determine next steps
  - RECP options for immediate implementation
  - RECP options to be evaluated in detail
  - RECP options to parked

Feasibility Studies

Detailed assessment completed

FEASIBILITY STUDIES

1. Technical & operational evaluation
2. Economic evaluation
3. Environmental evaluation

1. Listing of achievable RECP options
2. Documentation of projected benefits

4.1 Technical Evaluation

- Consists of
  - Identification and evaluation of required new equipment and necessary changes in existing plant infrastructure
    - » Will it work?
    - » What do we have to do to make it work?
  - – Leading to an engineering design for the project, so that the investment can be costed
  - Assessment of the impact of the respective option on material and energy balance
    - » What will we gain?
  - – Enabling a before-after comparison, providing the basis for the quantification of operational benefits (cost savings and revenue gains)

4.2 Economic Evaluation

- Major steps in financial analysis on basis of discounted cash flows
  - Establish baseline
    - Gather existing information
  - Calculate the costs
    - Determine the capital or investment cost of the project
    - Establish the lifetime of the equipment and compute annual depreciation
  - Calculate the benefits
    - Determine revenue implications of the project
    - Estimate any changes in operating costs
  - Calculate incremental cash flows
  - Assess the project's financial viability using various decision rules

4.3 Environmental Evaluation

- Evaluate environmental improvements
  - Reduction of the amount of pollutants generated
  - Reduction of toxicity of emissions or waste generated
  - Reduction of energy consumption
  - Reduction of material consumption
  - Reduction of water consumption
  - Reduction of pollutant load in product

Feasibility Studies

- Integrate results of technical, economic and environmental evaluation
  - Rule out options that do not meet hurdle rate or have doubtful technical and environmental impact
  - Select among feasible options
    - Compatible options: implement in order of decreasing profitability
    - Exclusive options: implement option with highest profitability
  - Document properly to facilitate fund raising and monitoring and evaluation of results

Implementation

Feasibility studies completed

IMPLEMENTATION

1. Plan and implement feasible options
2. Monitor RECP benefits
3. Integrate RECP in management

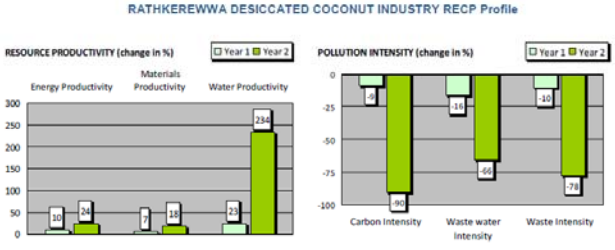
Continued improvements in resource productivity and environmental performance

5.1 Plan and Implement RECP Options

Option	*Responsible person*	*Deadline for implementation*	*'Milestones'*
• *Rinse solvent reuse*	*Supervisor*	*2 months*	*monitoring programme (6 months duration)*
• *Insulation (steam and condensate)*	*Chief technician*	*3 months*	
• *Reuse cooling water for process bath make up*	*Technical Supervisor*	*2 months*	*modification of working instructions (4 months)*

5.2 Monitor RECP Benefits

1. Document total benefits achieved
   - Total investment and (accumulated) annual savings
   - Accumulated and/or annual environmental benefits
     - » Energy, water, materials conservation, waste and emission reduction
2. Track progress with RECP indicator profile



5.3 Sustain RECP

- What matters most to mainstream RECP in company's management and operations?
  - Management accounting reflecting total waste costs
  - Continued employee participation (including reward for suggestions)
  - Mainstreamed leadership
  - Anchoring in (environmental and/or quality) management system

Creativity and Innovation

Even though good results can generally be achieved with replication of RECP options demonstrated elsewhere, the benefits of RECP assessment stem from the cooperative team work which leads to creativity and innovation throughout the workplace.

Barriers to Creativity

- Routines and habits
  - It simply is like that; it is right; ...
- Wrong categories
  - Generalizations, wrong presumptions
- Premature evaluation
  - Too early criticism, typical idea killers
- Emotional insecurity
  - Fear of exposing oneself
- Pressure of conformity
- Cultural barriers
  - Culture of logical and conclusive thinking, no intuition
- Working environment
- Intellectual barriers

Enablers (?) for Creativity

Individual factors

- Personality
- Age
- Knowledge
- Motivation and willingness to take risks
- Stress

Organizational factors

- Hierarchy
- Autonomy
- Management style
- Information, communication
- Working environment
- Uniformity of procedures

Brainstorming

Four principles

- Any kind of criticism is strictly forbidden!
- There are no limits to imagination
- Quantity comes before quality
- Take up the ideas of others and develop them

Type 1: Random Creativity

- Assumption
  - The more ideas are generated the greater the chance that a brilliant one will surface
    - Brainstorming etc
    - Widely endorsed
  - In practice most effective for identifying common ground

- Application
  - Targeted Eco-Efficiency brainstorm:
    - Reduce material intensity
    - Reduce energy intensity
    - Reduce toxic dispersion
    - Enhance material recyclability
    - Maximise renewables
    - Extend product life
    - Increase service intensity

Van Berkel, R. (2007), *Eco-Innovation: opportunities for advancing waste prevention,* IJET&MVol 7, No 5-6, pg 527-550

Some Examples

- Reduction of Material Intensity
- Reduction of Energy Intensity
- Reduction of Toxic Dispersion
- Enhanced Material Recyclability
- Sustainable Use of Renewables
- Extended Product Durability
- Increased Service Intensity

Sumitomo Chemical: Sustainable Chemistry

- Catalyst process for propylene oxide production (avoids generation of styrene monomers and conserves energy and materials)
- Oxidation technology for hydrochloric acid (recovery of chlorine in chemical synthesis processes)
- Hydroperoxide process for resorcinol production (low waste process for rubber adhesive)

Denso Engine Plant

- Staff designed and built waterwheel and alternator to generate electricity from 16 m drop of run-off water from carpark

Sompo Insurance

Encourage environmental initiatives of its customers:

- 1.5 % premium discount for eco-cars
- Incentive for repair shops to use recycled parts
- Weather derivates for solar and wind energy

Van Berkel, R. (2007), *Eco-Innovation: opportunities for advancing waste prevention,* IJET&MVol 7, No 5-6, pg 527-550

Type 2: Replicate Creativity

- Assumption
  - Replication of environmental features to do the same or even better than a benchmark environmental product or process
    - Benchmarking
    - Widely practiced in process and product design
  - Not necessarily addressing the specific root causes of environmental impact
- Application
  - Eco-Design Strategies
    - New concept development
    - Selection of low impact materials
    - Reduction of materials use
    - Optimisation of production techniques
    - Optimisation of distribution system
    - Reduction of impact during use
    - Optimisation of initial life time
    - Optimisation of end of life system

Supported by checklists, guidelines etc.

Van Berkel, R. (2007), *Eco-Innovation: opportunities for advancing waste prevention,* IJET&MVol 7, No 5-6, pg 527-550

Some Examples

- New Concept
- Materials Reduction
- Low Impact Materials
- Optimised Production Techniques
- Optimised Distribution System
- Reduced Impacts during Use
- Optimised Initial Lifetime
- Optimised End of Life System

Sony
Light weight, hand and solar powered, integrated emergency radio, phone charger and torch

Patagonia
Fleece jackets and jumpers made of Post Consumer Recycled PET from soda bottles

WIN Stadium
Stadium seating of Sydney's Aquatic Centre demounted and re-used in WIN Stadium in Wollongong

Van Berkel, R. (2007), *Eco-Innovation: opportunities for advancing waste prevention,* IJET&MVol 7, No 5-6, pg 527-550

Type 3. Systemic Creativity

- Assumption
  - Inventiveness can be systematised by following templates derived from successful product developments
    - Gaining recognition
- Application
  - Creativity templates
    - Replacement
    - Displacement
    - Component control
    - Division
    - Attribute dependency

Van Berkel, R. (2007), *Eco-Innovation: opportunities for advancing waste prevention,* IJET&MVol 7, No 5-6, pg 527-550

Some Examples

Replacement	Classic: Table mounted leg-less high chair Eco-Product: All in one: printer, scanner, fax, copier
Displacement	Classic: Calendar without days of week Eco-Product: Paints without solvents
Component Control	Classic: Anti-dandruff shampoo Eco-Product: Entropy carpet tiles
Division	Classic: Multi-blade shaving Eco-Product: Hybrid car
Attribute Control	Classic: Rough poles that build strength in icy conditions Eco-Product: Phase change wall paints

Van Berkel, R. (2007), *Eco-Innovation: opportunities for advancing waste prevention,* IJET&MVol 7, No 5-6, pg 527-550

Lessons Learned

- RECP assessments are effective if these have
  - Practical value
    - Immediate operational economic, environmental and technical benefits
    - ➔ early use of RECP indicators
  - Technical impact
    - Structural impact on the way technology and equipment are being selected
    - ➔ do not limit to low hanging fruits
  - Systemic impact
    - Business systems and organisation strengthened to provide better incentives
    - ➔ environmental management accounting and management systems

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Thank You

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