hkpc 生產力局 綠色及智慧生活

# Smart Energy Solutions: Transforming Manufacturing through Energy-Efficient Technologies
# 智能能源解決方案：透過能源節能技術轉變製造業


Dr. Michael CHING 程永鏗博士

Head, Air and Energy Innovation, HKPC

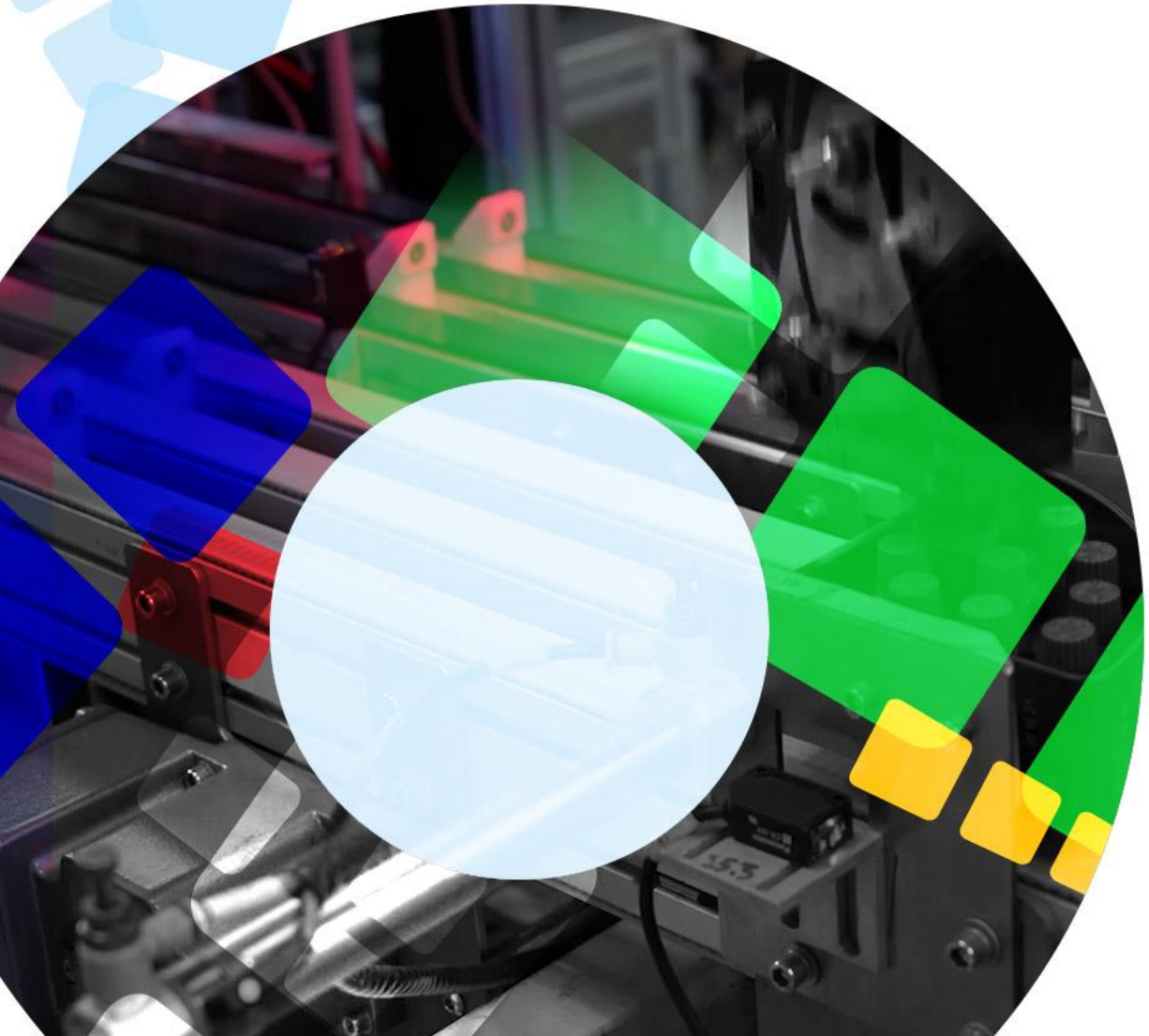
香港生產力促進局空氣及能源創新主管


2025年5月30日

# Dr. Michael CHING 程永鏗博士

Head, Air and Energy Innovation, HKPC
香港生產力促進局空氣及能源創新主管

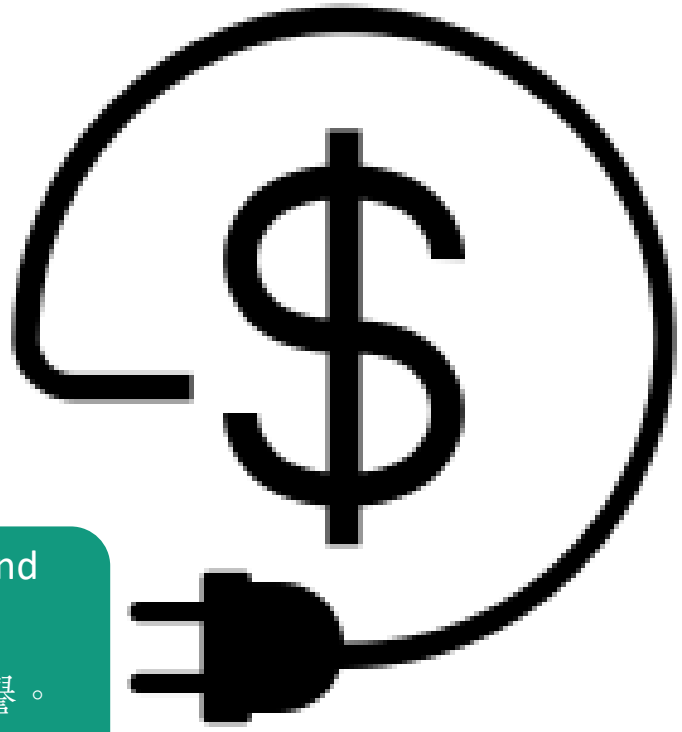
- ✓ Over 20 years of experience in energy management, smart energy solutions, and engineering
  擁有逾10年能源管理及智能能源方案經驗
- ✓ Adjunct Assistant Professor at The University of Hong Kong
  香港大學客席助理教授
- ✓ Former Branch Head of Energy Consulting at CLPe Solutions Limited and to led projects in energy audits and retro-commissioning
  曾任職於中電源動，負責能源審核及重新校驗



# Content 目錄

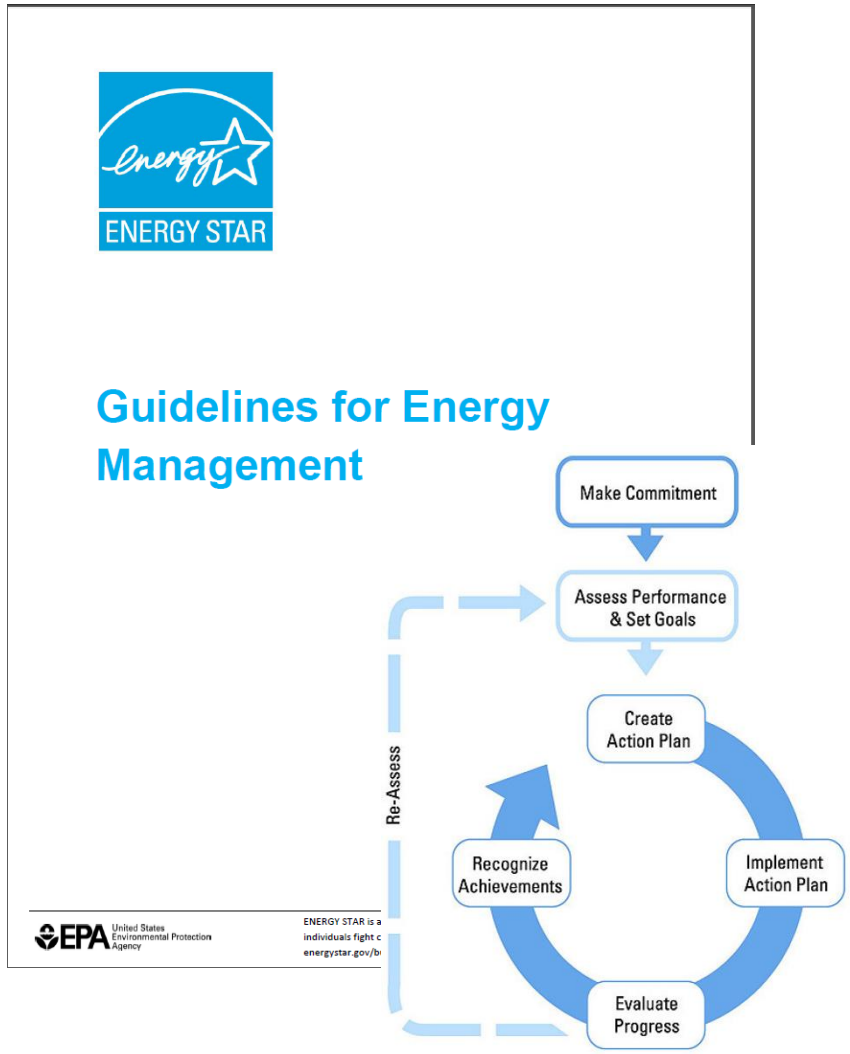
# 01 The Business Opportunity for Energy Efficiency
# 能源效率的商業機會

- To **SAVE** 5–7% of manufacturing expenses.
  節省 5–7% 的製造開支。



- To **reduces** long-term risks, **stabilizes** costs, and **improves** environmental reputation.
  **降低**長遠風險，**穩定**成本，並**提升**環保聲譽。

# 01 Key Steps for Energy saving
# 節能減排的重要步驟




**1. Commit and Organize**
**承諾與組織**

- Appoint an Energy Director and form a cross-functional energy team. Establish a clear energy policy supported by management.
  指派能源主管，成立跨部門能源團隊。制定明確的能源政策，並獲管理層支持。

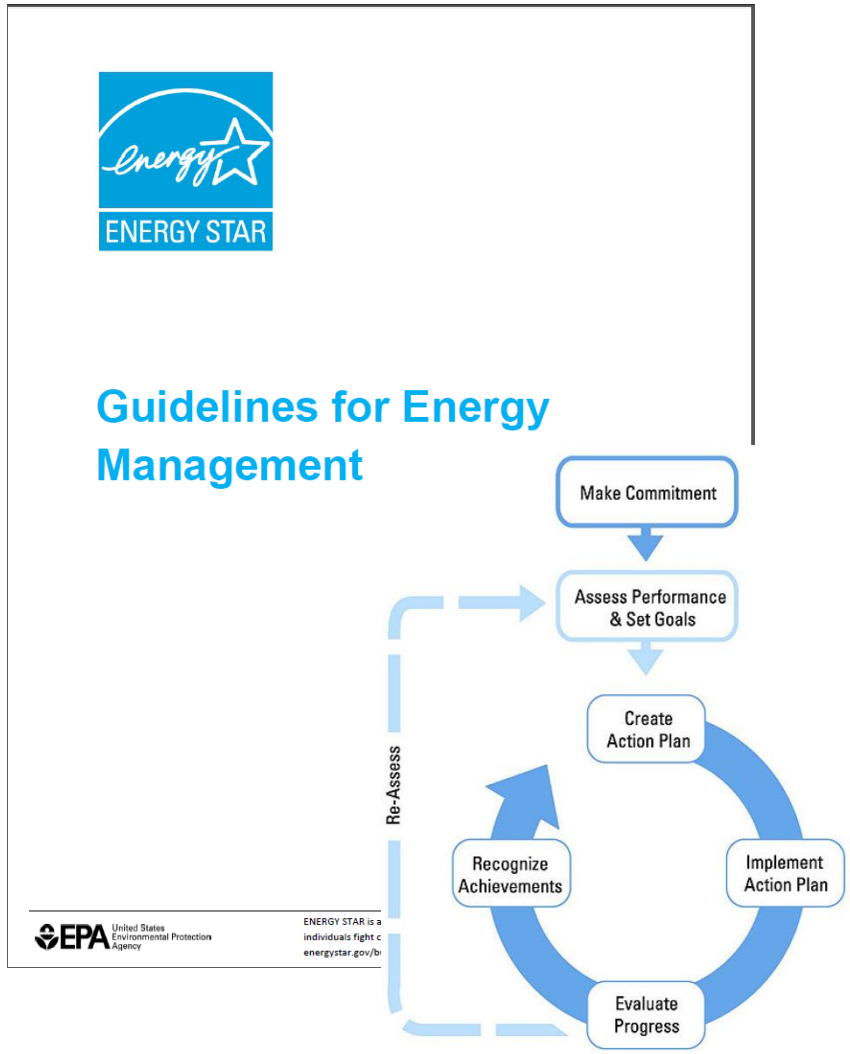
**2. Assess and Benchmark**
**評估與基準比較**

- Gather detailed energy data, benchmark against industry standards using tools like ENERGY STAR Plant EPIs, and conduct energy audits to find inefficiencies.
  收集詳細能源數據，運用如 ENERGY STAR 工廠能源績效指標（EPI）等工具，與行業標準進行基準比較，並進行能源審核以找出低效環節。

**3. Commit and Organize**
**設定可量度目標**

- Define specific energy reduction targets (e.g., kWh per kg of fabric) at plant and process levels.
  於廠房及製程層面，訂立具體的能源減排目標（例如每公斤布料耗電量〈kWh/kg〉）。

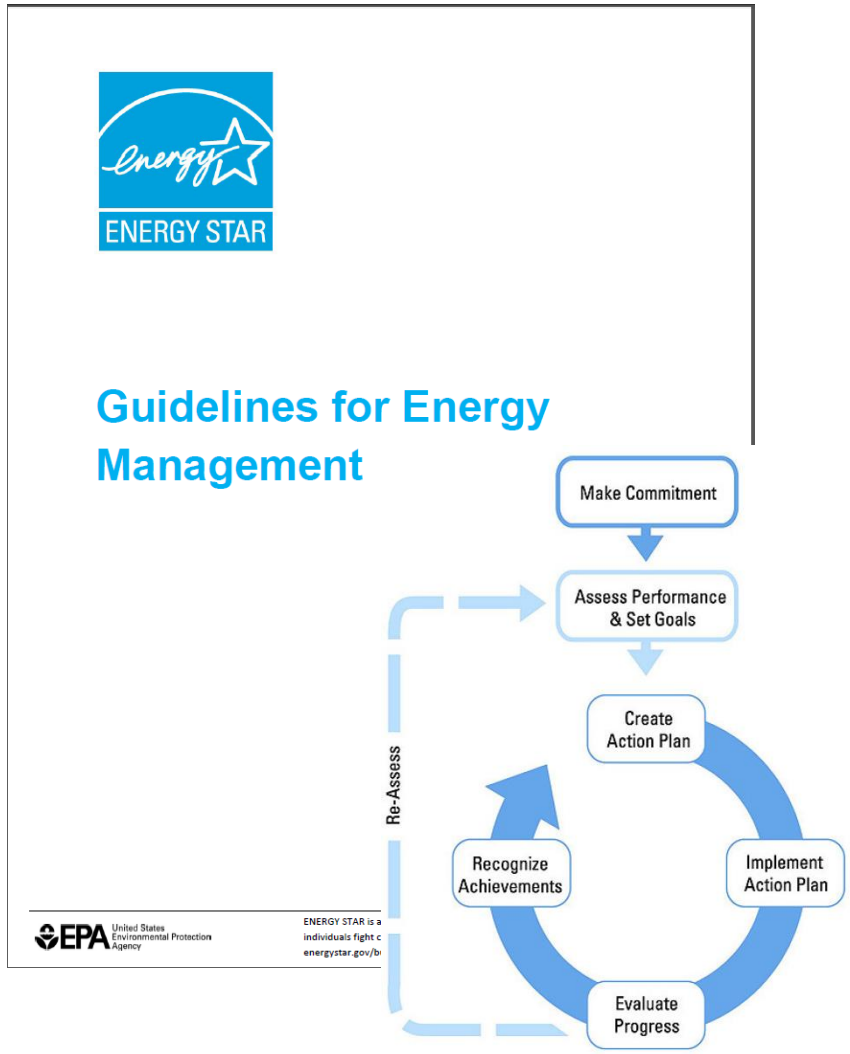
# 01 Key Steps for Energy saving
# 節能減排的重要步驟




4. Action Plan & Upgrade
行動計劃及技術升級

- High-efficiency motors, variable speed drives, and advanced process controls.
  高效能馬達、變頻驅動及先進製程控制系統。
- Optimized compressed air systems.
  優化壓縮空氣系統。
- Integrate renewable energy (solar, biomass) and consider electrification for heating needs.
  融入可再生能源（如太陽能、生質能），並考慮加熱用電氣化。

# 01 Key Steps for Energy saving
# 節能減排的重要步驟




**5. Engage & Train Staff**
**員工參與與培訓**

- Raise awareness, provide training, and incentivize energy-saving behaviors across all levels.
  提升全體員工的節能意識，提供培訓，並推行激勵措施，鼓勵節能行為。

**6. Monitor & Improve**
**監察與持續改進**

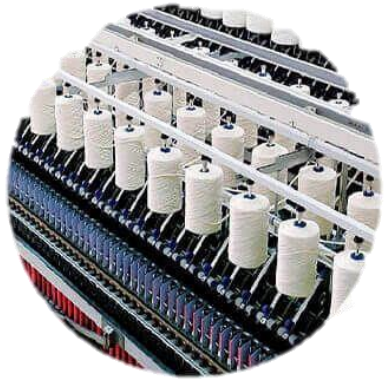
- Track progress with centralized systems, review results regularly, and update action plans as needed.
  利用集中系統追蹤進度，定期檢討成效，並根據需要更新行動計劃。

**7. Recognize Achievements**
**表揚成就**

- Celebrate successes internally and seek external recognition (e.g., ENERGY STAR certification) to motivate continuous improvement.
  於內部慶祝成功，並爭取外部認可（如 ENERGY STAR 認證），以激勵持續改進。

# 02 Production Process and Energy consumption in the Textile industry
# 紡織業的生產流程和能源消耗

Spinning
紡紗



Weaving
編織

Dyeing + Printing + Finishing
染色+印花+整理

Cutting and Sewing
剪裁和縫紉

# 02 The Energy Saving Opportunities in the Textile industry
# 紡織業的節能機會

**01. Wastewater pre-treatment**
**污水前處理**

**Use of energy efficient oil-free magnetic-bearing centrifugal blower in aeration process for waste water treatment.**
**污水處理曝氣工序採用無油磁懸浮離心式鼓風機。**

**Average Energy Saving**
**平均節能**

**23 %**

**02. Compressed air system**
**壓縮空氣系統**

Replacing multiple standalone compressed air network with centralised compressed air network employing central controller and variable speed drive.
壓縮空氣系統由獨立分佈式改為中央系統並採用中央控制系統及變頻器。

**18 %**

**04. Central air conditioning**
**空調系統**

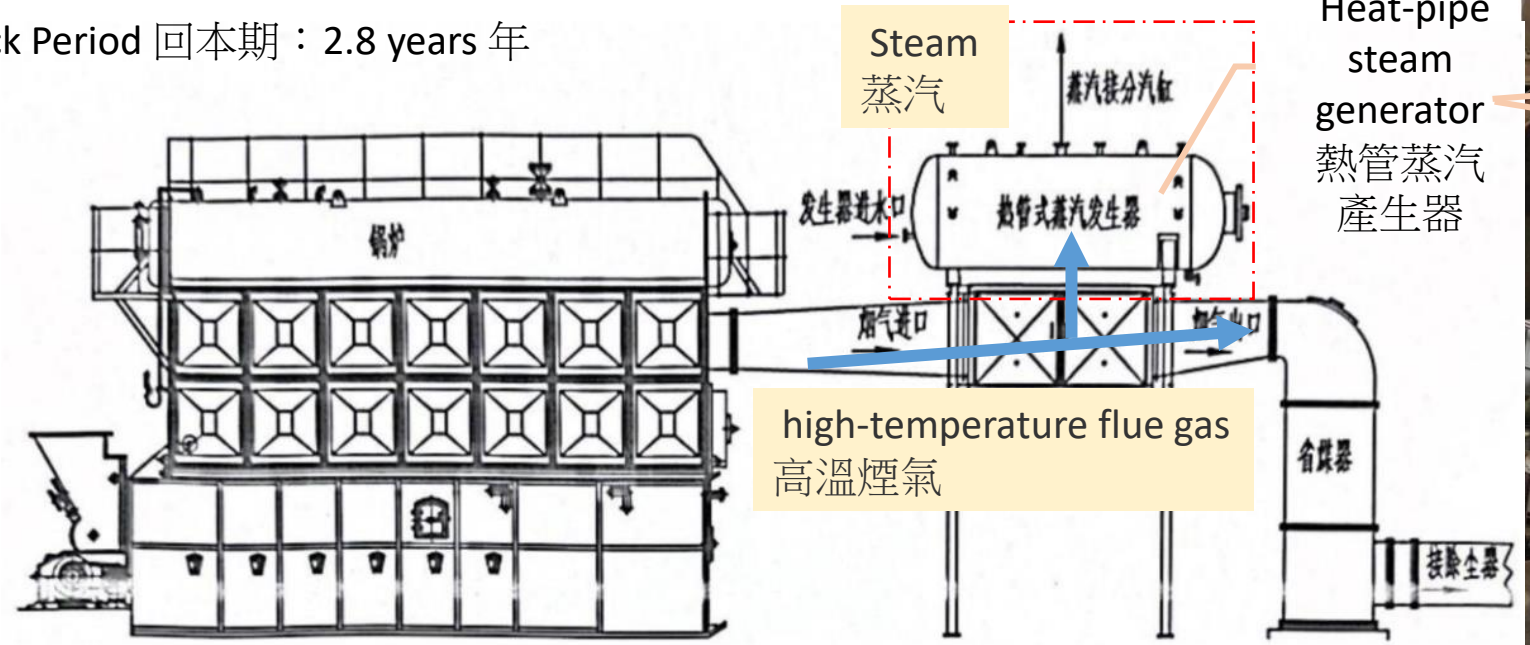
**Adoption of central control and monitoring system (CCMS) to enhance centralised air-conditioning system operation efficiency and save energy.**
**採用中央控制及監察系統以提升中央空調系統運作效率及節省能源。**

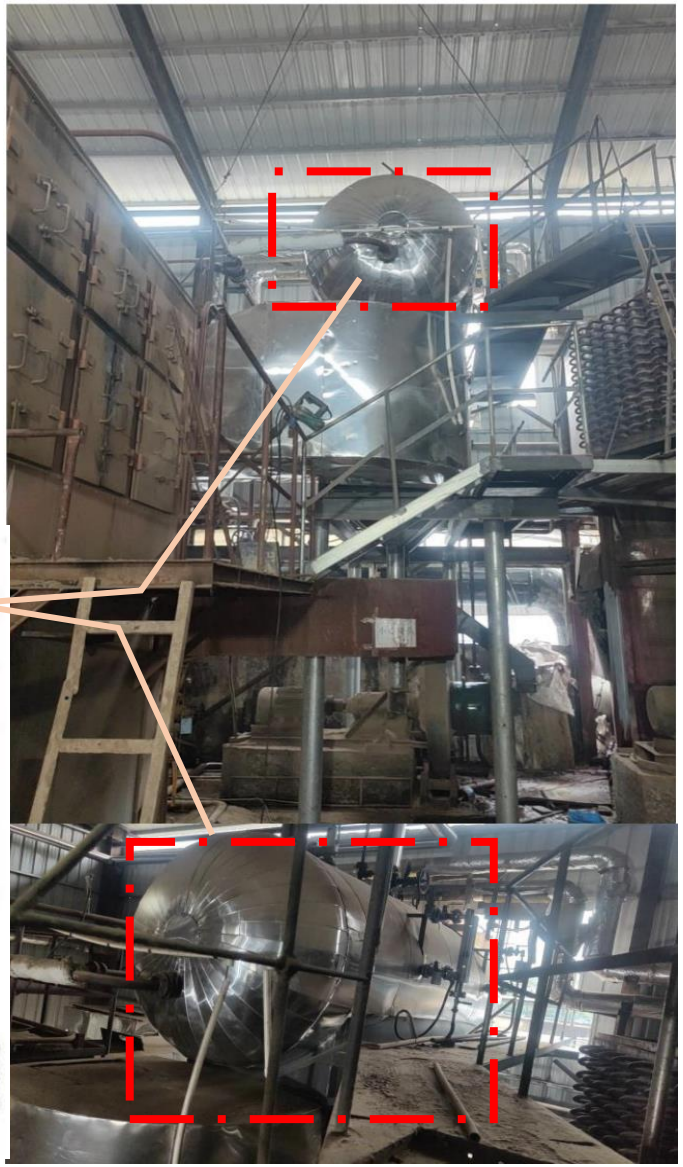
**25 %**

# 03 Case Study Sharing - Improve boiler operating efficiency
# 案例分享 - 改善鍋爐運作效率

**Key Achievements 主要成就：**

- Annual Biomass Savings 每年節省生物質用量：234 tons 噸
- $CO_2$ Emissions Reduction 二氧化碳減量：197.6 tons per year 每年/噸
- $SO_2$ Emissions Reduction 二氧化硫減量：75.6 kg per year 每年/公斤
- NOx Emissions Reduction 氮氧化物減量：241 kg per year 每年/公斤
- Payback Period 回本期：2.8 years 年

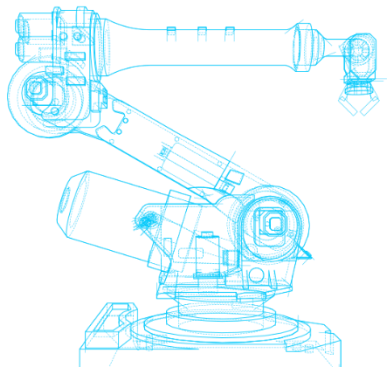


# 03 Case Study Sharing - Improve Knitting operating efficiency
# 案例分享 - 改善編織運作效率

**Key Achievements 主要成就：**

- Annual Electricity Savings 每年節省電力： 600,000 kWh 千瓦時
- $CO_2$ Emissions Reduction 二氧化碳減量： 500 tons per year 每年/噸
- Payback Period 回本期: 1.6 years 年

# 03 Case Study Sharing - Thermal insulation coating for dye vats
# 案例分享 - 染缸保溫塗層

**Key Achievements 主要成就：**

- Annual Steam Savings 每年節省蒸汽：8,000 tons 噸
- $CO_2$ Emissions Reduction 二氧化碳減量：2,500 tons per year 每年/噸
- Payback Period 回本期：0.2 years 年

| 溫差/速率比較 | 做保溫塗料前 | | 做保溫塗料後 | | 保溫前後蒸汽差異 | | | |
|---|---|---|---|---|---|---|---|---|
| | 常溫升至 92 度 耗用蒸汽(T) | 常溫升至 132 度 耗用蒸汽(T) | 常溫升至 92 度 耗用蒸汽(T) | 常溫升至 132 度 耗用蒸汽(T) | 常溫升至 92 度 | | 常溫升至 132 度 | |
| | | | | | 蒸汽 (T) | 百分比 | 蒸汽 (T) | 百分比 |
| (1T 缸入水 1500 升) | 0.33 | 0.64 | 0.21 | 0.56 | 0.12 | 36.4% | 0.08 | 12.5% |
| (2T 缸入水 3000 升) | 0.44 | 1.16 | 0.3 | 0.79 | 0.14 | 31.8% | 0.37 | 31.9% |
| (3T 缸入水 4500 升) | 0.68 | 1.15 | 0.43 | 0.88 | 0.25 | 36.8% | 0.27 | 23.5% |
| (4T 缸入水 6000 升) | 0.68 | 1.39 | 0.45 | 0.96 | 0.23 | 33.8% | 0.43 | 30.9% |
| (6T 缸入水 9000 升) | 0.72 | 1.56 | 0.5 | 1.08 | 0.22 | 30.6% | 0.48 | 30.8% |
| 平均 | | | | | | 33.9% | | 25.9% |

Steam Saving%
蒸汽節省百份比

# 謝謝

## Hong Kong Productivity Council
## 香港生產力促進局

HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong
香港九龍達之路78號生產力大樓
Tel: +852 2788 5678  Whatsapp: +852 5283 4131
www.hkpc.org