Mr. Rusmanto ST.MT

PT. Langgeng Ciptalindo

- Registered as Certified Industry Energy Auditor by Badan Nasional Sertifikasi Profesi (BNSP) with registered number of 70209 2612 0013698 2024.
- Actively as Instructor for Steam and Energy Conservation.

Energy audit to reach the Sustainability goals

GRUNDFOS

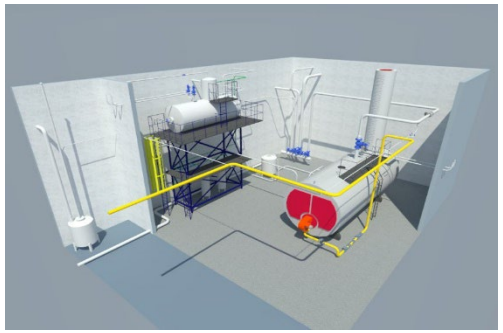
Possibility in every drop

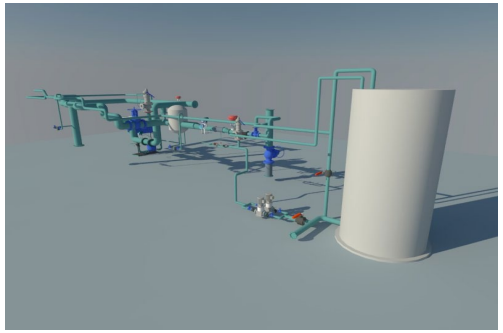
PT. LANGGENG CIPTALINDO
www.langgengciptalindo.com
12 Years Your Sustainable Partnership

GRUNDFOS

ENERGY EFFICIENCY PROJECTS FOR SUSTAINABLE ENERGY SUPPLY

It all starts with an Energy Audit





Developing & Implementing Approach

Contents

- Company Profile
- Government Regulation
- Energy Audit
- Energy Efficiency Project
- Key Succes

Contents

- **Company Profile**
- Government Regulation
- Energy Audit
- Energy Efficiency Project
- Key Succes

Who we are

Welcome to *LANGGENG GROUP*

PT. LANGGENG CIPTALINDO is energy services company (ESCo) that is capable in **developing** and dealing with packaged **implementation** on plant energy performance to comply regulation and compliance. We have been focusing on many strategic industrial sectors such as Food & Beverages, Sugar Refinery, Pharmaceuticals, Tobacco, Hotels, Feed Mill, Household Chemical, and other energy users. Having long experience practically in application engineering and energy auditor mainly in design and build, piping and installation, and fabrication, we believe that we are able to bring more benefit and best solution to the client.

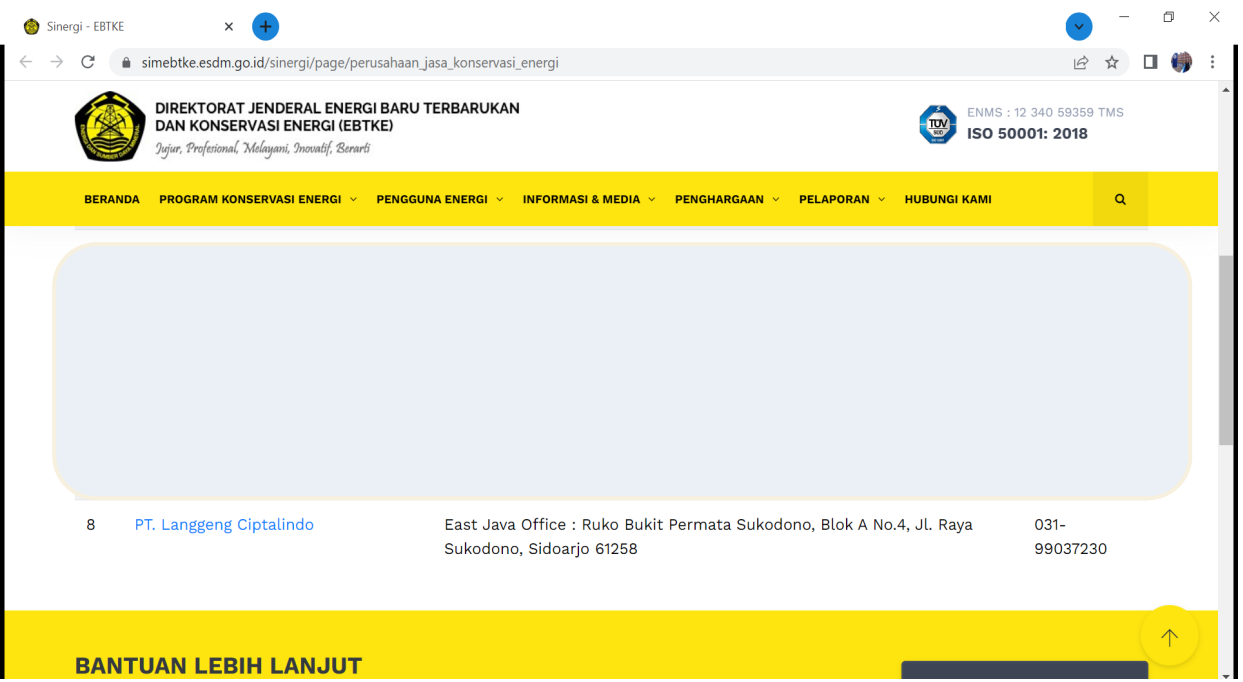
A simple philosophical approach…

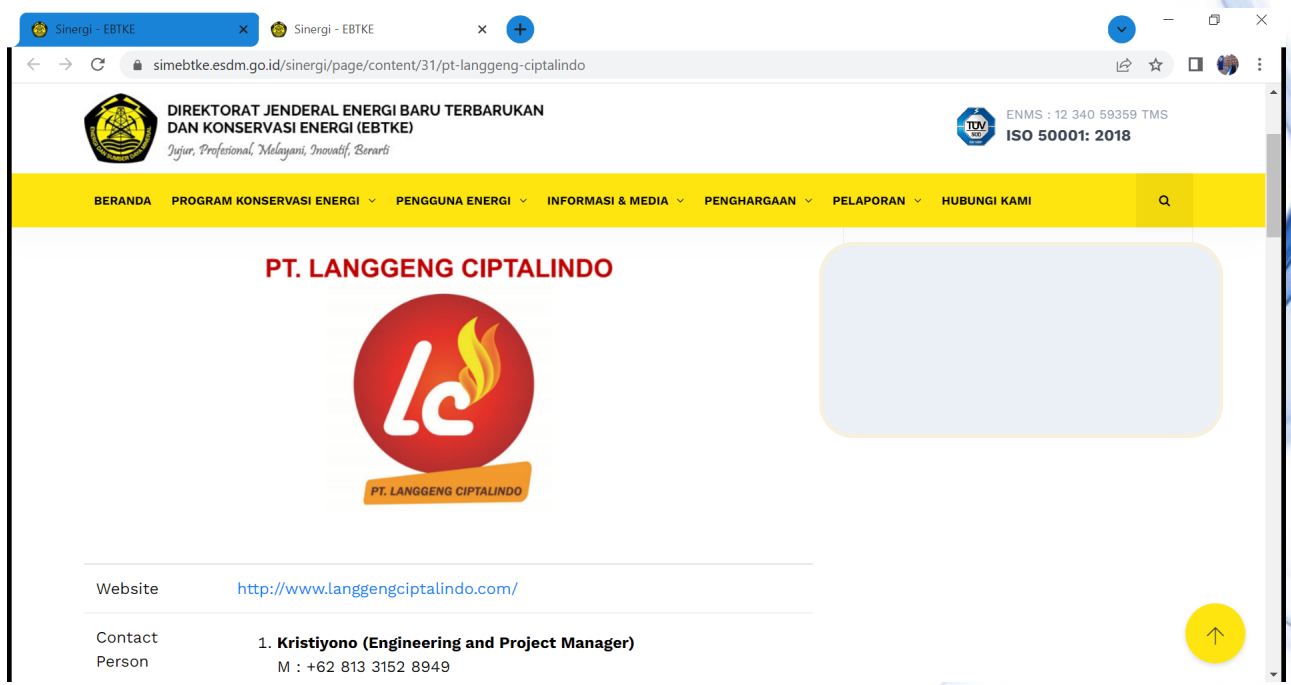
Developing and Implementing

that confirming clearly our strong commitment in delivering proper sustainable solutions for all customers.

Our Website

https://simebtke.esdm.go.id/sinergi/page/perusahaan_jasa_konservasi_energi
https://simebtke.esdm.go.id/sinergi/page/content/31/pt-langgeng-ciptalindo
https://www.langgengciptalindo.com





Our Capabilities

Engineering Services

- Design & build new steam plant system and other utilities
- Improve and optimize steam system performance
- Energy service company (ESCO) in energy and cost saving turnkey project

Construction & Fabrication

- Supply and install for steam & process fluids piping & insulation
- Plate work (tank/vessel, hopper, ducting, chimney, platform, and etc)
- Installation, testing and commissionong of mechanical & electrical equipment

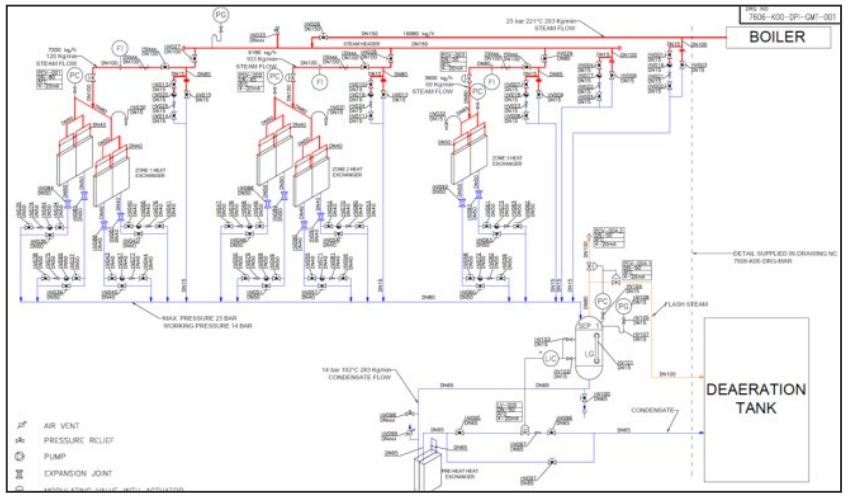
Packaged System Products

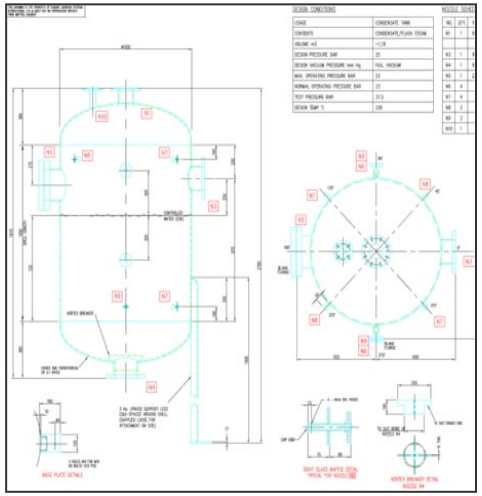
- Heat recovery system using heat exchanger packaged solution
- Electric steam boiler and heat pump technology solution
- Automation and system integrator for energy monitoring using HMI-PLC

Audit & Training

- Energy audits (thermal and electricity) with certified energy auditor
- Comprehensive steam audits and process fluids piping on existing plant
- Energy & water conservation training with certified energy auditor

Engineering Services



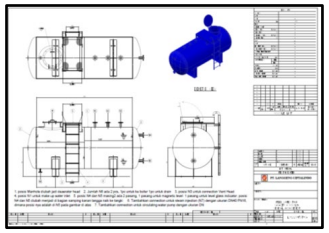


Newspaper : Kompas, 28 October 2014

Scope of project :

1. Detailed Engineering Design (DED) of New Steam System
2. Project Implementation & Installation of Steam Piping System
3. Project Management

Packaged System Products



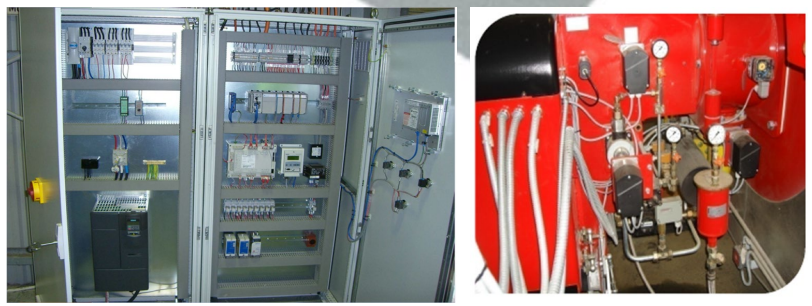
Deaerator Tank

Heat Recovery System

Condensate Recovery System

Improved Steam System Performance

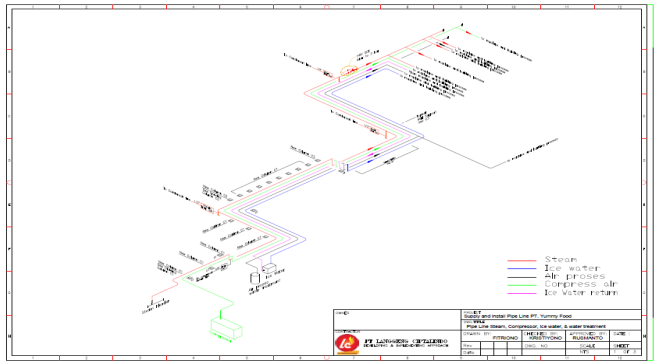
Blowdown Heat Recovery System

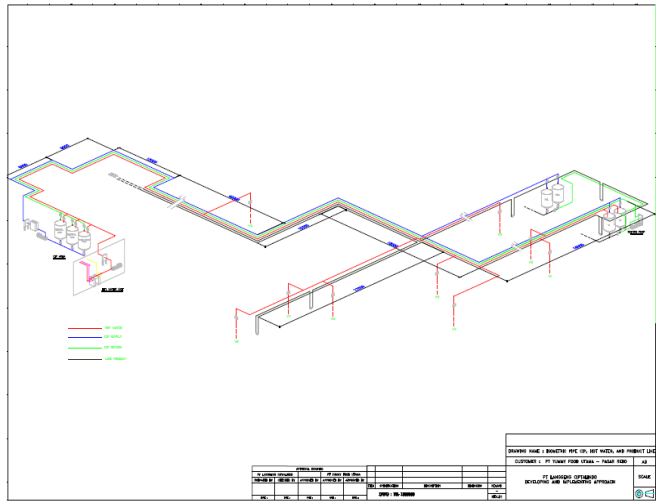


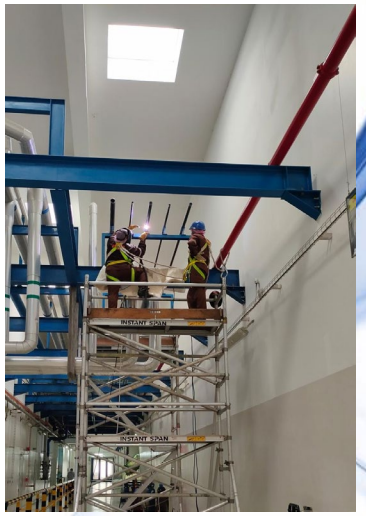
Retrofit Burner Control System

Electric Steam Boiler Packaged System

Construction & Fabrication





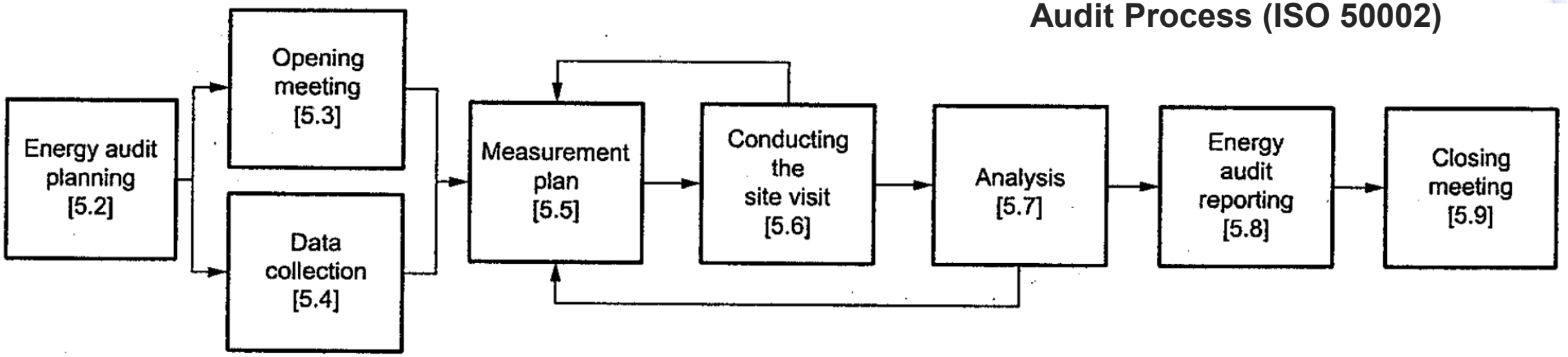


Scope of project :

1. Detailed Engineering Design (DED) of Utility & Product Piping (steam, compressed air, etc)
2. 3D drawing of Product Tank System
3. Design and Project Management

Energy Audit & Training

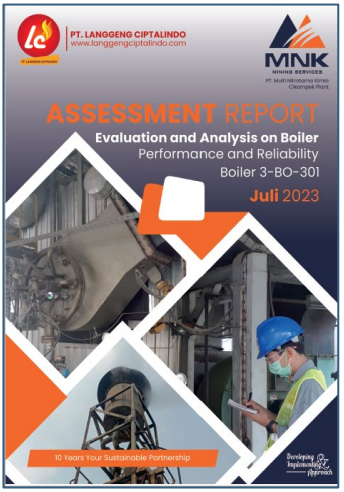
Audit Process (ISO 50002)

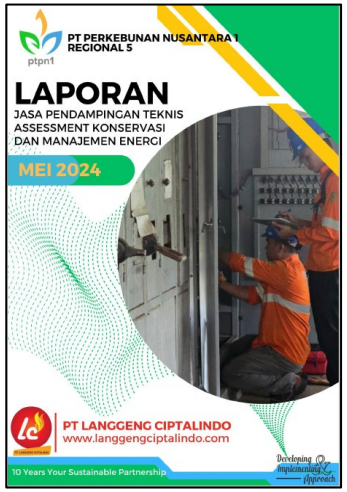


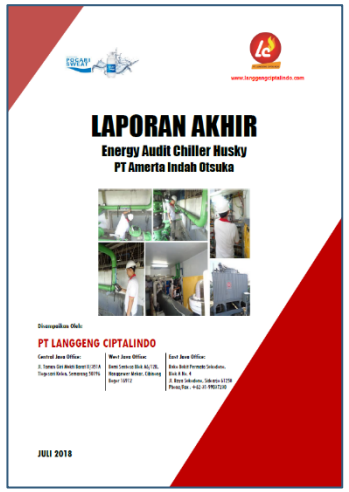


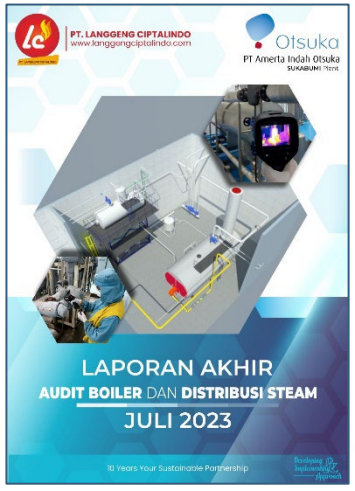


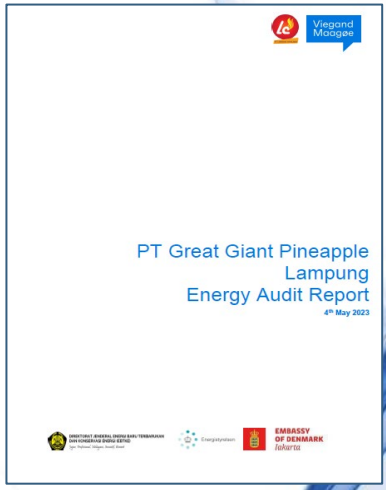

Object of Energy Audit

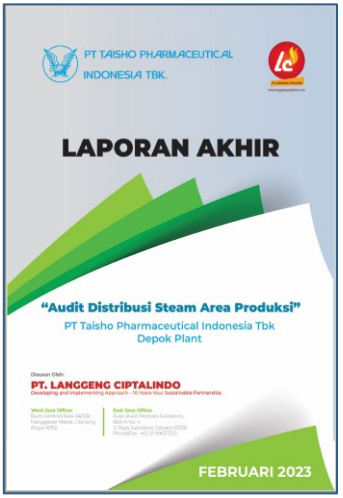


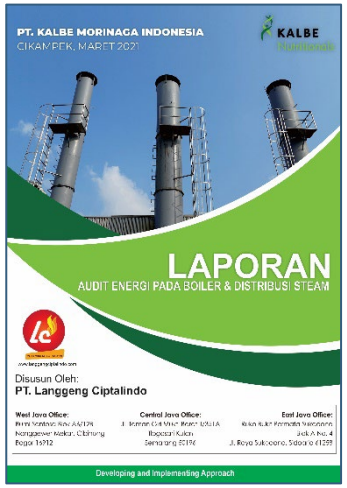


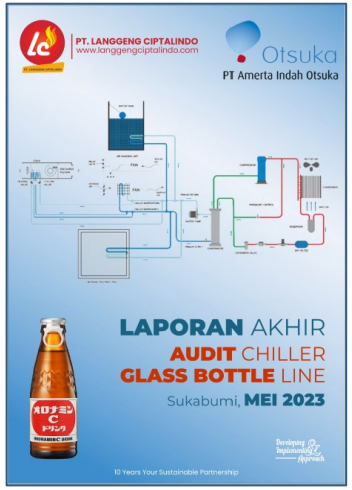


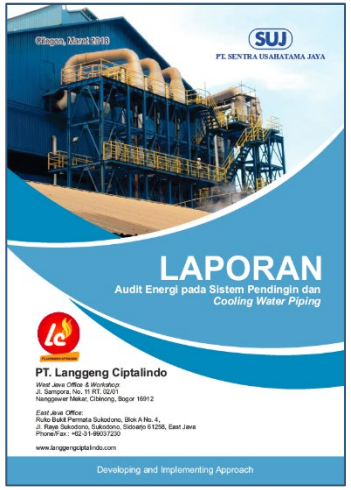




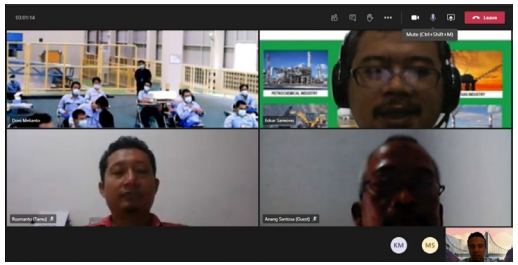








Training Activities



Final Training Review

Audit Reporting & Proposal

Presentation

Tools & Measurement

Group Discussion

Field Survey & Mentoring

International Cooperation

Mapping/benchmarking on Energy Efficiency in Industries under the Energy Partnership Programme between Indonesia and Denmark (INDODEPP)

EMBASSY OF DENMARK Jakarta

DIREKTORAT JENDERAL ENERGI BARU TERBARUKAN DAN KONSERVASI ENERGI (EBTKE)
Jujur, Profesional, Melayani, Inovatif, Berarti

Viegand Maagøe

Danish Energy Agency

BARRY CALLEBAUT

ABC KraftHeinz

PT. INDOLAKTO

Otsuka

PT GREAT GIANT PINEAPPLE

Garudafood

International Cooperation

Energy Audit and Pre-feasibility Study under the Energy Partnership Programme between Indonesia and Denmark (INDODEPP)

EMBASSY OF DENMARK Jakarta

DIREKTORAT JENDERAL ENERGI BARU TERBARUKAN DAN KONSERVASI ENERGI (EBTKE)
Jujur, Profesional, Melayani, Inovatif, Berarti

Viegand Maagøe

Danish Energy Agency

SARIHUSADA
NUTRISI UNTUK BANGSA

DANONE
ONE PLANET. ONE HEALTH

CERES

Delfi

IndoAgri

International Cooperation

L'Oréal Indonesia Plant Carbon Neutrality

Boiler Conversion Options Study : Electric Steam Boiler

Yulia Dobrolyubova
Partner
Corporate Sustainability & Climate Change Lead, Southeast Asia
Thailand

Ajoy Gupta
Senior Consultant,
Biogas and Biomass Specialist
India

Rusmanto, ST. MT.
Energy Auditor
Indonesia

Arryati Ramadhani
Principal Sustainability Consultant
Indonesia

Iwan Abdurrahman
Project Manager
Indonesia

Anditya Sudirgo
Project Support
Indonesia

Rufayda Ghazia
Project Support
Indonesia

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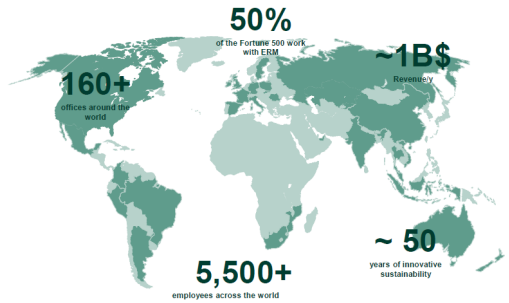
ERM: Trusted advisor to leading corporate clients and Fortune 500 companies

History
~ 50 years of working with leading organizations, and over 25 years in Indonesia.

ERM Group
ERM Group of companies includes SustainAbility, Critical Resource, CSA Global, the Fifth Business and MJB&A.

Over 5500 People
Unique blend of staff, i.e. Technical, Strategy, Digital, Private Equity, Banking and Big 4 Accounting experience.

Experience
Nearly 50 years of working with leading organizations including 50% of Fortune 500 companies in the last 5 years.



Project Title : Supply and Installation of Electric Steam Boiler

Energy Audit & Training

Garudafood

POCARI SWEAT Otsuka PT. Amerta Indah Otsuka

PT GREAT GIANT PINEAPPLE

Reckitt Benckiser

SUJ PT. SENTRA USAHATAMA JAYA

Otsuka PT. Otsuka Indonesia

kimia farma

PT. INDOLAKTO

Delfi CHOCOLATE

ANGGARDA PARAMITA 1913 PT HM SAMPOERNA Tbk.

KARYA DIBYA MAHARDHIKA

JTI

BARRY CALLEBAUT

ABC KraftHeinz

CLARIANT

Since 1951 SIDOMUNCUL

L'ORÉAL

andalan furnindo

KALBE

Energy Efficiency Project List

Bayer HealthCare

POCARI SWEAT — Otsuka — PT. Amerta Indah Otsuka

BASF — The Chemical Company

Capsugel — Now a Lonza Company

SUJ — PT. SENTRA USAHATAMA JAYA

PT. HOKKAN INDONESIA — HOKKAN INDONESIA

EVOLUZIONE TYRES

L'ORÉAL

ANGGARDA PARAMITA 1913 — PT HM SAMPOERNA Tbk.

Cargill

andalan furnindo

Gyproc — SAINT-GOBAIN

Garudafood

BARRY CALLEBAUT

ABC — KraftHeinz

LI & FUNG

PT. QL AGROFOOD

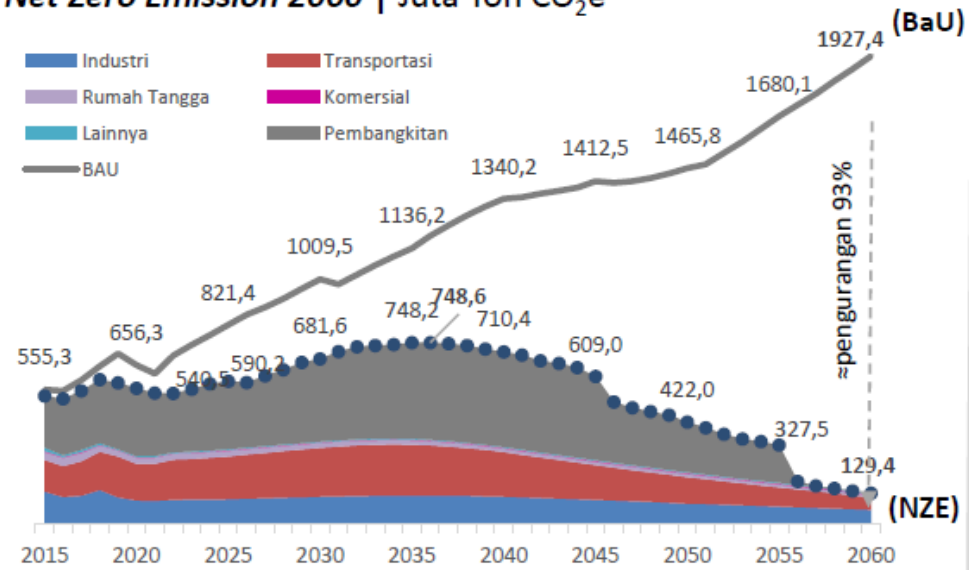
MEDAN SUGAR INDUSTRY

Contents

- Company Profile
- **Government Regulation**
- Energy Audit
- Energy Efficiency Project
- Conclusion

PETA JALAN NZE SEKTOR ENERGI

Net Zero Emission 2060 | Juta Ton CO_2e



Pengurangan emisi NZE yaitu 93% dari *BaU* melalui optimalisasi **suplai** dengan EBT dan ***demand*** dengan menerapkan efisiensi energi.

Strategi Mencapai NZE

1. **Penerapan Efisiensi Energi**
2. ***Elektrifikasi*** *(*EV, kompor induksi, elektrifikasi pertanian, dll*)*
3. **Moratorium PLTU & pensiun dini PLTU yang sudah ada**
4. **Pengembangan EBT** (offgrid, ongrid & BBN)
5. **Sumber energi baru** (hidrogen and amonia)
6. ***ccs/ccus***

Roadmap NZE 2060 atau Lebih Cepat

2021-2025

Supply:
Pengembangan PLT EBT sesuai RUPTL 2021-2030, *cofiring* PLTU Batu Bara

Demand:
Kompor induksi, jargas, DME, mandatori B35, kendaraan listrik

2026-2030

Supply:
Pengembangan PLT EBT sesuai RUPTL 2021-2030, *pump storage* mulai 2025

Demand:
Kompor induksi, jargas, mandatori B40, kendaraan listrik, manajemen energi

2031-2035

Supply:
Produksi EBT *Green Hydrogen* mulai 2031 untuk transportasi, *BESS* tahun 2034

Demand:
Kompor induksi, jargas, mandatori B40, kendaraan listrik, manajemen energi, & penerapan hidrogen untuk transportasi

2036-2040

Supply:
Pemanfatan nuklir mulai 2039, PLTS secara massif serta PLTB *onshore* dan *offshore*

Demand:
Kompor induksi, jargas, mandatori B40, kendaraan listrik, dan CCS untuk industri semen dan baja

2041-2050

Supply:
Produksi EBT *Green Hydrogen* untuk subtitusi gas alam, bauran energi didominasi EBT

Demand:
Kompor induksi, jargas, mandatori B40, kendaraan listrik, penerapan hidrogen untuk industri

2051-2060

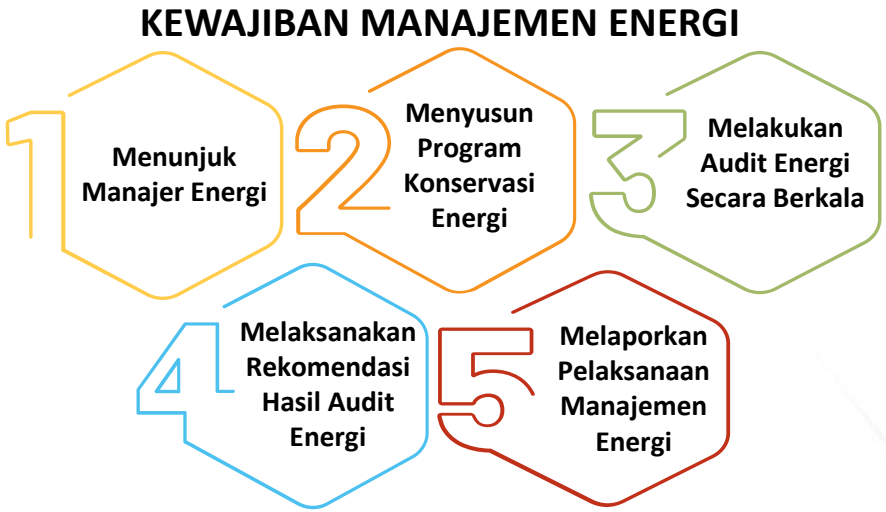
Supply:
Semua listrik dihasilkan dari PLT EBT dan emisi tersisa sebesar 129 juta ton CO2

Demand:
Kompor induksi, jargas, kendaraan listrik, dan CCS untuk industri

KEBIJAKAN KONSERVASI ENERGI
PERATURAN PEMERINTAH NOMOR 33 TAHUN 2023

Pokok-pokok pengaturan diantaranya:

1. Menurunkan ambang batas konsumsi energi sebagai persyaratan kewajiban pelaksanaan manajemen energi
   a. Penyedia Energi ≥ 6000 TOE
   b. Pengguna Energi:
      1) Sektor Industri ≥ 4000 TOE (47.00 MWh/tahun)
      2) Sektor Transportasi ≥ 4000 TOE
      3) Sektor Bangunan Gedung ≥ 500 TOE
2. Pengaturan pelaksanaan konservasi energi di lingkup Pemerintah pusat dan Pemerintah daerah
3. Pengembangan usaha jasa konservasi energi



Contents

- Company Profile
- Government Regulation
- **Energy Audit**
- Energy Efficiency Project
- Key Success

Audit Energi oleh Auditor Energi

PENGERTIAN AUDIT ENERGI, dari sudut pandang :

✓ **REGULASI (PEMERINTAH):**

Proses evaluasi pemanfaatan energi dan identifikasi peluang penghematan energi serta rekomendasi peningkatan efisiensi pada pengguna energi dan pengguna sumber energi dalam rangka konservasi energi nasional.


3964914

BADAN NASIONAL SERTIFIKASI PROFESI
INDONESIAN PROFESSIONAL CERTIFICATION AUTHORITY

SERTIFIKAT KOMPETENSI
CERTIFICATE OF COMPETENCE

91122 2149 0101045 2018

Rusmanto

HKE 083 00045 2018

Manajemen Energi Sub Bidang Industri
Energy Management on Sub Division of Industry

Sebagai
As:

Auditor Energi Industri
Energy Auditor on Industry

Sertifikat ini berlaku untuk: 3 (tiga) Tahun
This certificate is valid for: 3 (three) Years

Bekasi, 19 Juli 2018

LSP HAKE

Ir. Parlindungan Marpaung
Ketua
Chairman

✓ **TEKNIK (ENGINEERING) :**

Kegiatan mengevaluasi unjuk kerja suatu fasilitas pengguna energi guna mengidentifikasi dimana dan berapa terjadi *energy loss* serta berapa potensi penghematan (*energy saving*) yang mungkin diperoleh dalam suatu fasilitas pengguna energi tersebut.

✓ **EKONOMI (FINANSIAL) :**

Proses evaluasi performa penggunaan biaya energi pada fasilitas pengguna energi dan mengidentifikasi berapa rugi-rugi biaya yang terjadi dan potensi penghematan biaya dalam suatu fasilitas tersebut.

Energy Audit Level

Level 1 (Walk-Through)

- Memperoleh gambaran distribusi penggunaan energi
- Memperoleh info tentang sistem pengelolaan energi yang ada
- Identifikasi kebocoran / peluang penghematan energi
- Menyusun laporan hasil survei energi.
- Lama survey = 2 - 3 hari

Level 2 (Preliminary)

- Pengumpulan data dan informasi dasar.
- Identifikasi besarnya penghematan energi yang mungkin diperoleh
- Basic data: sekunder dan questioner. Pengukuran dibutuhkan untuk verifikasi beberapa angka yang dianggap kurang rasional.
- Pengamatan lapangan dan interview.
- Audit awal juga menentukan lokasi dan kebutuhan untuk audit rinci. (next level)
- Rekomendasi (spesifik)
- Lama survey = 3 hari s/d 1 minggu (tergantung kompleksitas objeknya)

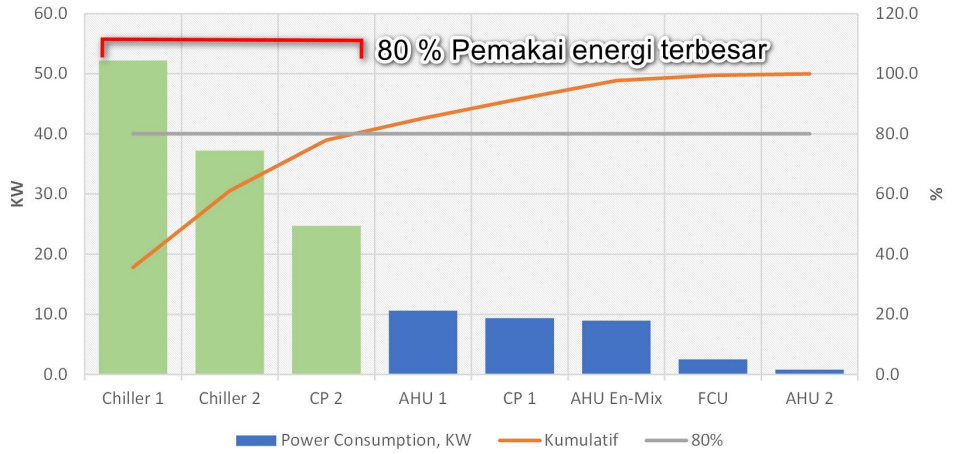
Level 3 (Detailed)

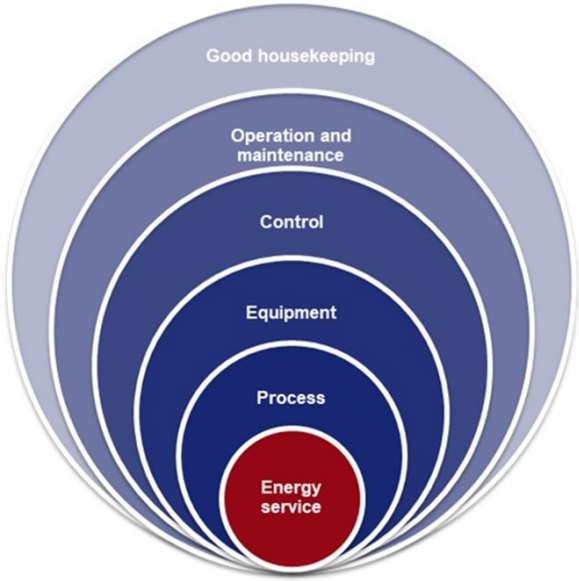
- Rekomendasi engineering, estimasi penghematan energi dan biaya yang diperlukan.
- Analisis ekonomi secara detail mengenai penghematan energi yang direkomendasikan.
- Rencana pelaksanaan implementasi
- Menyusun laporan hasil audit rinci.
- Lama survey = 1 - 2 bulan (tergantung kompleksitas objek)

Energy Audit

Identify Potential Energy Saving
→
Significant Energy Uses (SEU)

- Focus on the main energy consumers like steam generation, heating, cooling, and the processing of the raw materials
- Gap between Best Available Technology (BAT) and present setup – technical energy saving potential
- Estimation of financially feasible energy saving potential



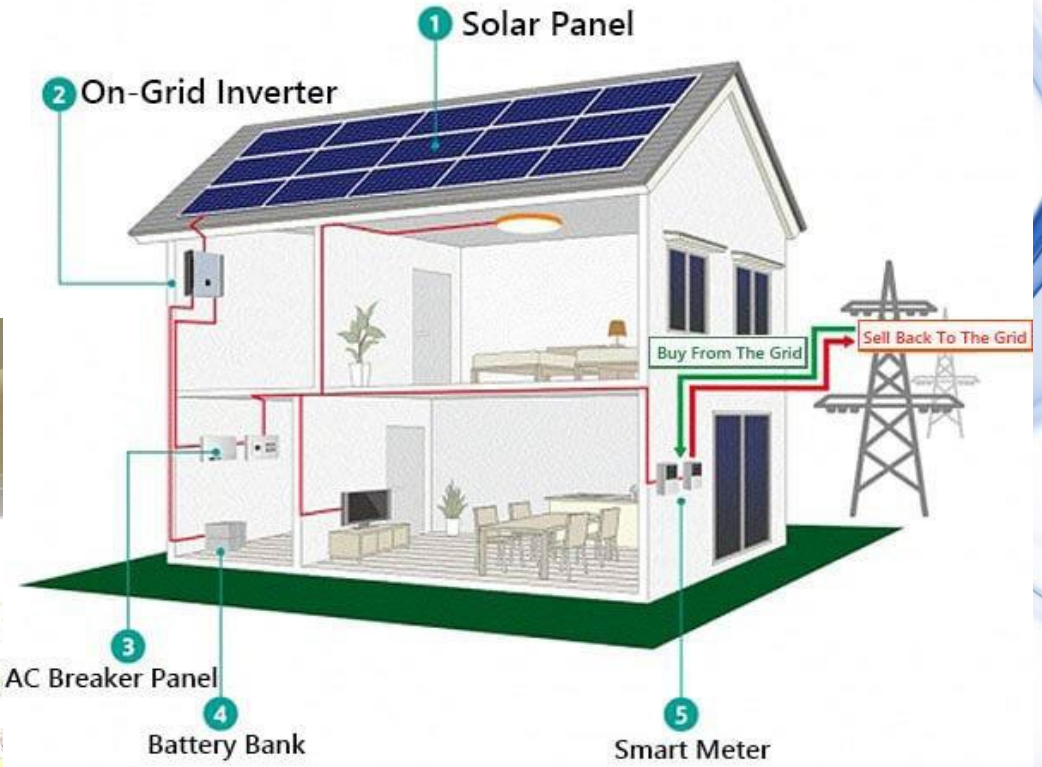


Audit Energi Bangunan

Audit energi Bangunan Gedung adalah proses pemeriksaan dan evaluasi sistem energi yang digunakan dalam suatu gedung untuk mengidentifikasi potensi penghematan energi. Tujuan dari audit energi gedung adalah untuk meningkatkan efisiensi penggunaan energi, mengurangi biaya energi, dan mengurangi dampak lingkungan dari konsumsi energi.

Kegiatan Audit energi gedung dapat mencakup pemeriksaan

1. sistem penerangan
2. sistem pendingin udara
3. sistem pemanas
4. Peralatan peralatan lain seperti TV, Dispenser dll



Audit Energi Industri

Audit Energi pada utilitas pabrik bertujuan untuk mengevaluasi efisiensi dan efektivitas penggunaan energi, air, dan sumber daya lainnya dalam pabrik. Audit ini dapat membantu mengidentifikasi potensi penghematan energi, efisiensi sistem, dan sumber daya lainnya sehingga dapat mengurangi biaya operasional, meningkatkan keberlanjutan, dan memastikan kepatuhan dengan peraturan dan standar lingkungan.
Beberapa jenis audit energi sistem utilitas yang umum dilakukan antara lain:

1. Audit energi sistem pendingin (cooling system audit)
2. Audit energi sistem uap (steam system audit)
3. Audit energi sistem kompresi (compressor system)
4. Audit energi sistem pompa (pump audit)
5. Heating Cooling Integration

Audit Energi

- Audit Energi adalah bagian dari Manajemen Energi
- Sasaran
  - Memperoleh Gambaran Penggunaan Energi
    - Fluktuasi Penggunaan Energi (faktor berpengaruh ?)
    - Neraca/Distribusi energi
  - Mengukur Kinerja Energi
    - Efisiensi Penggunaan Energi (output/input ?)
    - Konsumsi Energi Spesifik (kJ/kg-prod)
  - Mengidentifikasi pemborosan energi dan menyusun langkah-langkah pencegahannya
    - Rugi-rugi Energi (*losses*)
    - Rasionalisasi dan optimalisasi penggunaan energi
  - Dasar untuk melakukan peningkatan efisiensi penggunaan energi
    - Perbaikan manajemen operasi dan perawatan peralatan konversi energi
    - Reparasi alat dan retrofit
    - Instalasi peralatan baru/teknologi hemat energi

Summary of Saving Potential Identification

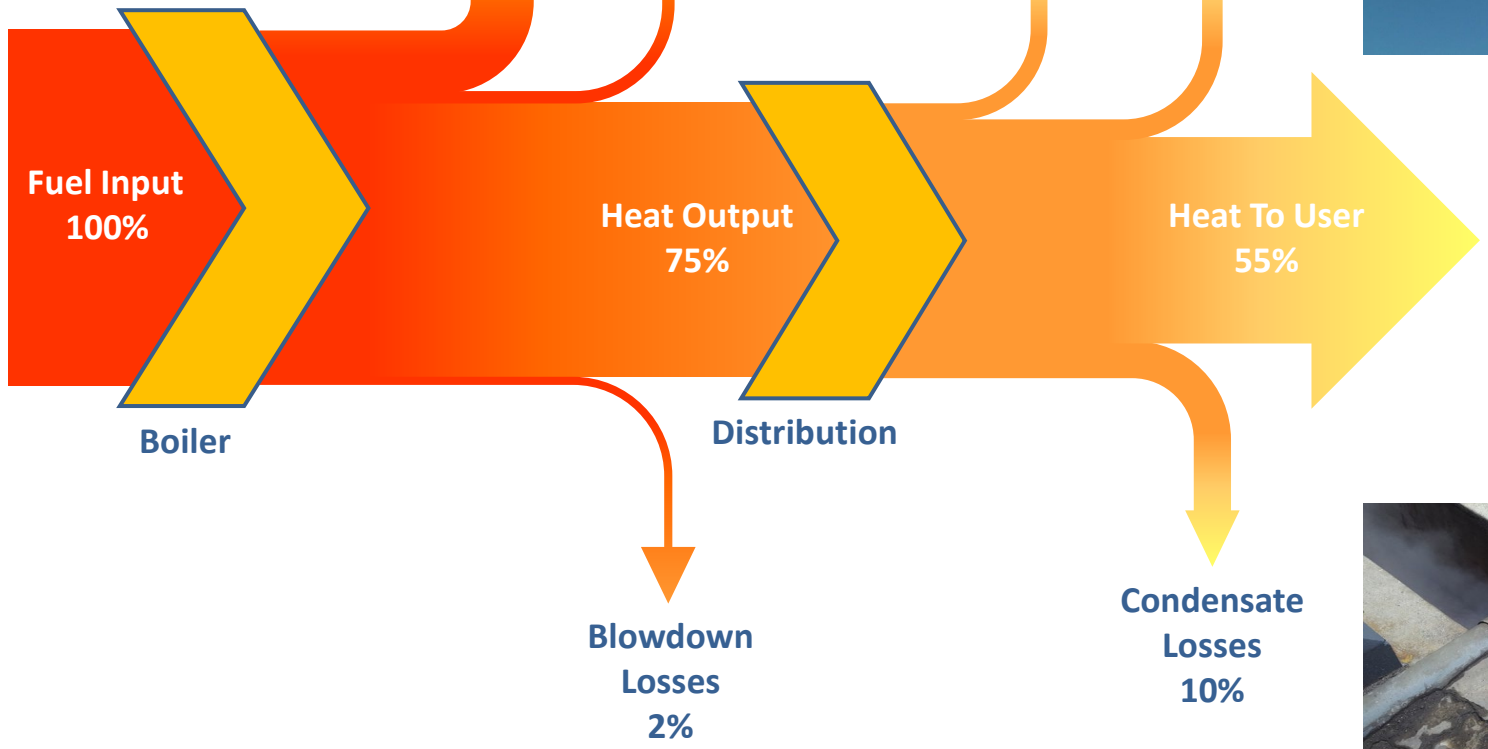
Thermal Energy Saving

THERMAL ENERGY	Estimated Consump-tion, MWh	Share of consump-tion, %	Saving potential, MWh	Estimated CO2-emission reduction, ton	Estimated Investment, mill. IDR	Estimated payback period, years
Supply Side (Steam Generation)						
Boiler Alstom (palm oil shell and woodchips mixture)	8.625	19.4	1,102	-	588	1.7
Gas Boiler 8T (gas, standby)	9.354	21.0	509	93	500	6,0
Boiler Basuki (rice husk)	26,555	59.6	277	-	200	1.3
IN TOTAL	**44,533**	**100**				
Demand Side (Steam User)						
Chilli	15,450	34.9	-	-	-	-
Soy	8,308	18.7	2,380	-	1,520	7,1
Ready to Drink (RTD)	9,862	22.3	2,544	-	1,610	7,0
Cordial (Bottle Syrup)	10,699	24.1	4,752	-	2,840	6,6
IN TOTAL	**44,319**	**100**				
Distribution Losses						
Insulation	97	45.3	97	-	200	1,4
Leak Trap	117	54.7	117	-	40	1,1
IN TOTAL	**214**	**100**				
TOTAL SAVINGS	**44,533**	**100**	**11,778**	**93**	**7,498**	**5,7**

Electric Energy Saving

ELECTRIC ENERGY	Estimated Consump-tion, MWh	Share of consump-tion, %	Saving potential, MWh	Estimated CO2-emission reduction, ton	Estimated Investment, mill. IDR	Estimated payback period, years
Compressor	2,177	13%	228	186	565	1.9
Chilli	1,844	12%	-	-	-	-
Wastewater Treatment Plant 1	1,621	10%	-	-	-	-
Fan CT at WWTP 1			149	122	1,368	7.2
Fan CT at WWTP 2			86	70	580	5.3
Ready to Drink (RTD)	1,613	10%	-	-	-	-
Cordial (Bottle Syrup)	1,596	10%	-	-	-	-
Wastewater Treatment Plant 2	1,044	6%	-	-	-	-
CT pump in WWTP 2			87	71	393	2.7
Soy	1,012	6%	-	-	-	-
Water Treatment Plant New	932	6%	-	-	-	-
Distribution pump in WTP new			114	93	437	2.3
CT pump 1 in WTP new			23	19	83	2.1
Others	4,492	27%	-	-	-	-
FWP Boiler Basuki			27	22	108	2.4
Transformer			64	52	500	6.1
IN TOTAL	**16,371**	**100**	**778**	**635**	**2,667**	**4.7**

Audit Energi pada Sistem Steam



Steam System Audit

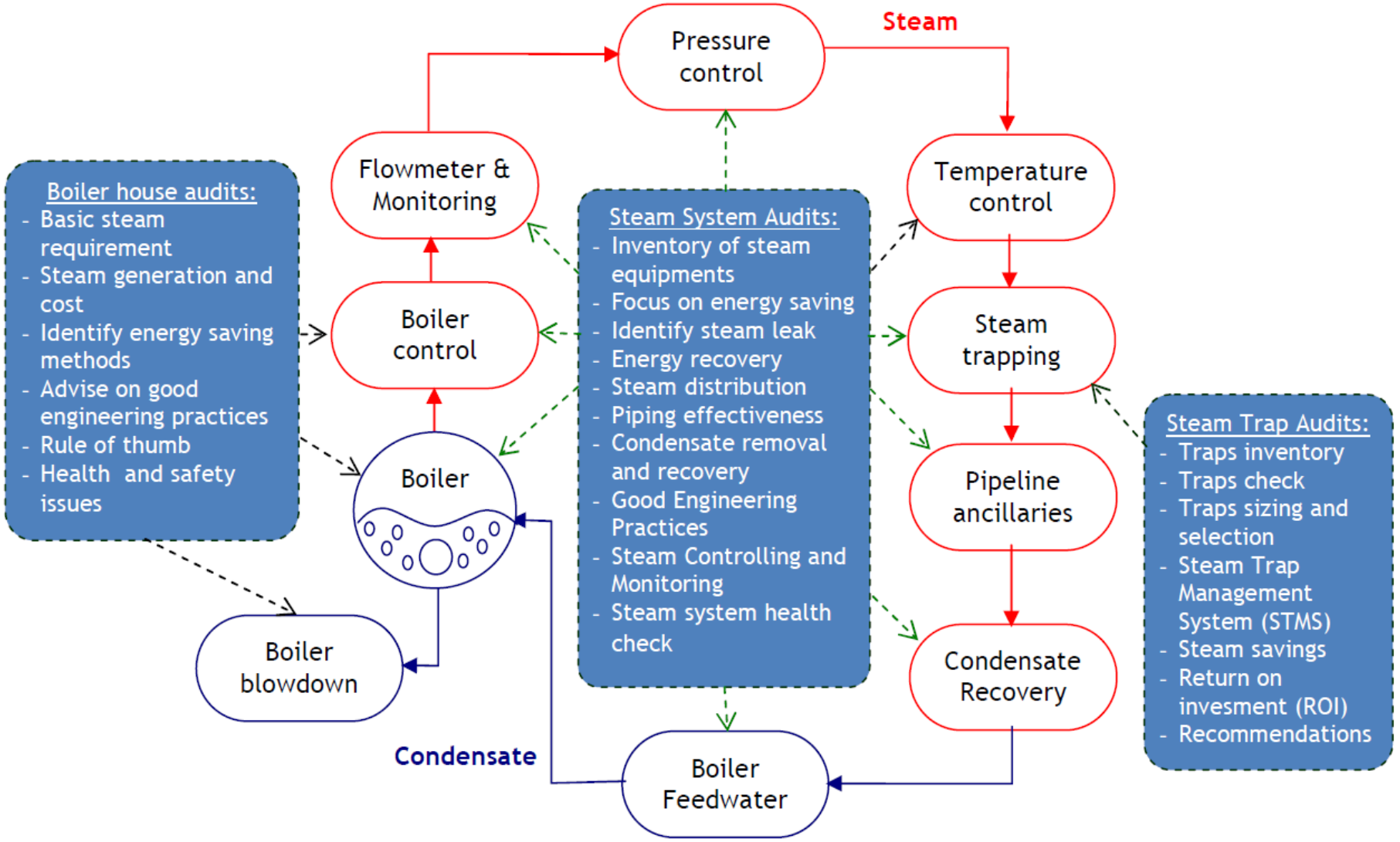
- Evaluasi terhadap kinerja sistem steam terpasang secara komprehensif
- Analisis *steam supply and demand*
- Identifikasi potensi perbaikan dan konservasi energi
- Analisis dampak perbaikan terhadap sistem steam
- Implementasi proyek konservasi energi
- *Monitoring and verification* terhadap proyek konservasi energi

Plant Survey
Inventarisasi
Pengumpulan data
Investigasi
Assesmen
Identifikasi

Laporan
Presentasi
Diskusi
Rekomendasi
Potensi
Kelayakan

Implementasi
Prioritas
Biaya
Payback
Monitoring
Verifikasi

Scope of Steam System Audit



Steam System Components

✓ Generation

- Boiler
- Boiler auxiliaries
- Water treatment equipment
- Deaerator
- Feedwater Pumps
- Fuel storage and handling equipment

✓ Distribution

- Steam piping
- Pressure reducing stations

✓ End-use (Utilization)

- Steam turbines
- Heat exchangers
- Live steam injection
- Hot Water Generator
- Evaporators, Drier, etc.

✓ Recovery

- Steam traps
- Condensate recovery and return system
- Condensate pumps
- Flash steam recovery

Steam and Energy Conservation Opportunities

- Boiler process control
- Reduction of flue gas quantities
- Reduction of excess air
- Properly sized boiler systems
- Boiler insulation
- Boiler maintenance
- Flue gas heat recovery
- Blowdown steam recovery
- Boiler replacement

- Distribution system insulation
- Steam trap improvement
- Steam trap maintenance
- Steam trap monitoring
- Leak repair
- Flash steam recovery
- Condensate return
- Preventive maintenance
- Process integration and pinch analysis

The Step of Steam System Audit

Final Presentation

Kick off Meeting

Plant Survey

Reporting

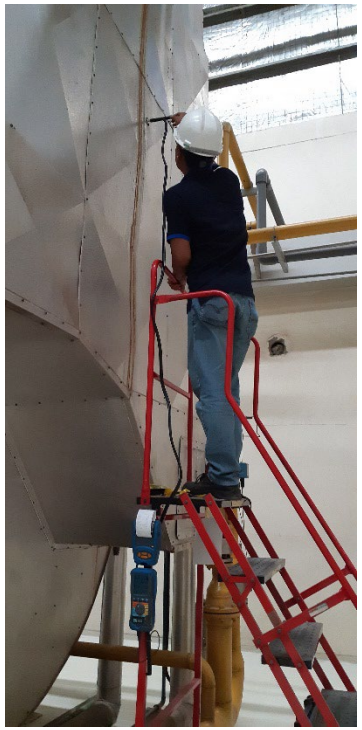
Closing Field Survey Meeting

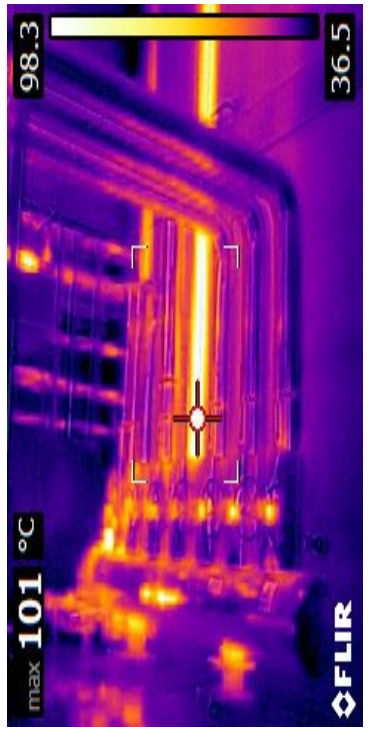
Process & Instrumentation Diagram Drawing

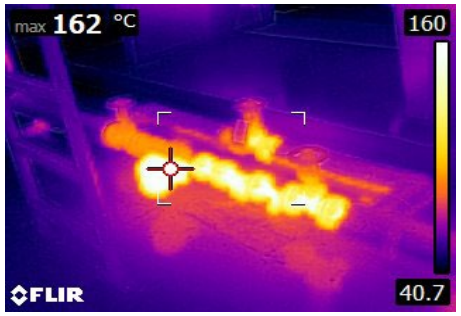
Tools of Steam System Audit

No	Tools	Function	Dispaly
1	Infra Red Thermometer	Measure temperature of media with non contact method (with infrared media)	
2	Ultrasonic Leak Detector	Measure leak of steam (detection) with ultrasonic sound methods	
3	Thermal Imager	Measure image of temperatur profile of media (ie. Steam temperature profile on pipe and insulation). Use for initial information of leakage from temperature difference (losses).	
4	Conductivity/TDS meter	Measure the value of conductivity or TDS of condensate	
5	Flue Gas Combustion Analyzer	Measure flue gas such as oxygen and CO2 content (%), temperature of stack	
6	Humidity-meter Anemometer	Measure humidity (%RH) Measure air velicity	
7	Distance Mater	Measure the length of pipe	

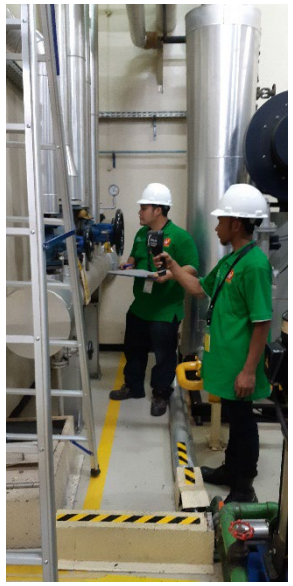
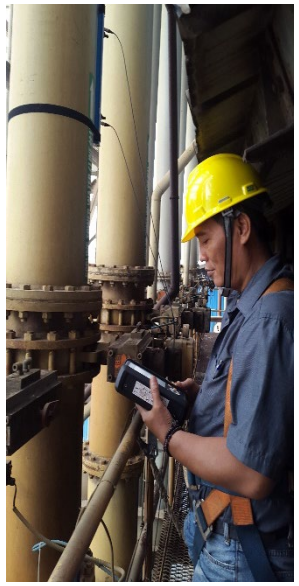
The Activities of Steam System Audit



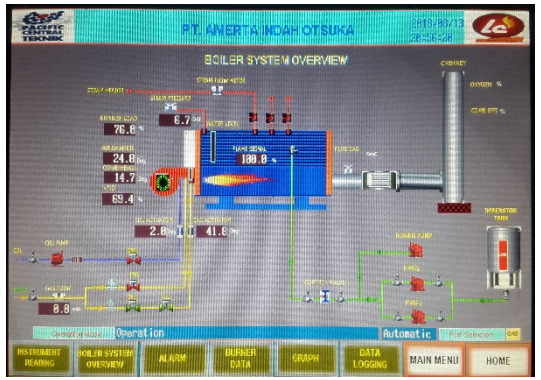


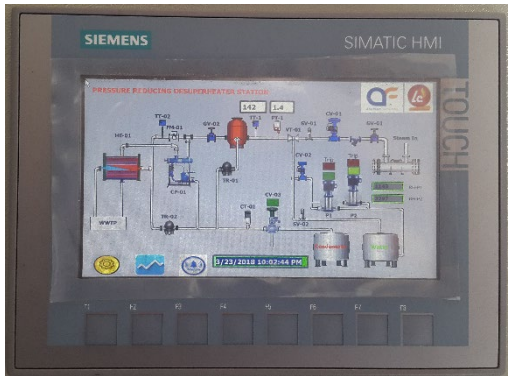


The Activities of Steam System Audit







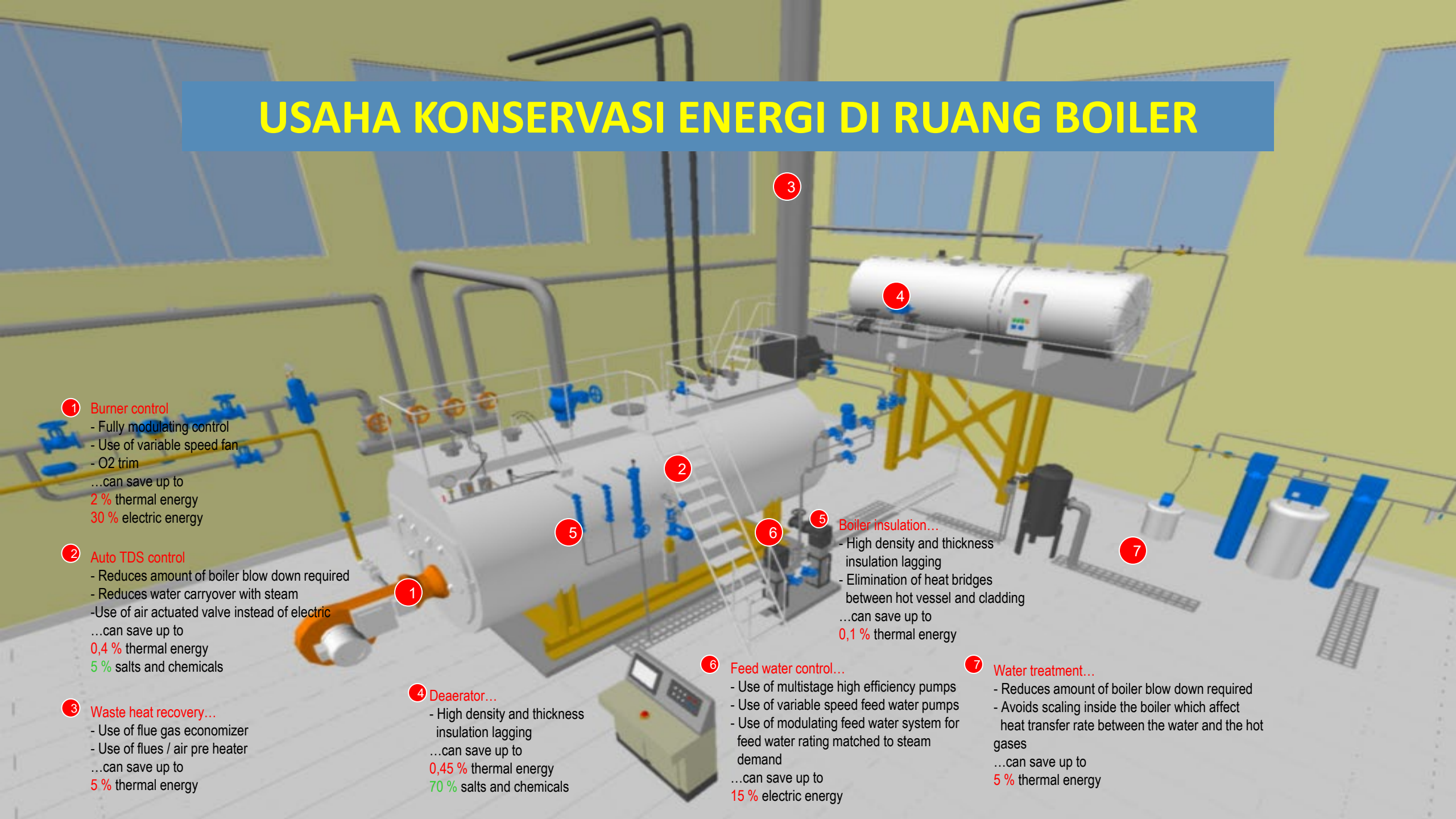
Contoh Hasil Audit Steam

No	Rekomendasi	Potensi Penghematan dan Penuruan Emisi Karbon					Biaya Investasi	Payback Period	Tipe Proyek
	Konservasi Energi	Gas (m3/bulan)	Solar (L/bulan)	Energi (GJ/bulan)	Biaya (Rp/bulan)	kg CO2e/bulan	(Rp)	(Tahun)	
	RUANG BOILER								
1	Resetting and Retrofit Burner Control System dan Boiler Management System	7.229	403	294	39.319.179	15.274	700.000.000	1,5	Konservasi Energi, Safety, dan Environment
2	Daur Ulang Panas Blowdown Sebagai Pemanas Air Umpan	5.592	-	215	28.860.075	10.984	200.000.000	0,6	Konservasi Energi
3	Pengoperasian Boiler Solar dengan Efisiensi lebih tinggi dari Boiler Gas pada LP Steam (Boiler Switching)	-	-	-	50.851.195	-	-		Konservasi Energi
4	Modifikasi Tangki Air Umpan Menjadi Deaerator Tank dengan Elevasi lebih Tinggi berkisar 5 m dari Pompa Air Umpan	-	-	-	-	-	492.700		Best Practices dan Konservasi Energi
5	Cleaning Secara Fisik atau Kimia Unit Burner dan Economiser Bagian Sisi Gas Cerobong Boiler Solar	119	5	5	638.105	247			Konservasi Energi dan Kehandalan
6	Insulasi Pipa Air Umpan dan Blowdown	-	-	-	-	-	100.000.000		Safety
7	Instalasi Flowmeter HP dan LP steam	-	-	-	-	-	250.000.000		Energy Monitoring
8	Pemisahan Jalur Chimney Boiler Solar dan Gas, Chimney LP dan HP Boiler	-	-	-	-	-	571.000.000		Environment Compliance
9	Sample Cooler untuk Keakuratan Sampling Air Boiler	-	-	-	-	-	30.000.000		Safety and Accuracy
	DISTRIBUSI STEAM								
10	Insulasi dan Modifikasi Temperatur Control System pada Tangki Air Panas	3.413		131	17.614.395	6.704	150.000.000	0,7	Konservasi Energi dan Safety
11	Pemisahan Jalur Kondensat HP dan LP Steam Unit Air Drier	-	-	-	-	-	400.000.000		Best Practise dan Pencegahan Waterhammer
12	Daur Ulang Flash Steam Tangki Kondensat	1.276		49	6.585.620	2.506	200.000.000	2,5	Konservasi Energi
13	Modifikasi Daur Ulang Kondensat Area AHU dengan Instalasi APT/Pompa Listrik	-	-	-	-	-	250.000.000		Konservasi Energi dan Best Practice
14	Penggantian Steam Trap yang Bocor	828		32	4.271.111	1.626	10.000.000	0,2	Konservasi Energi
15	Modifikasi Tubular Heat Exchanger Area CIP dari Posisi Mendatar ke Vertical	-	-	-	-	-	75.000.000		Best Practise dan Pencegahan Waterhammer
	Total	**18.456**	**408**	**726**	**148.139.681**	**37.341**	**2.936.492.700**	**1,7**	**Medium Cost**
	Potensi Penghematan Energi	**6%**	**Total Energi Bahan Bakar Boiler**						
	Potensi Penghematan Biaya	**9%**	**Total Tagihan Bahan Bakar Boiler**						

Contents

- Company Profile
- Government Regulation
- Energy Audit
- **Energy Efficiency Project**
- Key Success

USAHA KONSERVASI ENERGI DI RUANG BOILER



1 Burner control
- Fully modulating control
- Use of variable speed fan
- O2 trim
…can save up to
2 % thermal energy
30 % electric energy

2 Auto TDS control
- Reduces amount of boiler blow down required
- Reduces water carryover with steam
-Use of air actuated valve instead of electric
…can save up to
0,4 % thermal energy
5 % salts and chemicals

3 Waste heat recovery…
- Use of flue gas economizer
- Use of flues / air pre heater
…can save up to
5 % thermal energy

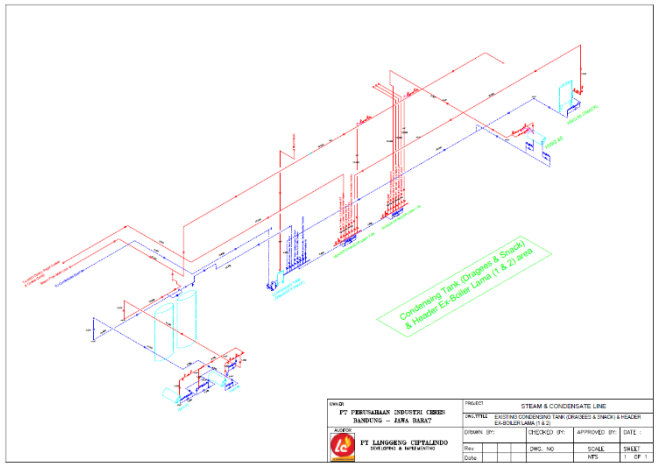
4 Deaerator…
- High density and thickness insulation lagging
…can save up to
0,45 % thermal energy
70 % salts and chemicals

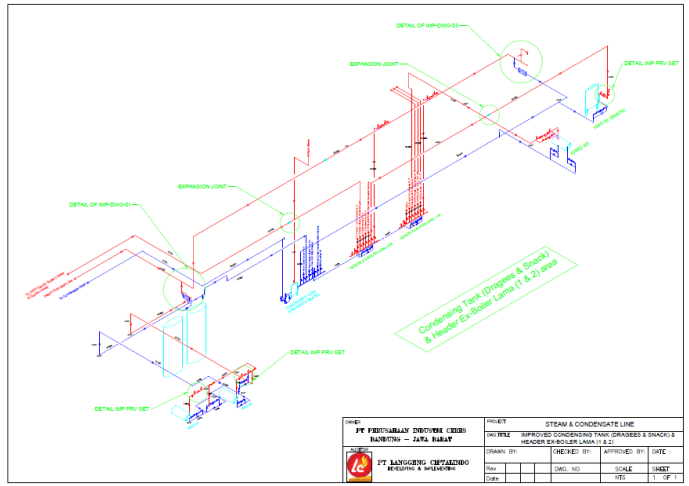
5 Boiler insulation…
- High density and thickness insulation lagging
- Elimination of heat bridges between hot vessel and cladding
…can save up to
0,1 % thermal energy

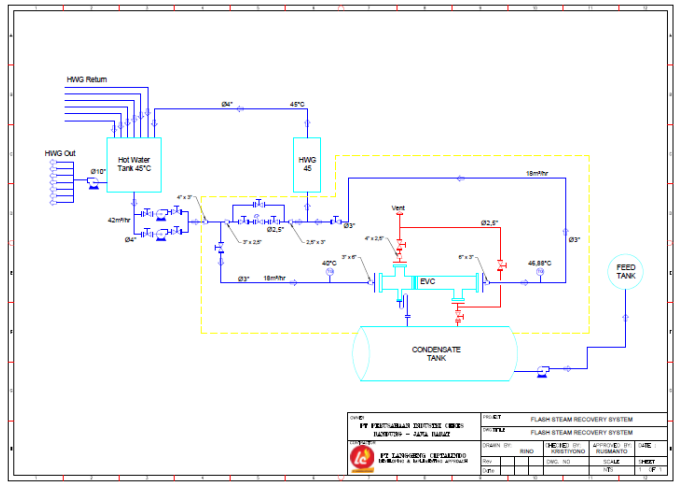
6 Feed water control…
- Use of multistage high efficiency pumps
- Use of variable speed feed water pumps
- Use of modulating feed water system for feed water rating matched to steam demand
…can save up to
15 % electric energy

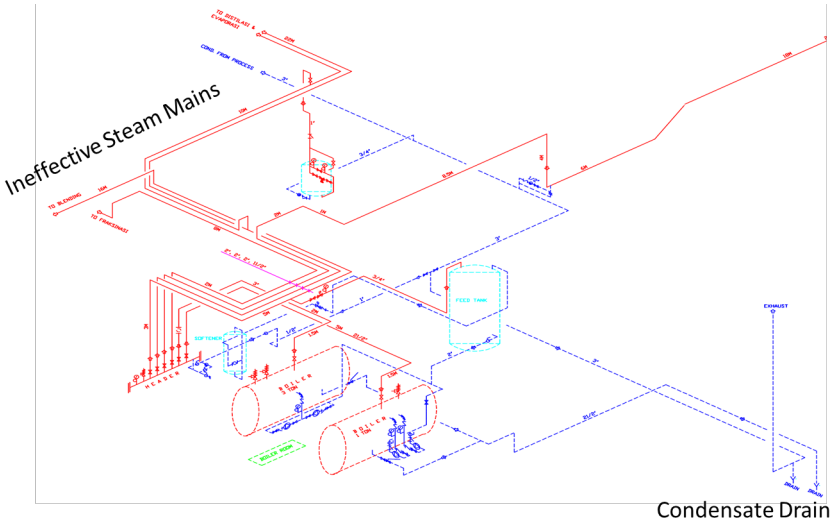
7 Water treatment…
- Reduces amount of boiler blow down required
- Avoids scaling inside the boiler which affect heat transfer rate between the water and the hot gases
…can save up to
5 % thermal energy

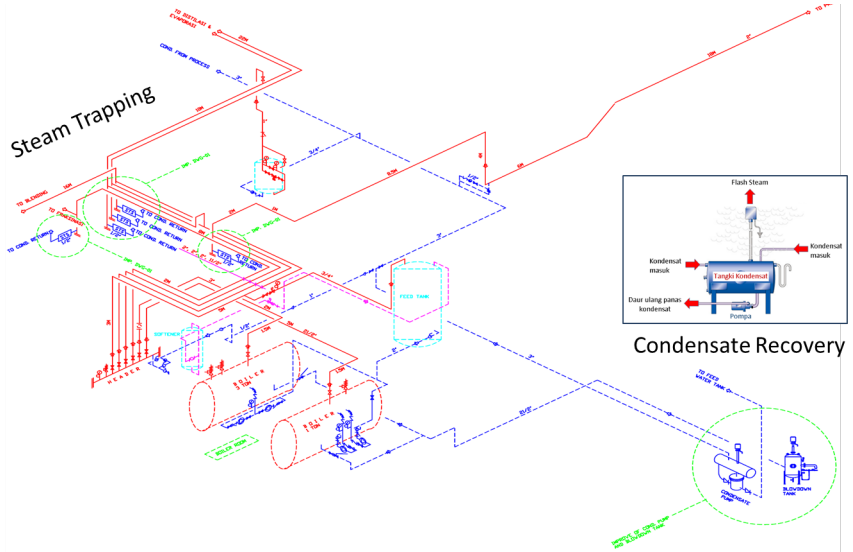
Steam Distribution Improvement











Existing steam system

Improved steam system

Findings and Opportunities


Blowdown losses

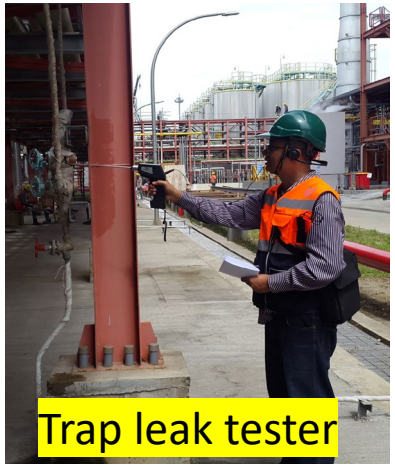
Radiation losses


Flash steam losses


Condensate overflow and not returned

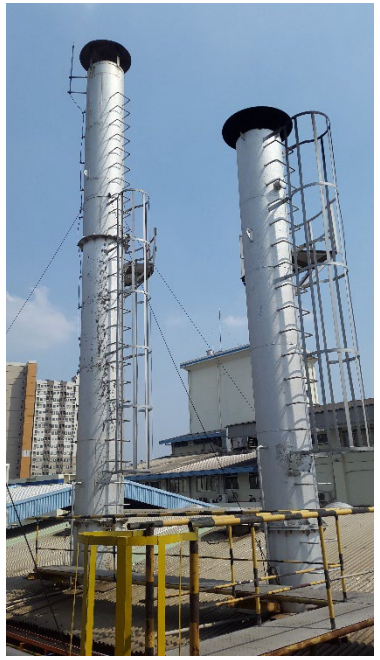

1800 pcs of steam traps

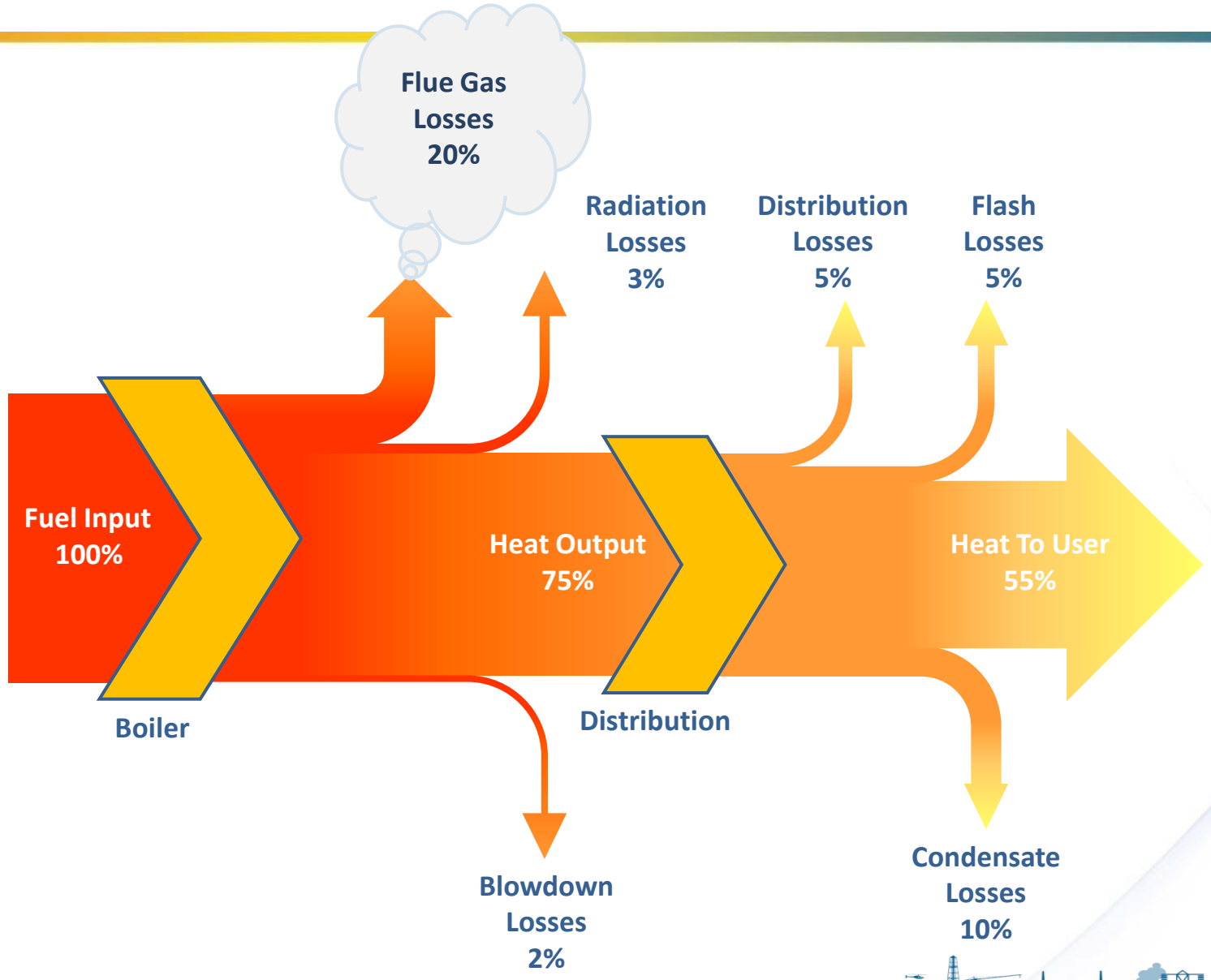

6,5% leak-steam traps


Trap leak tester

*Sumber : System System Audit Report, PT. Uniliver Oleochemical Indonesia, Seimangke

TEKNIK KONSERVASI ENERGI DI BOILER

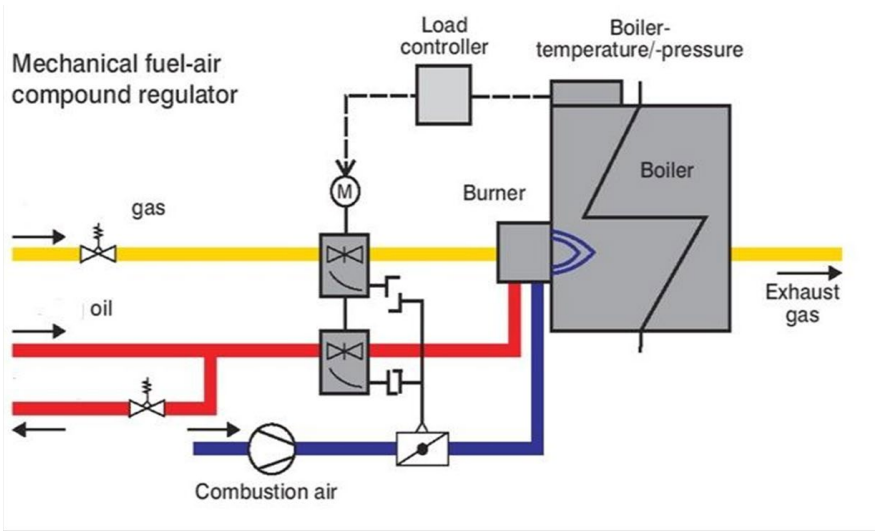




RETROFIT BURNER CONTROL SYSTEM
dan
DAUR ULANG PANAS GAS CEROBONG

Mechanical vs Electronic Burner Control System

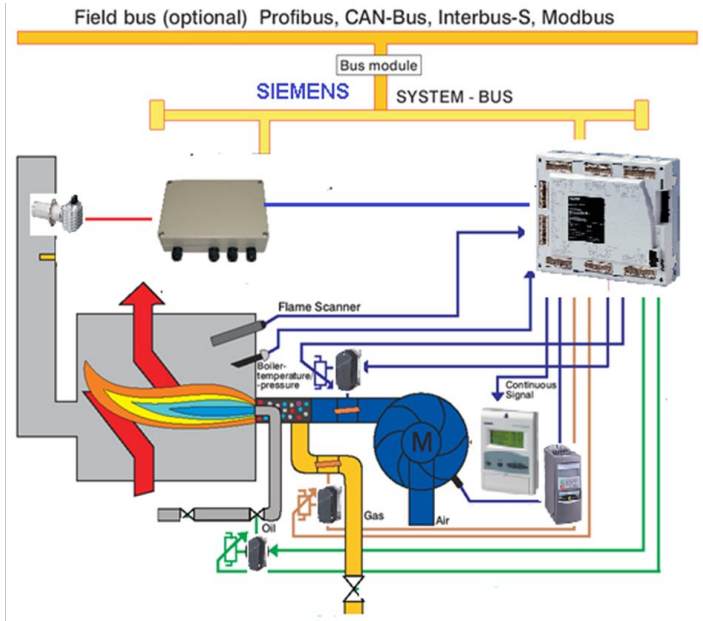
Boiler di pabrik secara umum masih menggunakan teknologi *mechanical linkage burner control system* sebagai kontrol pembakaran. Teknologi terbaru adalah *electronic modulating burner control system* yang lebih presisi.



Disadvantages:

- Complex start up with restricted adjustment of the fuel-/air ratio
- Hysteresis demand exess air
- Combustion optimisation (O_2 Control) not possible

Mechanical Burner Control System



Advantages:

- Easy start up
- Low hysteresis
- User friendly
- Flexible adjustment of the fuel/air ratio
- RPM Control
- Combustion optmization O_2 Control

Electronic Burner Control System

Retrofit Burner Control System

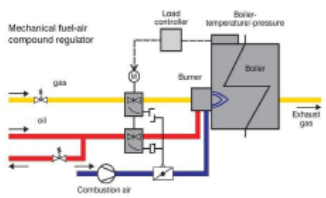
SUCCESS STORY

PENGHEMATAN ENERGI PADA BOILER UAP

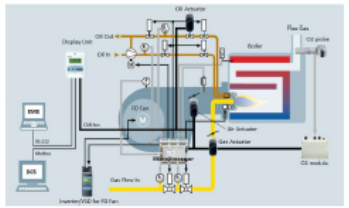
DENGAN *RETROFIT BURNER CONTROL SYSTEM*

PENDAHULUAN

Industri minuman umumnya menggunakan uap (*steam*) yang dihasilkan dari boiler sebagai sumber panas seperti proses pasteurisasi, pembangkitan air panas, dan proses lainnya. Kapasitas boiler uap yang digunakan umumnya 5-10 ton/jam pada tekanan 7-8 barg dengan menggunakan sistem burner gas atau bahan bakar minyak secara mekanik. Pengaturan rasio udara dan bahan bakar diatur dengan tuas mekanik yang disebut *mechanical burner control system*. Namun sistem ini mempunyai kesulitan pada pengaturan rasio udara dan bahan bakar, excess air, dan efisiensi pembakaran oleh kerja mekanik. Oleh karena itu, industri tersebut mencoba melakukan *retrofit electronic burner control system* dengan keunggulan pada kemudahan start up dan pengoperasian, pengaturan rasio udara dan bahan bakar, pengaturan putaran fan sesuai kebutuhan, dan optimalisasi efisiensi pembakaran. Perbandingan kedua sistem tersebut disajikan di gambar berikut.



Mechanical burner control system



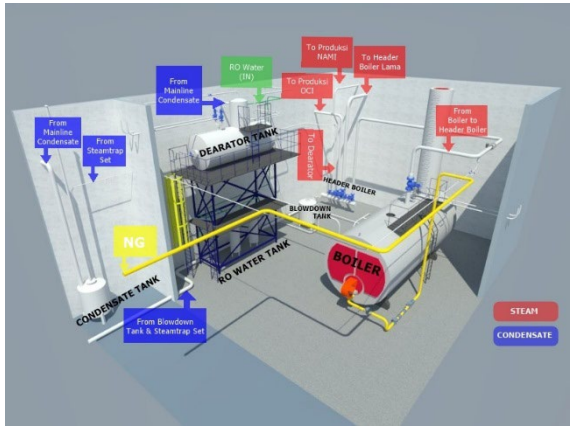
Electronic burner control system

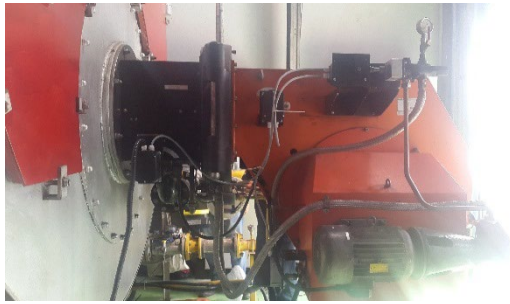
TEKNOLOGI EFISIENSI ENERGI

Electronic burner control system adalah perangkat khusus dirancang untuk mengendalikan secara otomatis efisiensi operasi dari *burner,* dengan menyesuaikan kebutuhan beban, terdiri dari sistem kontrol mikroprosesor untuk mengatur bukaan udara dan bahan bakar secara modulating dan akurat serta putaran motor FD fan.

HASIL IMPLEMENTASI

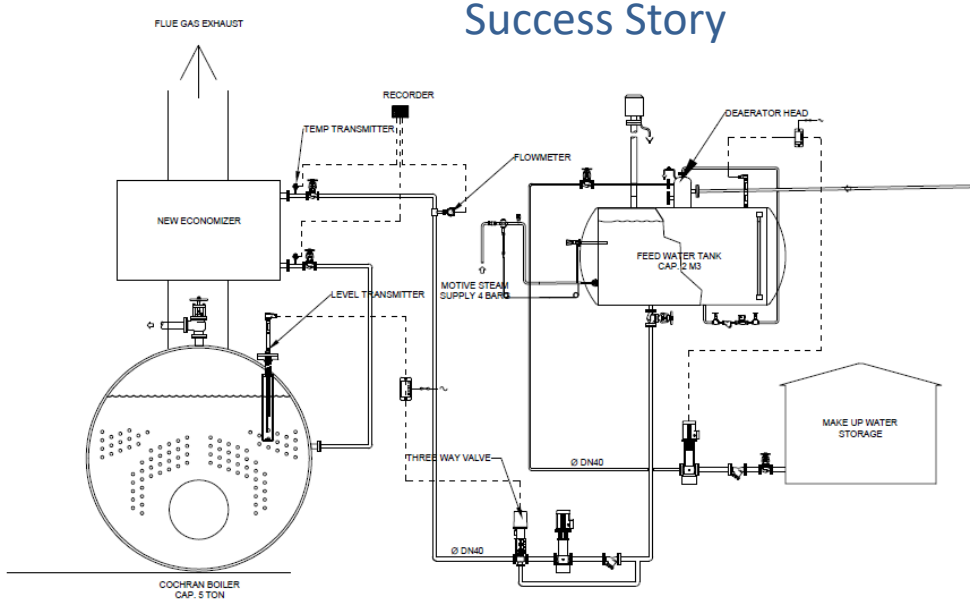
Retrofit dengan biaya investasi Rp 950.000.000 ini memberikan penghematan bahan bakar sebesar 3,5% dan penurunan konsumsi listrik FD Fan. Investasi ini cukup menarik, dikarenakan *payback period* kurang dari 2 tahun.

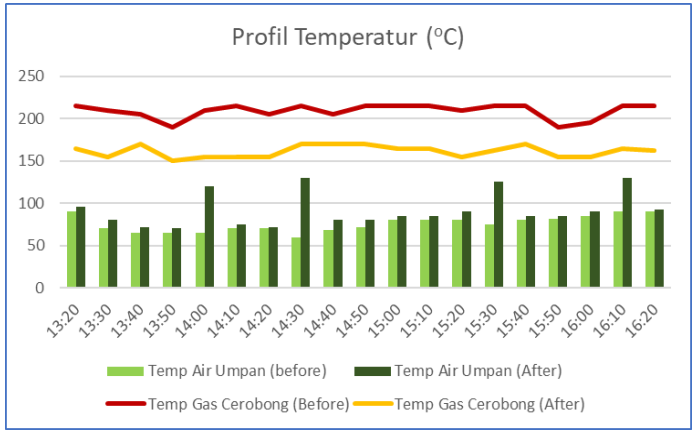




Sistem Daur Ulang Panas Gas Cerobong

Success Story

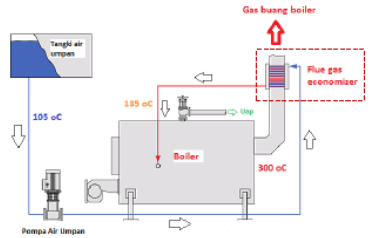




STUDI KASUS
PENGHEMATAN ENERGI PADA BOILER UAP
DENGAN TEKNOLOGI *FLUE GAS ECONOMIZER*

PENDAHULUAN

Pabrik susu umumnya menggunakan uap (*steam*) yang dihasilkan dari boiler sebagai sumber panas seperti proses sterilisasi, pasteurisasi, spray drier, dan lainnya. Kapasitas boiler uap yang digunakan umumnya 10 ton/jam pada tekanan 20 barg. Pada tekanan uap tersebut, temperatur gas buang boiler dapat mencapai 270-300 °C. Untuk itu, pabrik tersebut mencoba memanfaatkan panas gas buang sebagai pemanas awal air umpan boiler dengan *flue gas economizer*. Diagram proses pemanfaatan gas buang boiler sebagai sumber pemanas awal air umpan disajikan di gambar berikut.



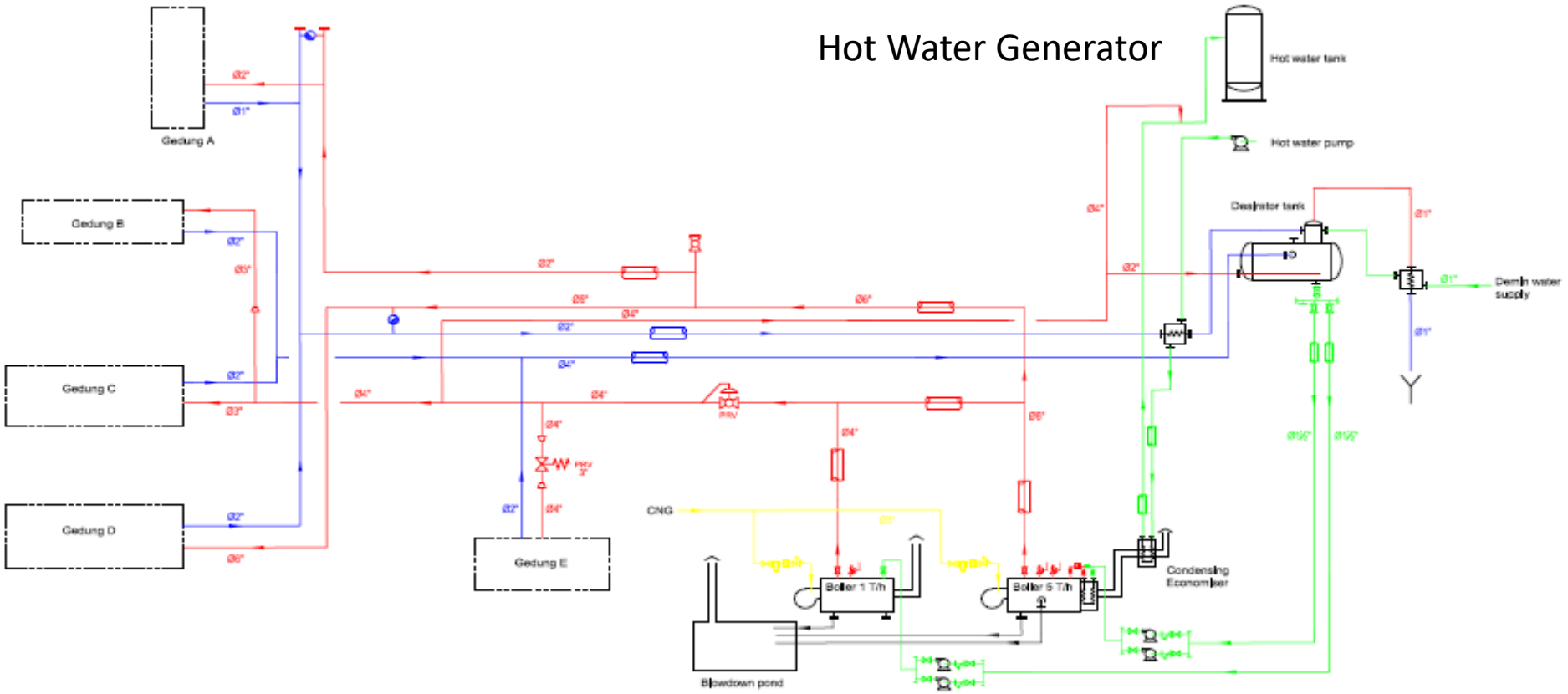
TEKNOLOGI EFISIENSI ENERGI

Flue gas economizer adalah perangkat khusus yang dirancang untuk menghemat konsumsi energi dari boiler uap dengan cara mengambil kembali panas *sensible* dari gas buang boiler. Panas yang diambil kembali ini biasanya digunakan untuk memanaskan air umpan boiler atau sistem pemanas lainnya.

HASIL IMPLEMENTASI

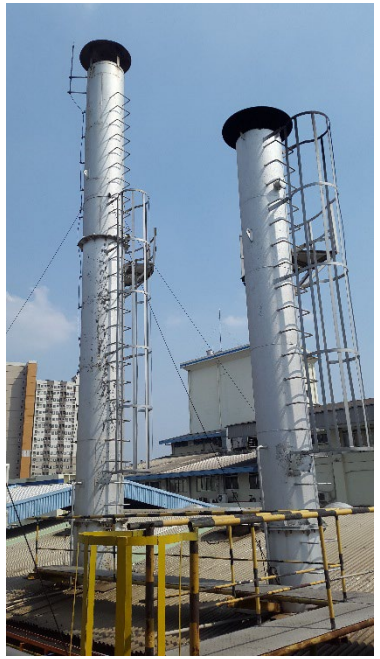
Setelah instalasi *flue gas economizer*, asesoris, valve, dan modifikasi jalur pipa air umpan dengan biaya investasi Rp 850.000.000 (*Delapan ratus lima puluh juta rupiah*), penghematan bahan bakar yang telah diperoleh mencapai 5% karena pengaruh peningkatan temperatur air umpan dari 105 °C menjadi 135 °C. Investasi ini cukup menarik, dikarenakan *payback period* kurang dari 1 tahun.

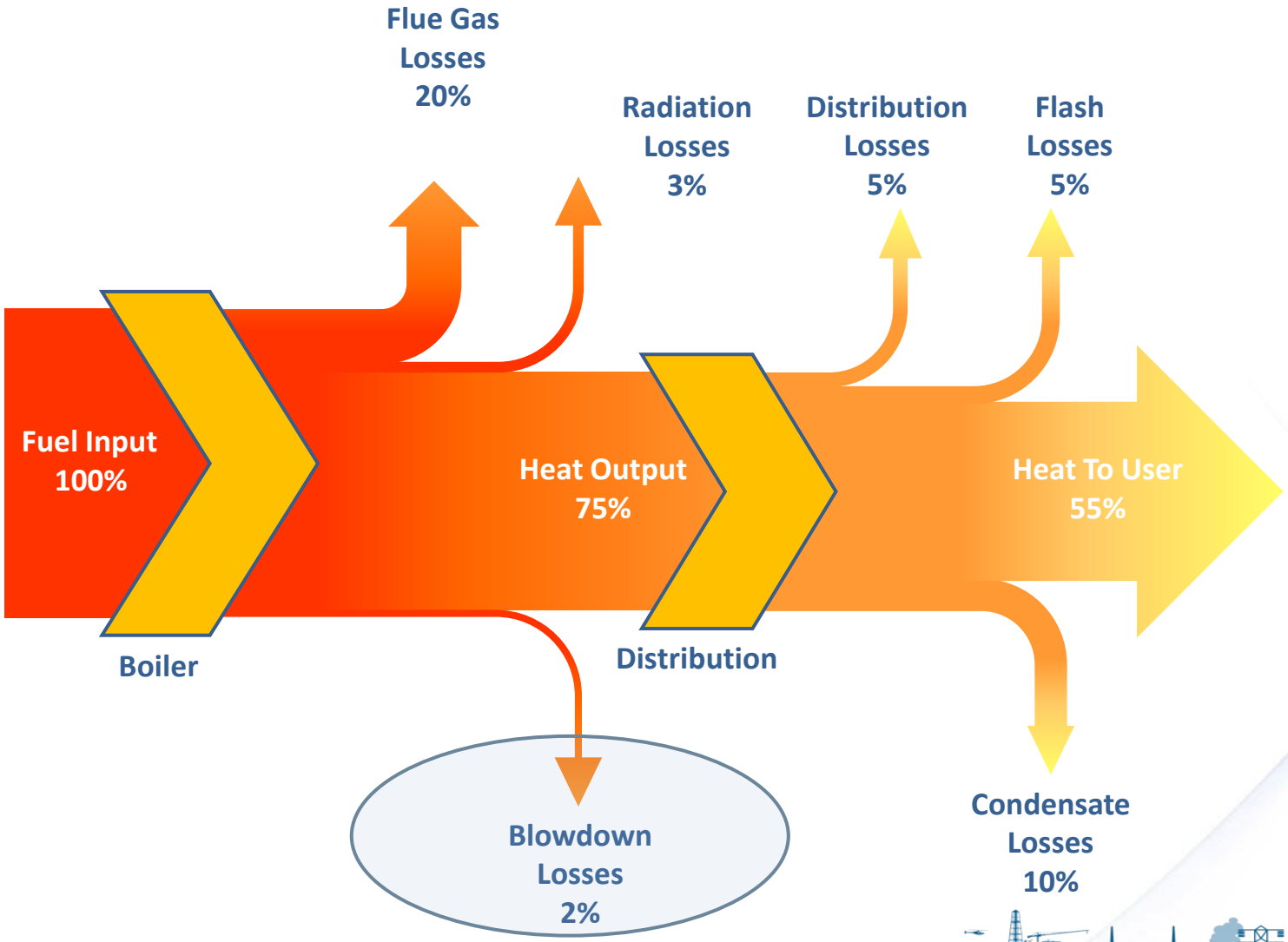
Sistem Daur Ulang Panas Gas Cerobong



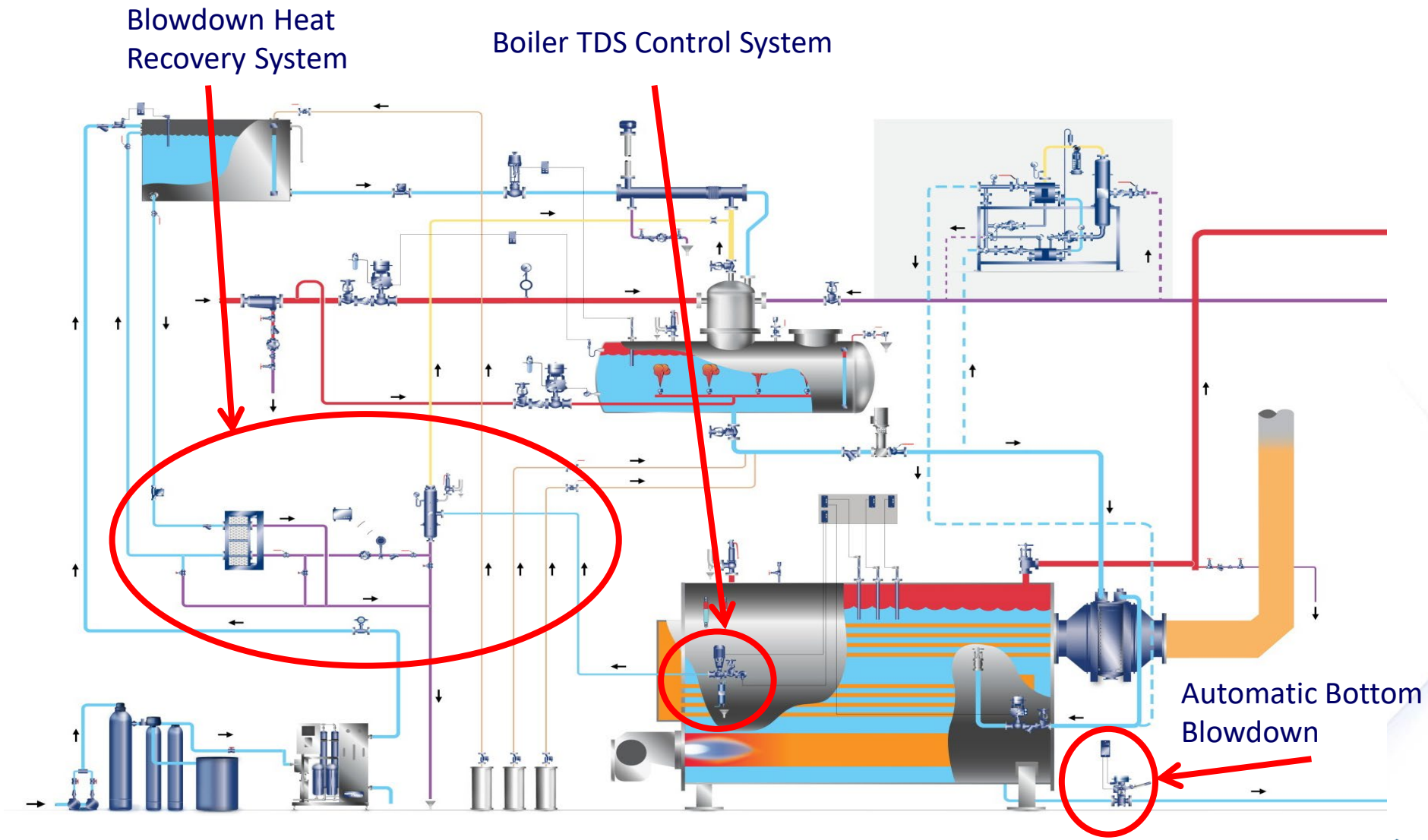
No	System	Boiler Efficiency @O_2 = 4%	Stack Gas Temperatur (°C)
1	Boiler	78 – 83%	177 – 288
2	With Economizer	84 – 86%	121 – 149
3	With Condensing Economiser	92 – 95%	24 – 66

TEKNIK KONSERVASI ENERGI DI BOILER

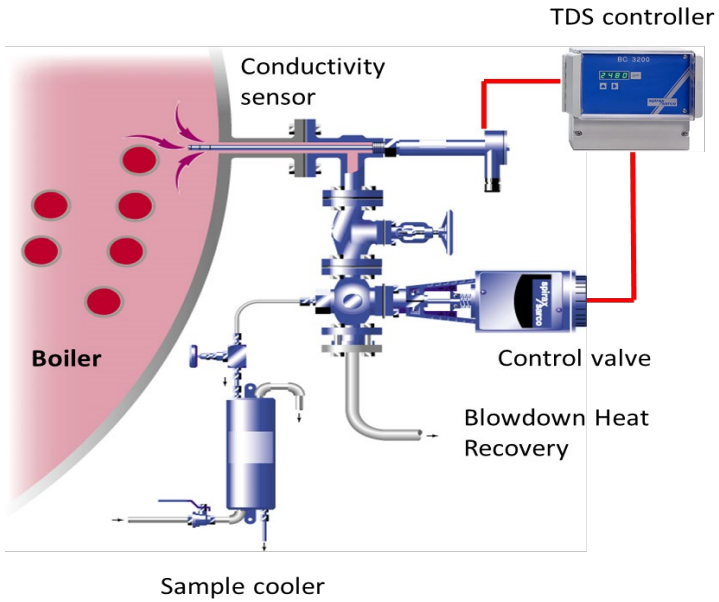


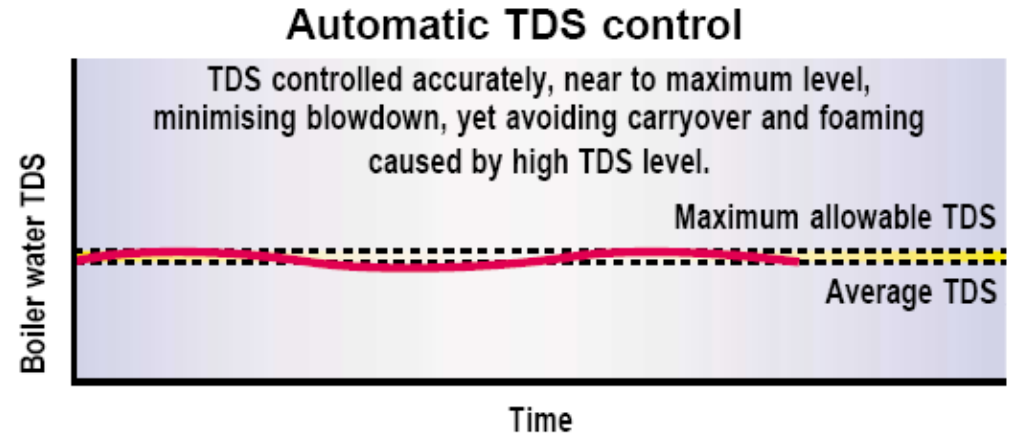


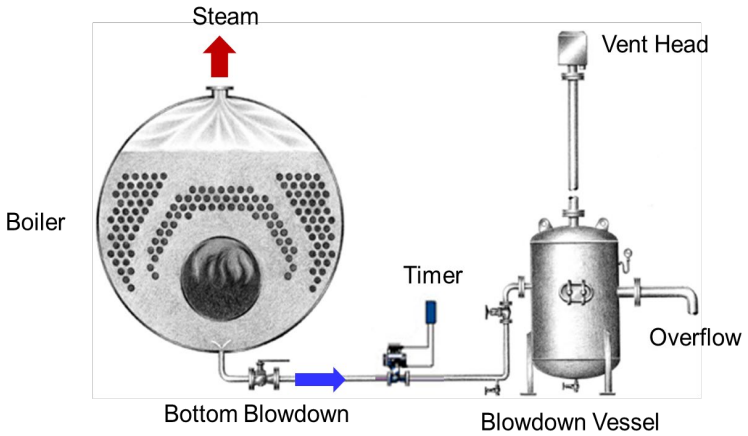
TDS control system dan Daur Ulang Panas Blowdown

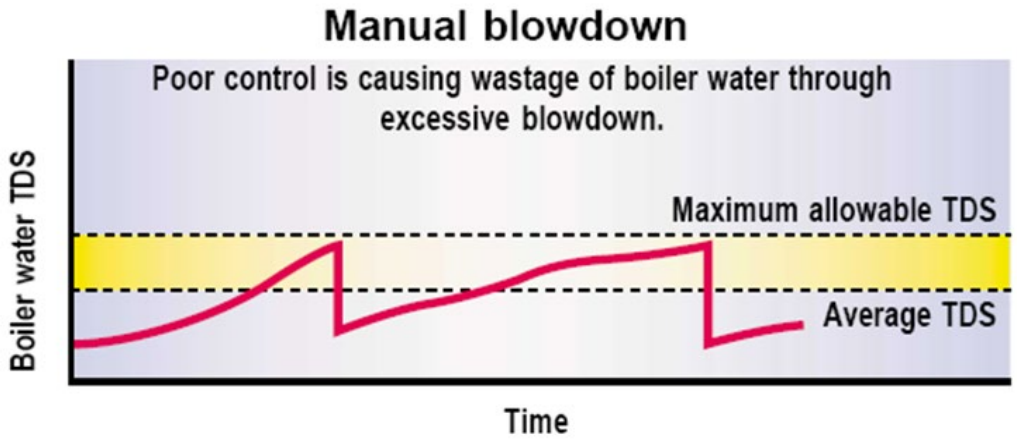


TDS/Blowdown Control System

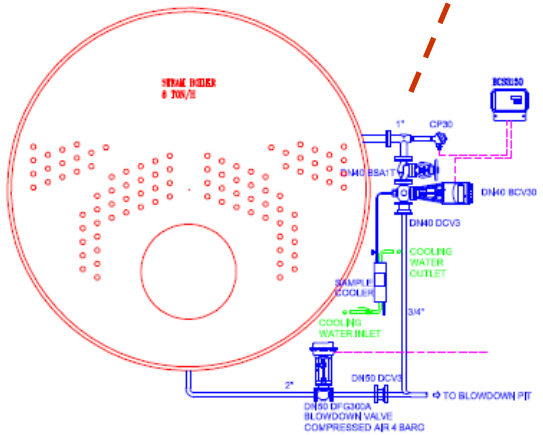


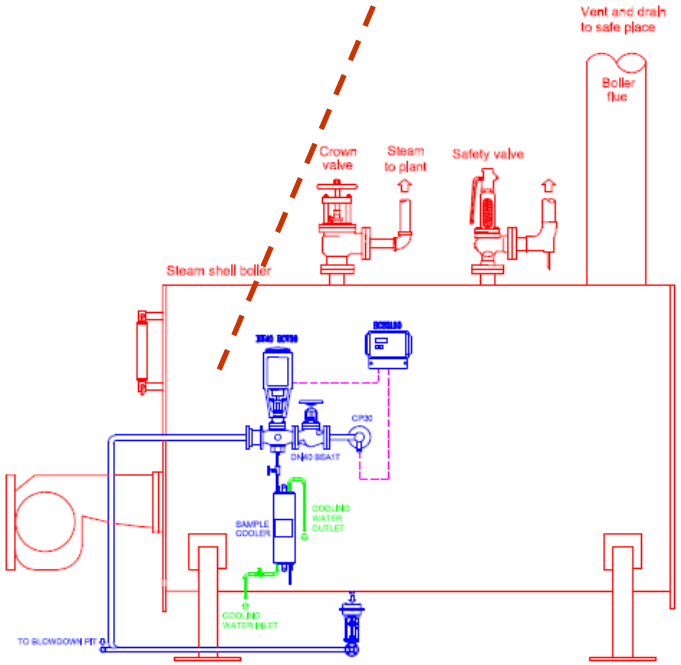






TDS/Blowdown Control System Project





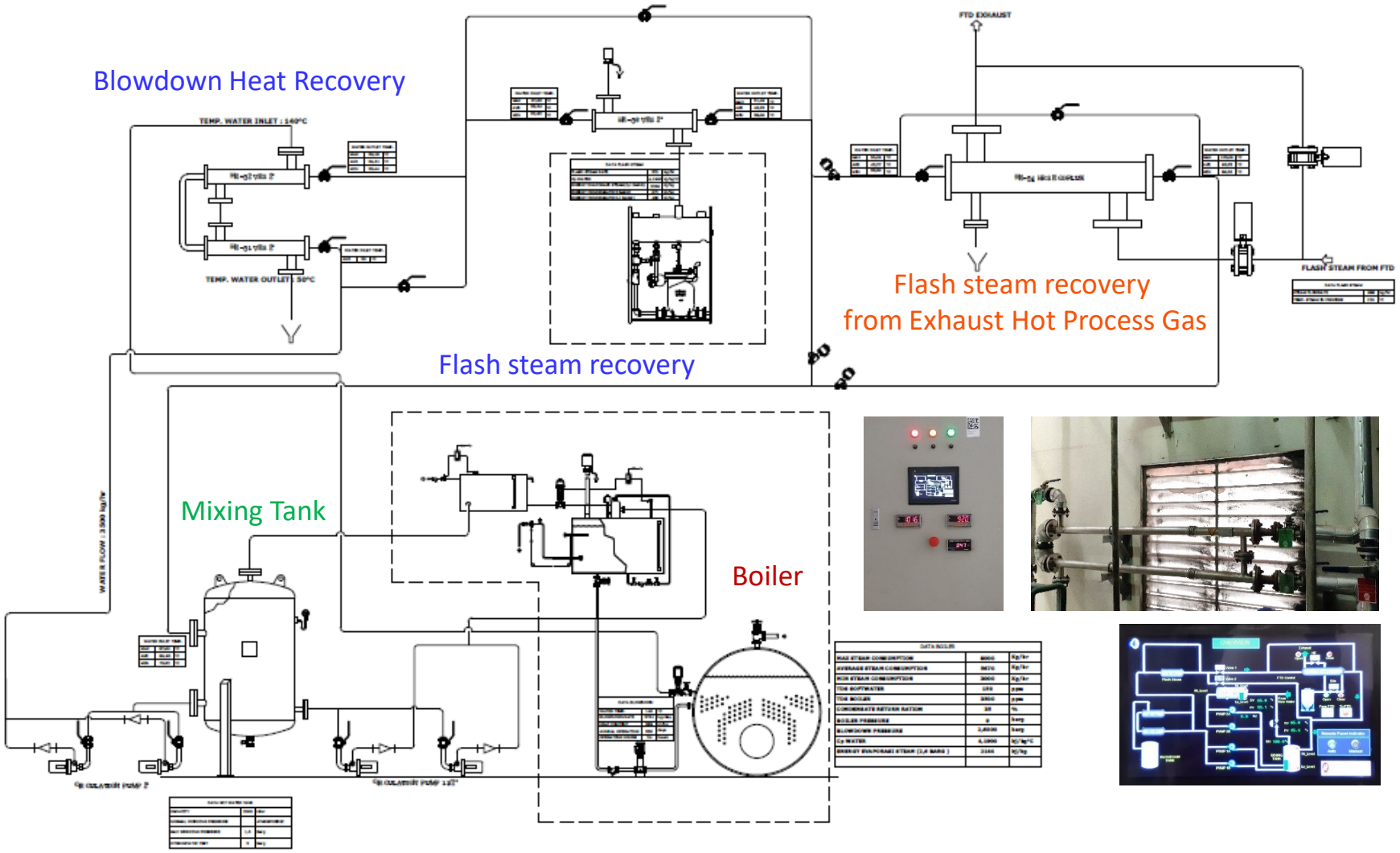
Perhitungan Penghematan Energi dengan Automatic Blowdown Control System

Nama Pelanggan	PT. TAK TERBATAS		
Nama Kontak Pelanggan	MR. BEJO	Nomor Kontak Pelanggan	
Nama Kontak Konsultan	MR. RUSMANTO/HP. 08156159711	Tanggal :	25-Mar-19

KONDISI OPERASI BOILER		
Tekanan steam boiler	11	barg
Temperatur air umpan boiler	80	°C
Konsumsi steam maksimum	7898	kg/jam
Konsumsi steam rata-rata	5042	kg/jam
Nilai TDS target	2500	ppm
Nilai TDS rata-rata terukur	1771	ppm
Nilai TDS air umpan boiler	198	ppm
DATA BLOWDOWN (Manual Blowdown)		
Persentase blowdown terhadap steam	12,59	%
Blowdown pada beban tertinggi	994	kg/jam
Laju alir umpan boiler pada beban tertinggi	8892	kg/jam
Blowdown pada beban rata-rata	635	kg/jam
Laju air umpan boiler rata-rata	5677	kg/jam
Energi temperatur air umpan --> cair jenuh	799	kJ/kg
Energi menaikkan temperatur air umpan	4.534.514	kJ/jam
Laju steam terbangkitkan	5042	kg/jam
Energi penguapan spesifik	1986	kJ/kg
Energi penguapan pada tekanan steam boiler	10.013.412	kJ/jam
Total konsumsi energi rata-rata	14.547.926	**kJ/jam**
Jam kerja	24	jam/hari
	24	hari/bulan
	288	hari/tahun

PENGHEMATAN ENERGI (Automatic Blowdown Control System)		
Persentase blowdown terhadap steam	9,10	%
Penghematan dalam persentase blowdown	3,49	%
Blowdown pada beban tertinggi	718	kg/jam
Laju alir umpan boiler pada beban tertinggi	8616	kg/jam
Blowdown pada beban rata-rata	459	kg/jam
Laju air umpan boiler rata-rata	5501	kg/jam
Energi menaikkan temperatur air umpan	4.393.859	kJ/jam
Laju steam terbangkitkan	5042	kg/jam
Energi penguapan pada tekanan steam boiler	10.013.412	kg/jam
Total konsumsi energi rata-rata	14.407.271	kJ/jam
Penghematan energi	140.655	**kJ/jam**
	39	kW
PENGHEMATAN BAHAN BAKAR DAN PERHITUNGAN KEMBALI MODAL		
Nilai kalor bahan bakar	38526	kJ/m3
Penghematan bahan bakar	3,7	m3/jam
Harga bahan bakar	4682	Rp/m3
Penghematan biaya	9.845.910	Rp/bulan
	118.150.916	**Rp/tahun**
Harga automatic blowdown control system	200.000.000	Rp
Kembali modal	1,6	tahun

Daur Ulang Panas Blowdown dan Flash Steam



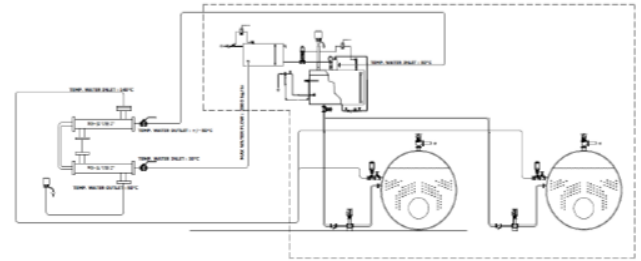
STUDI KASUS

PENGHEMATAN ENERGI PADA SISTEM UAP

DENGAN TEKNOLOGI *BLOWDOWN HEAT RECOVERY*

PENDAHULUAN

Pabrik rokok umumnya menggunakan uap (*steam*) yang dihasilkan dari boiler sebagai sumber panas seperti proses pembangkitan air panas dan pemanas udara pengering. Kapasitas boiler uap yang digunakan umumnya mencapai 10 ton/jam pada tekanan 8 barg. Untuk menjaga kualitas air dan kinerja boiler, diperlukan buangan blowdown agar tidak terjadi akumulasi kandungan padatan terlarut (*total dissolved solid/TDS*). Laju alir buangan blowdown pada kapasitas dan nilai TDS tersebut adalah antara 6-10% dari laju alir uap yang dihasilkan. Pabrik ini telah melakukan usaha konservasi energi dengan cara memanfaatkan panas blowdown sebagai pemanas awal air umpan boiler dengan sistem *blowdown heat recovery*, sebagaimana disajikan di gambar berikut.



TEKNOLOGI EFISIENSI ENERGI

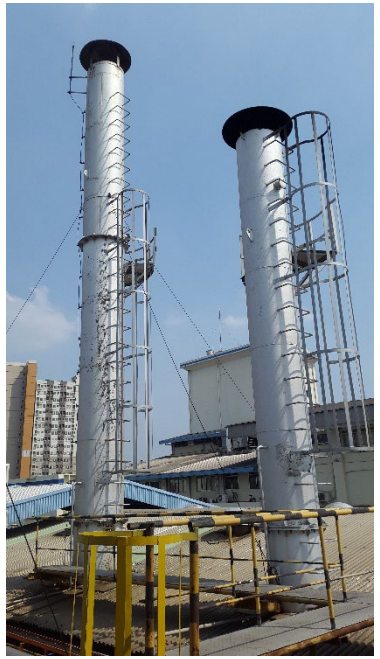
Blowdown Heat Recovery System adalah sistem/perangkat yang dirancang untuk mendaur ulang panas dari *blowdown* boiler, dengan menggunakan piranti penukar panas dan atau gabungan dengan tangki *flash steam*. Panas yang diambil kembali biasanya digunakan untuk memanaskan air umpan segar (*fresh water make up*) sebelum masuk ke tangki air boiler.

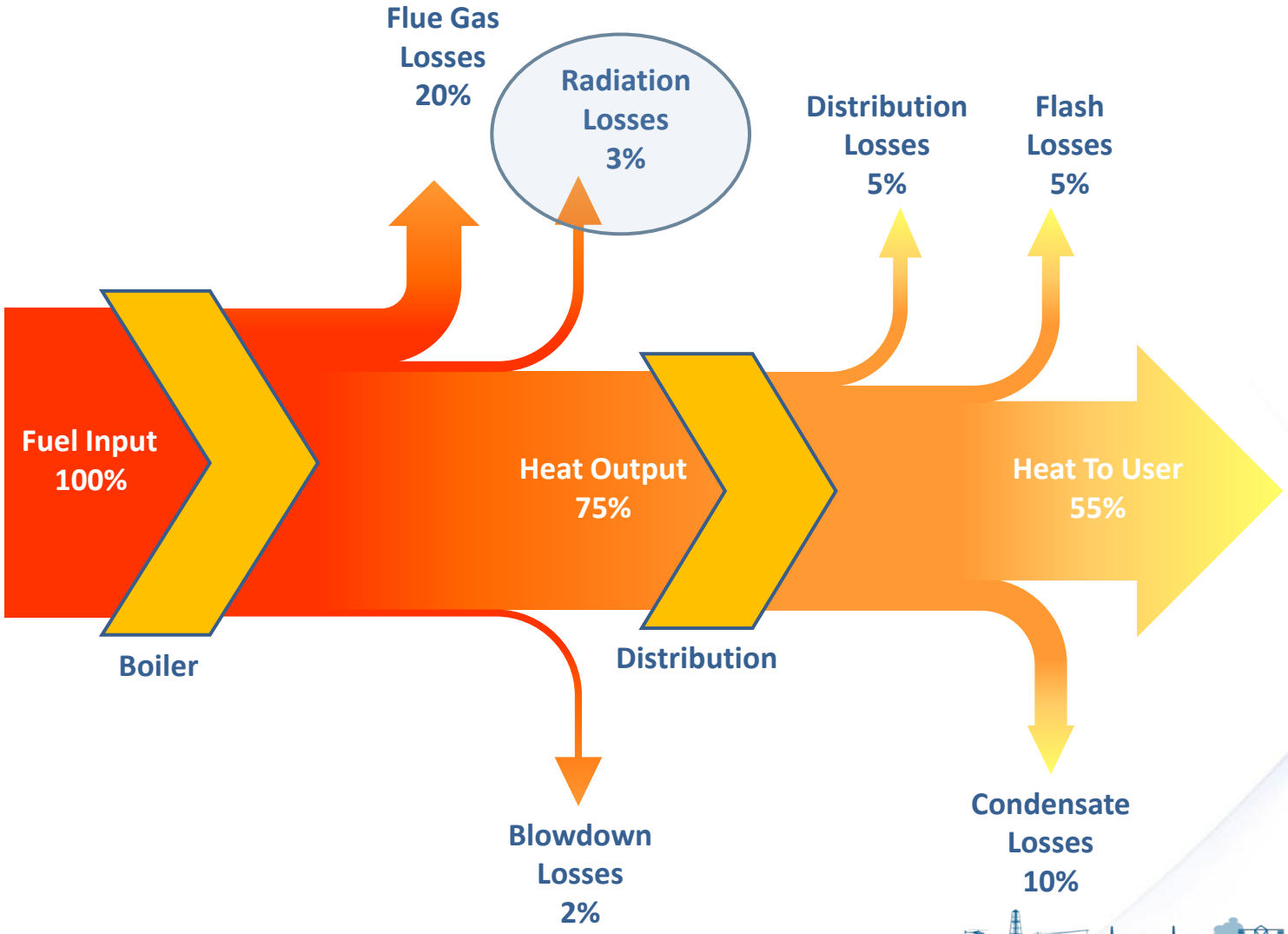
HASIL IMPLEMENTASI

Nilai investasi sebesar Rp 400.000.000 (*Empat ratus juga rupiah*) telah digunakan untuk pengadaan piranti penukar panas, valve, asesoris, dan pekerjaan pipa. Hasil implementasi ini dapat menghemat bahan bakar gas dan biaya karena kenaikan temperatur air umpan, yang memberikan *payback period* kurang dari 1,6 tahun.

RE-INSULATION BOILER BODY MENCEGAH PANAS RADIASI DAN KONVEKSI

TEKNIK KONSERVASI ENERGI DI BOILER



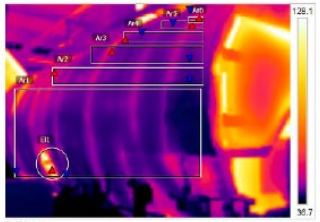


Laporan Thermal Imager

Measurements		°C
Ar1	Max	130.9
	Min	38.0
	Average	46.3
Ar2	Max	59.1
	Min	42.3
	Average	47.2
Ar3	Max	68.3
	Min	44.6
	Average	47.4
Ar4	Max	58.4
	Min	45.9
	Average	48.2
Ar5	Max	57.4
	Min	46.6
	Average	50.5
Ar6	Max	59.8
	Min	48.2
	Average	53.9
El1	Max	130.9
	Min	41.7
	Average	59.1

Parameters	
Emissivity:	0.95
Refl. apparent temp.:	20 °C

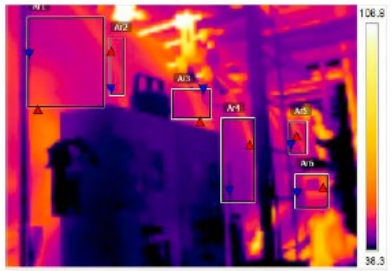
Note:
Kondisi temperatur sisi kiri permukaan boiler-1 masih cukup baik. Hanya ada satu spot yang temperaturnya di atas 60°C yaitu area burner.

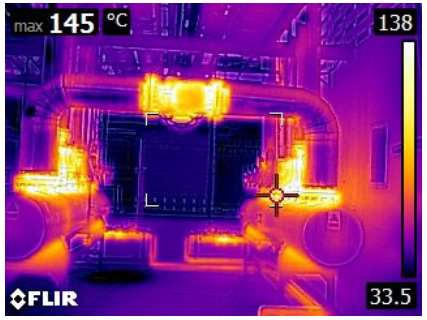


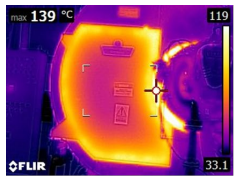
Measurements		°C
Ar1	Max	54.7
	Min	43.8
	Average	48.5
Ar2	Max	50.5
	Min	48.2
	Average	49.7
Ar3	Max	53.7
	Min	44.2
	Average	49.1
Ar4	Max	54.7
	Min	40.1
	Average	45.4
Ar5	Max	53.4
	Min	46.0
	Average	49.1
Ar6	Max	58.8
	Min	43.1
	Average	49.2

Parameters	
Emissivity:	0.95
Refl. apparent temp.:	20 °C

Note:
Kondisi temperatur sisi kanan permukaan boiler-1 masih cukup baik (<60°C).





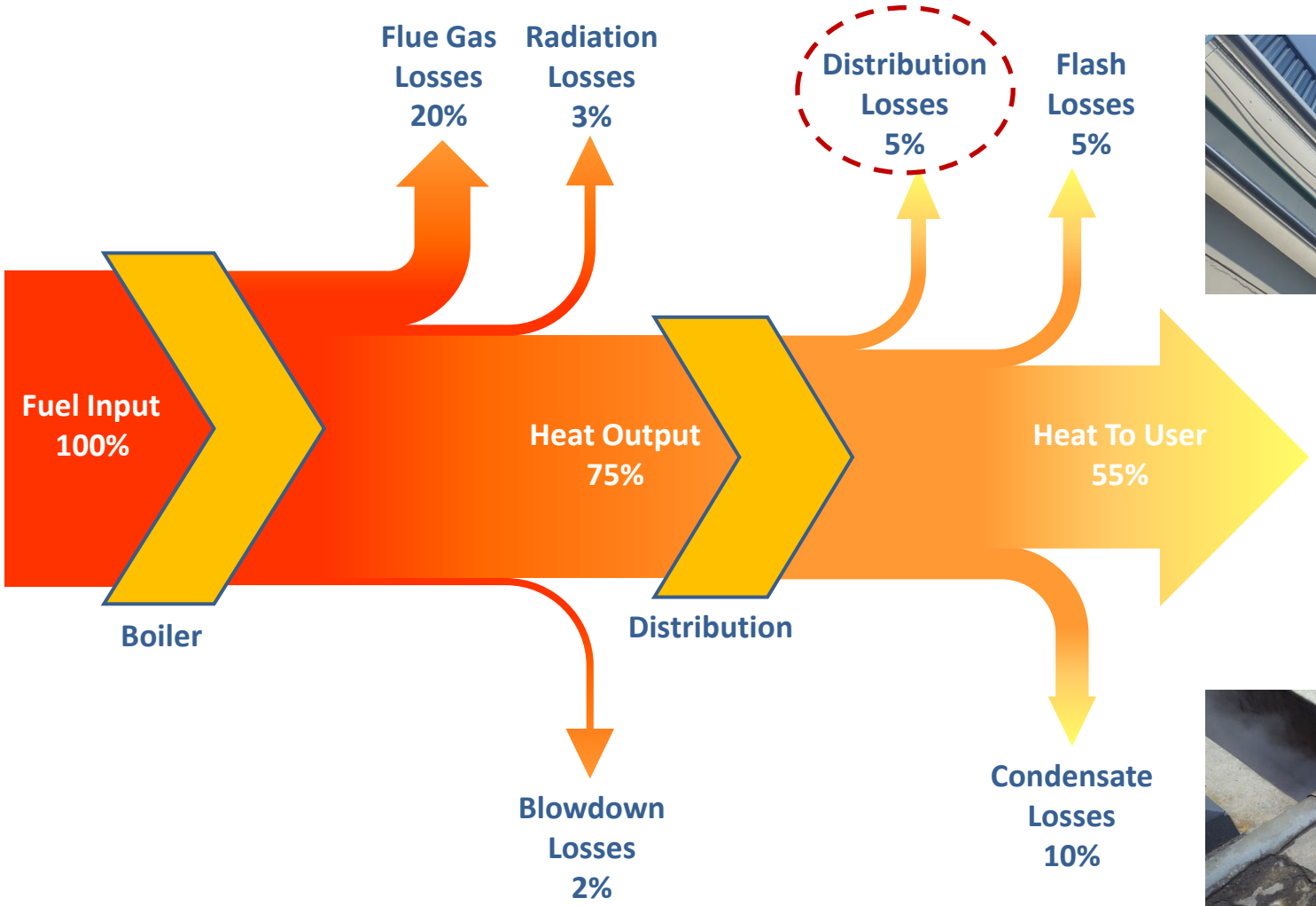


Insulasi Perpipaan Steam dan Kondensat

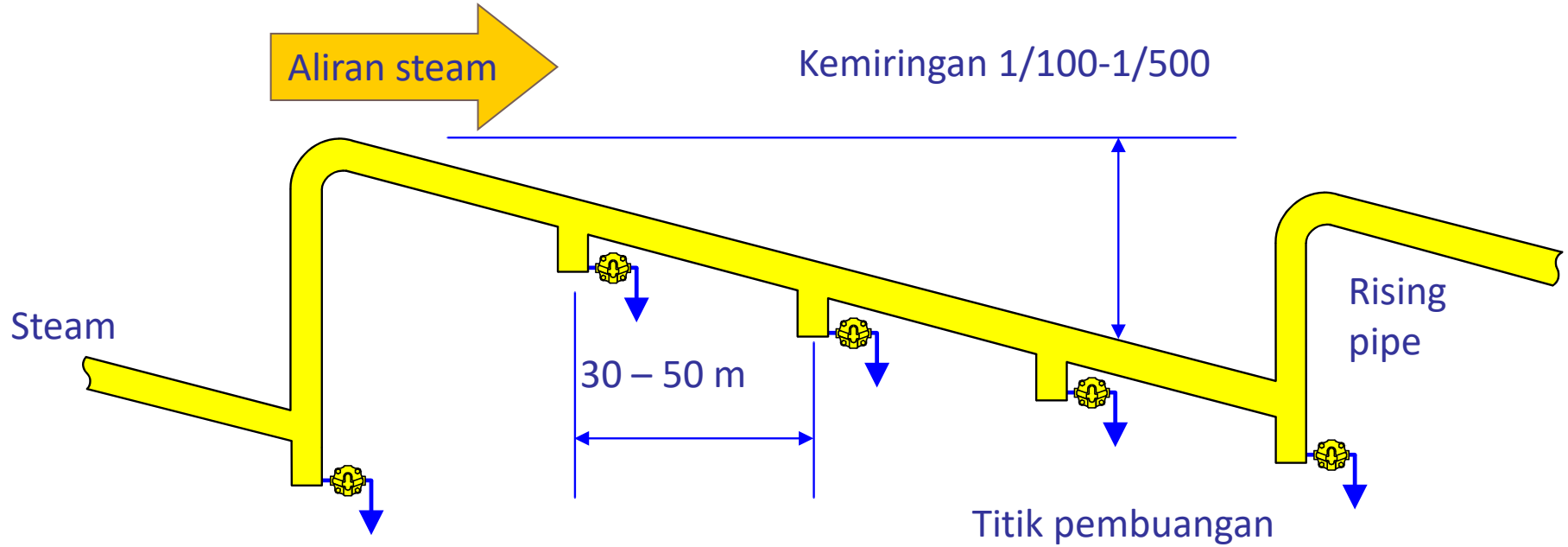
Calculate steam pipe running load			Comment
	Data Input		m (kg/h) = Qr x L x 3.6 x f / hfg
Nominal Pipe size	100	mm	
Steam pressure	10.0	bar g	
Ambient temperature	30	°C	
Equivalent length of pipe (L)	100	m	
Wind speed correction factor	4.0		
Unlagged pipe radiation loss (Qr)	2,486	W/m	
Steam temperature	184	°C	
hfg	1,998	kJ/kg	
	Results		
Running load unlagged	448	kg/h	
Running load 50 mm insulation	38	kg/h	
Running load 100 mm insulation	34	kg/h	
Running load 150 mm insulation	31	kg/h	

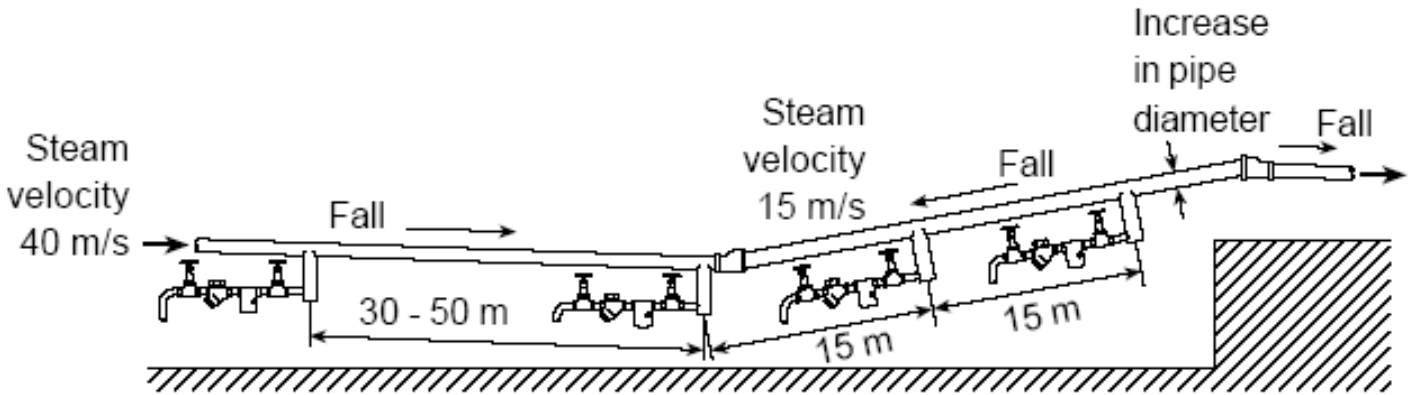
Rugi-rugi energi distribusi umumnya berkisar 1-3% meskipun telah diinsulasi

TEKNIK KONSERVASI ENERGI PADA DISTRIBUSI STEAM

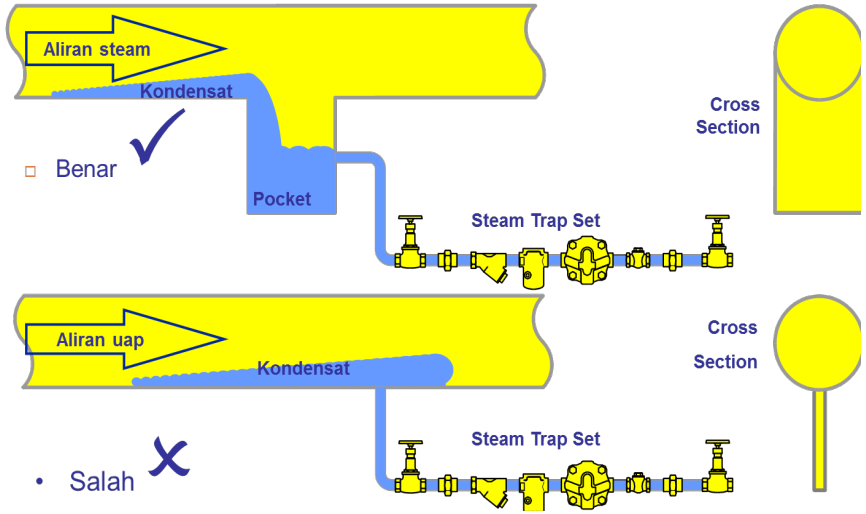


Best Practices Instalasi Distribusi Steam

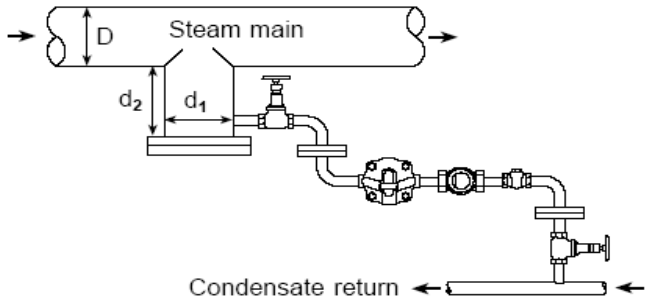


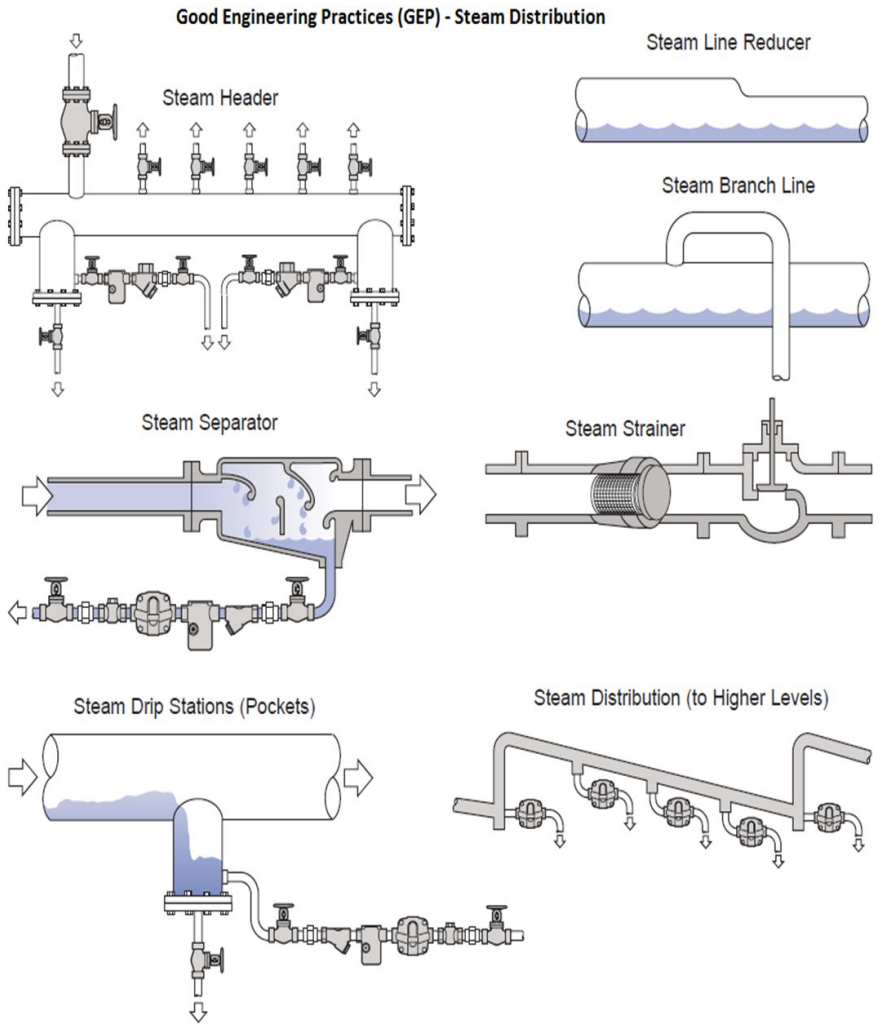


Best Practices Instalasi Distribusi Steam



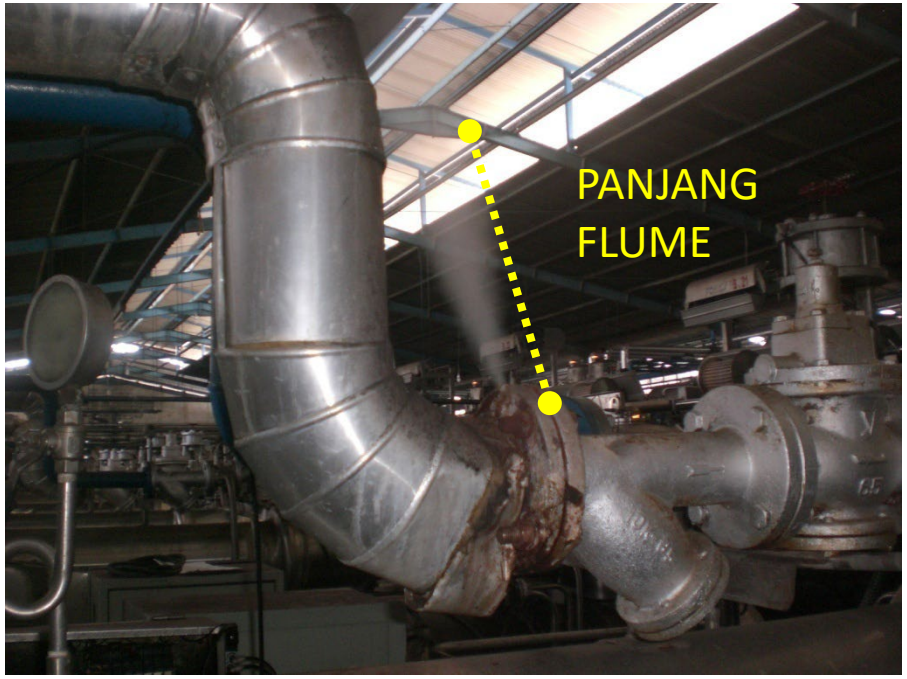
Mains diameter - D	Pocket diameter - d_1	Pocket depth - d_2
Up to 100 mm nb	d_1 = D	Minimum d_2 = 100 mm
125 - 200 mm nb	d_1 = 100 mm	Minimum d_2 = 150 mm
250 mm and above	d_1 = D / 2	Minimum d_2 = D

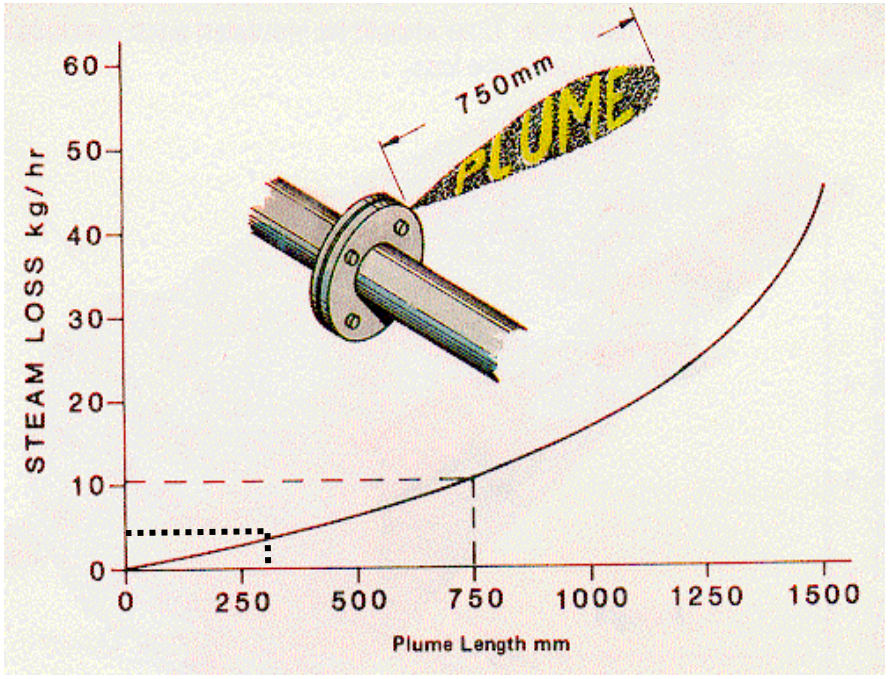




RUGI-RUGI PANAS PADA DISTRIBUSI
DAN
TEKNIK KONSERVASI ENERGI

Menutup Kebocoran Steam

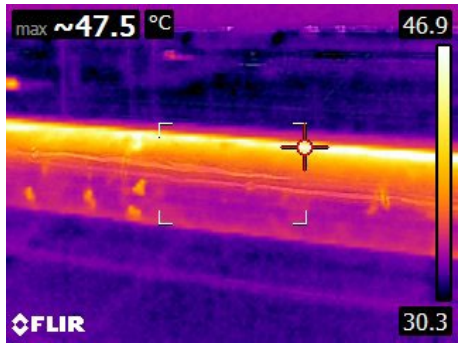


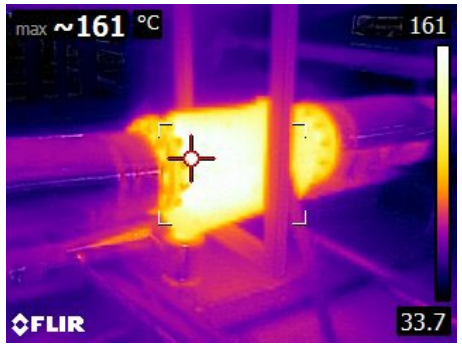


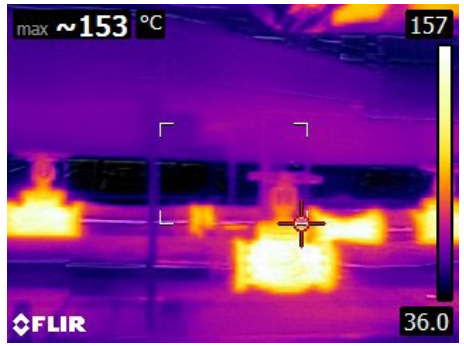
Contoh : Kebocoran uap dari gasket pada sambungan pipa = 4 kg/jam
dengan panjang 'Plume' 300 mm

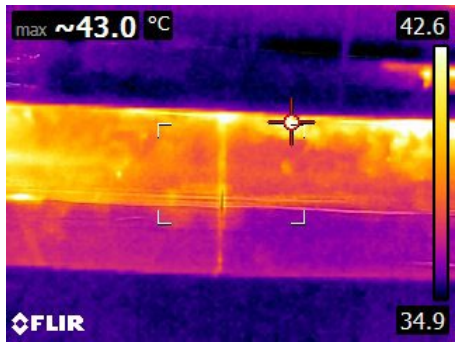
Kerugian biaya = 4 kg/jam x Rp 367/kg x 16 x 25 x 12 = Rp 7 juta/tahun

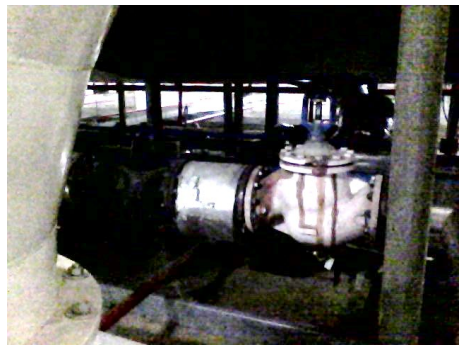
Thermal Imager Distribusi Steam

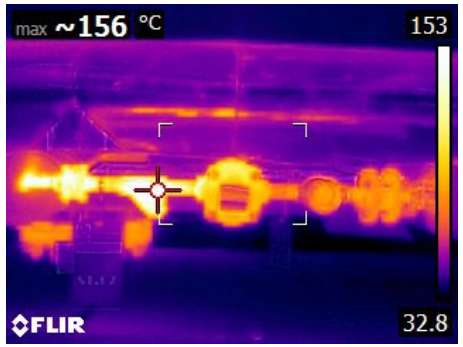


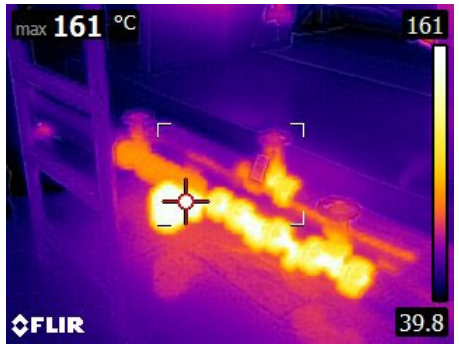


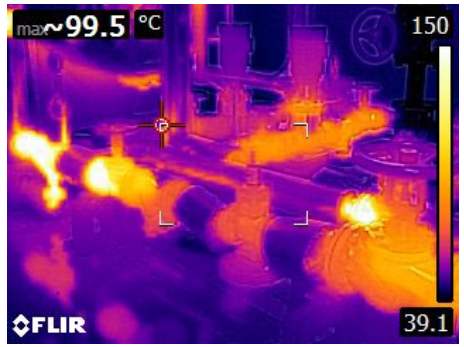












Insulasi Tangki Kondensat dan Jalur Pipa

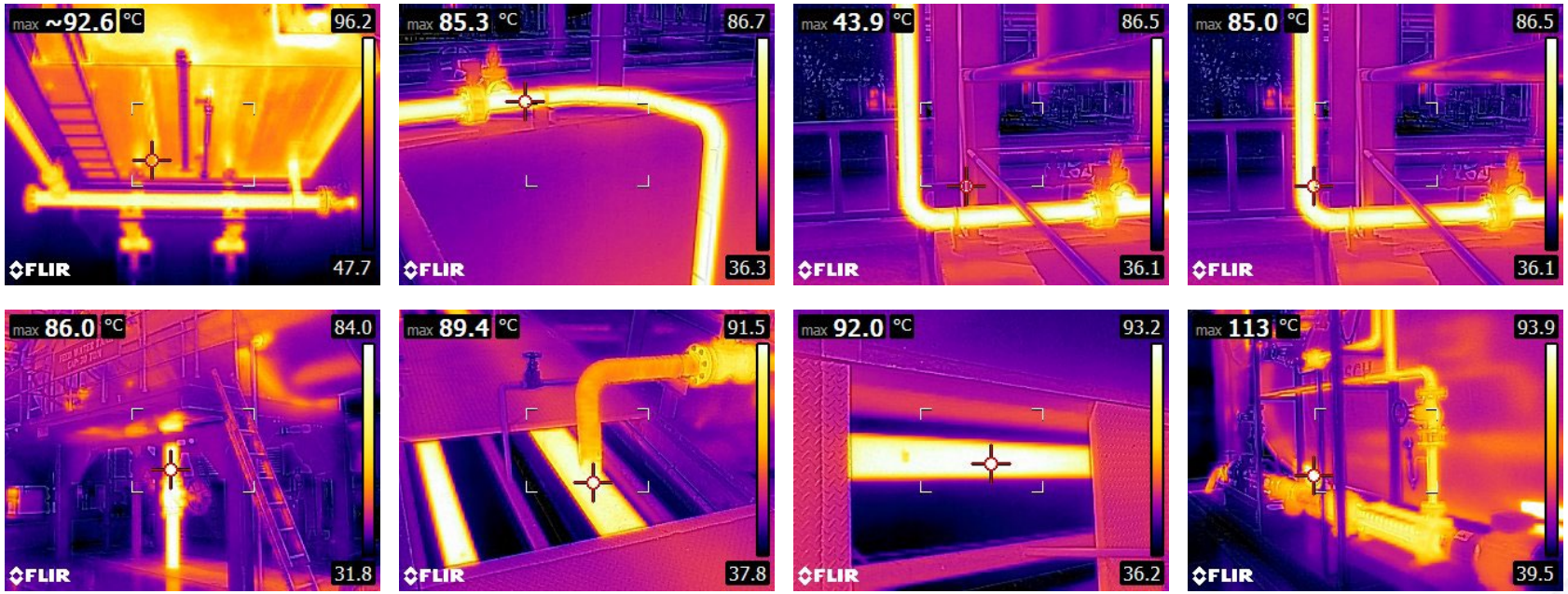
Kondisi Saat Ini :

Tangki kondensat tidak terinsulasi

Pipa kondensat 4” tidak terinsulasi dari tangki kondensat ke deaerator sepanjang 50 m

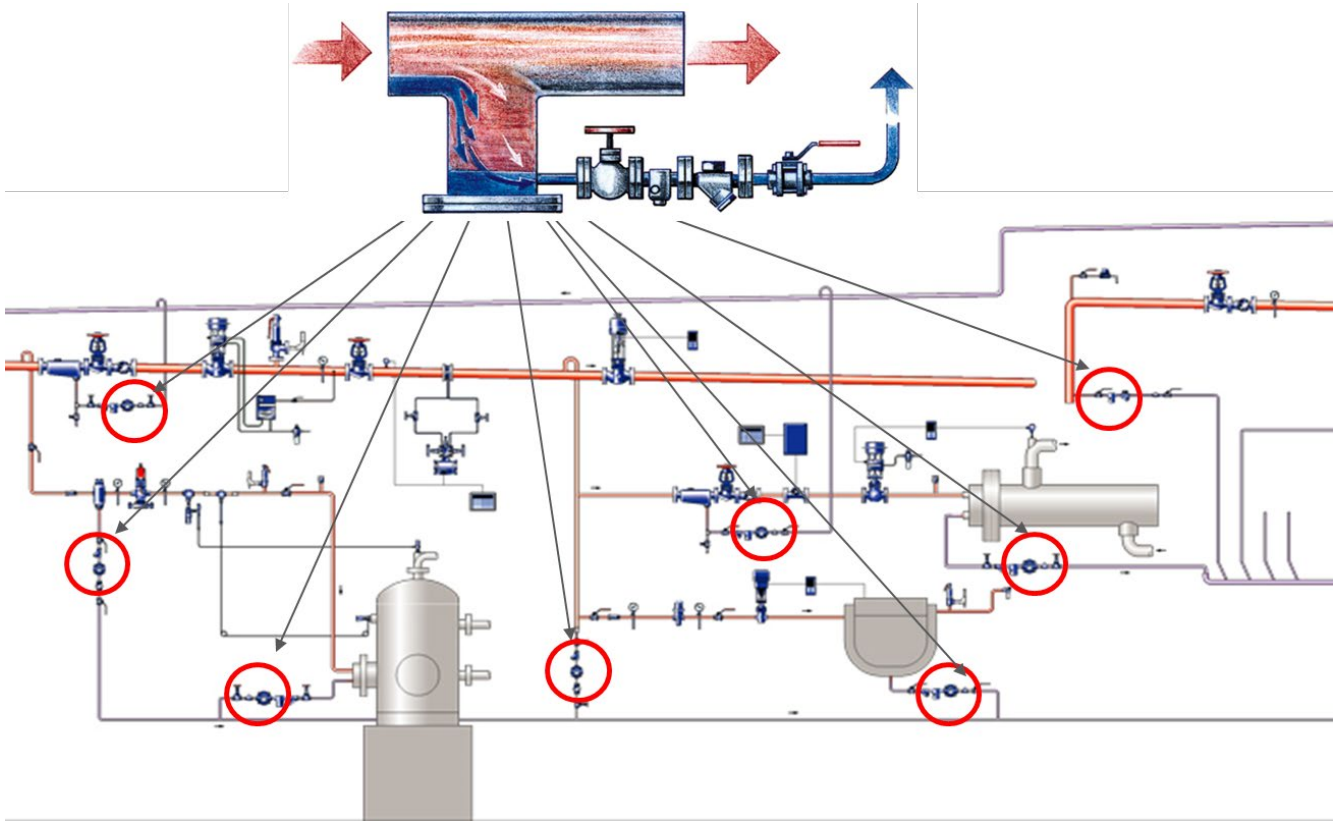
Pipa air umpan dari deaerator ke boiler 4” sepanjang 15 m, 6” 20 m

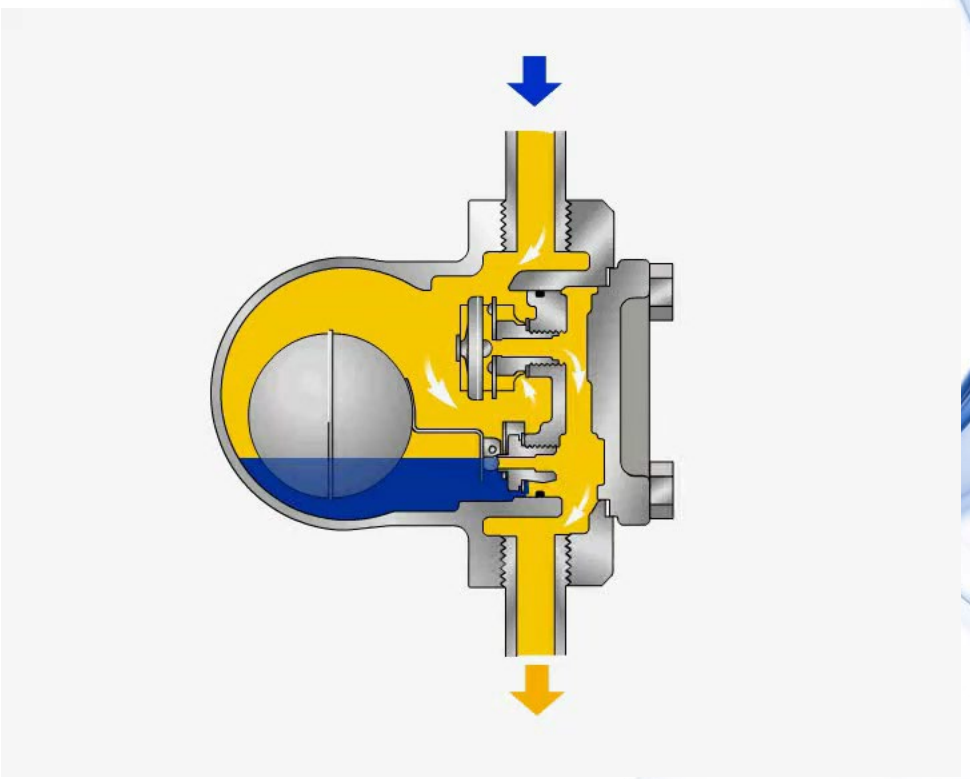
Pipa steam 1” sepanjang 15 m



Steam Trapping and Monitoring

Steam trap adalah peralatan otomatis untuk membuang kondensat dan udara dari distribusi dan proses, tetapi menahan steam agar tidak terjadi kebocoran steam ke jalur kondensat.

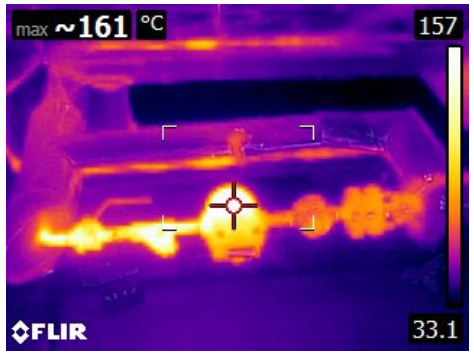




Cara Kerja Steam Trap

Steam Trapping and Monitoring

1. Uji kinerja steam trap dengan bantuan ultrasonic trap tester dan peralatan pendukung seperti infrared temperature gun sensor secara berkala atau realtime
2. Uji kebocoran lain, seperti valve steam trap set
3. Tagging and numbering steam trap
4. Tabulasi steam trap
5. Pengambilan gambar setiap steam trap setMengolah dan menampilkan data tabel *steam trap audit*
6. Perhitungan kebocoran steam dan emisi karbon
7. Laporan steam trap survey

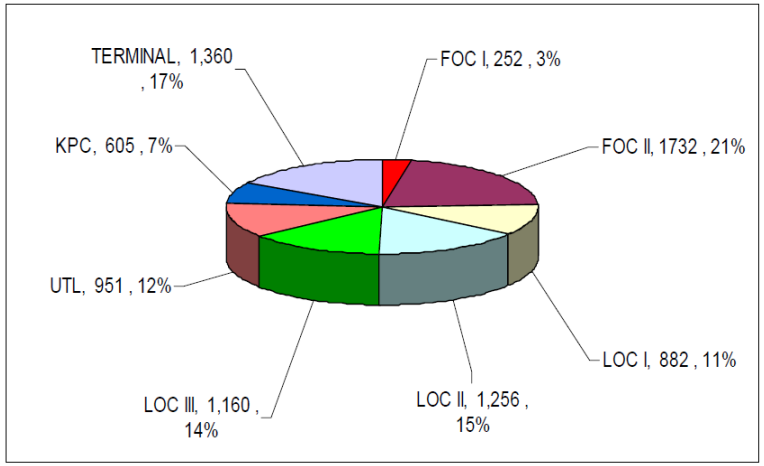


Hasil Steam Trap Audit

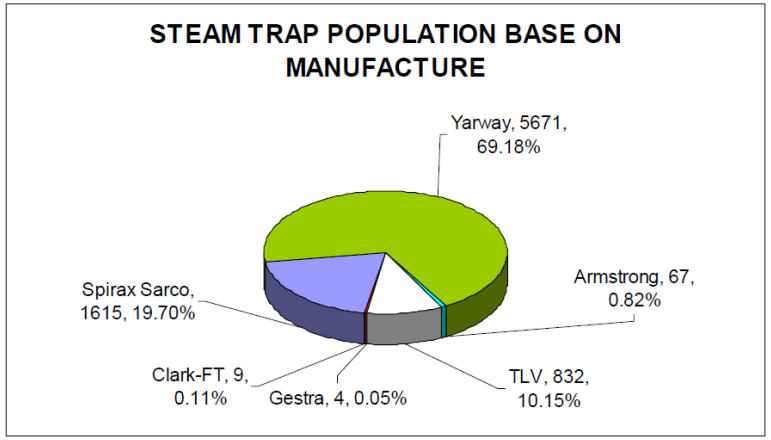
Tag Number	Location	Manufacturer	Model	Type	Connection Type	Connection Size	Pressure	Condition	Steam Loss per Hour	Replacement Model	Replacement Size	Notes
0001	Boiler House	Spirax	TD42H	Thermodynamic Disc	Screwed	1/2" (15mm)	9.00	OK	0.00			
0002	Boiler House	Spirax	TD42H	Thermodynamic Disc	Screwed	1/2" (15mm)	9.00	OK	0.00			
0003	Boiler House	Armstrong	811-15	Inverted Bucket	Screwed	1" (25mm)	9.00	OK	0.00			
0004	Belakang WFI	Spirax	FT14-10	Float & Thermostatic	Screwed	1/2" (15mm)	9.00	OK	0.00			
0005	Belakang WFI	Spirax	FT14-10	Float & Thermostatic	Screwed	1/2" (15mm)	4.00	Not in Use	0.00			
0006	WFI Lama	Spirax	FT14-10	Float & Thermostatic	Screwed	1/2" (15mm)	3.00	OK	0.00			
0007	WFI Lama	Spirax	FT14-10	Float & Thermostatic	Screwed	1" (25mm)	3.00	OK	0.00			
0008	Mezanin Post 3	Spirax	TD42H	Thermodynamic Disc	Screwed	1/2" (15mm)	9.00	OK	0.00			
0009	Mezanin	Unknown	Unknown	Thermodynamic Disc	Screwed	1/2" (15mm)	2.50	OK	0.00			
0010	Mezanin Hot Mud	Spirax	TD42H	Thermodynamic Disc	Screwed	1/2" (15mm)	9.00	OK	0.00			
0011	Samping Wifi Baru	Spirax	FT14-10	Float & Thermostatic	Screwed	1" (25mm)	9.00	Failed Open	14.93	FT14-10	1" (25mm)	
0012	Hot Mud Lt. 3	Spirax	FT14-4.5	Float & Thermostatic	Screwed	1" (25mm)	2.50	OK	0.00			
0013	Mixing 2C	Unknown	Unknown	Thermostatic	Tri Clamp	1/2" (15mm)	3.00	OK	0.00			
0014	Mixing 1C	Unknown	Unknown	Thermostatic	Tri Clamp	1/2" (15mm)	3.00	Failed Open	3.72	BT06	1/2" (15mm)	
0015	Mezanin	Spirax	TD42H	Thermodynamic Disc	Screwed	3/4" (20mm)	2.50	OK	0.00			
0016	Mezanin	Spirax	FT14-10	Float & Thermostatic	Screwed	1/2" (15mm)	2.50	OK	0.00			

Total kebocoran = 18 kg/jam
Kerugian = Rp 31,7 juta/tahun
Penggantian trap = Rp 10 juta
Payback = 4 bulan

STEAM TRAP POPULATION
TOTAL 8198 PCS

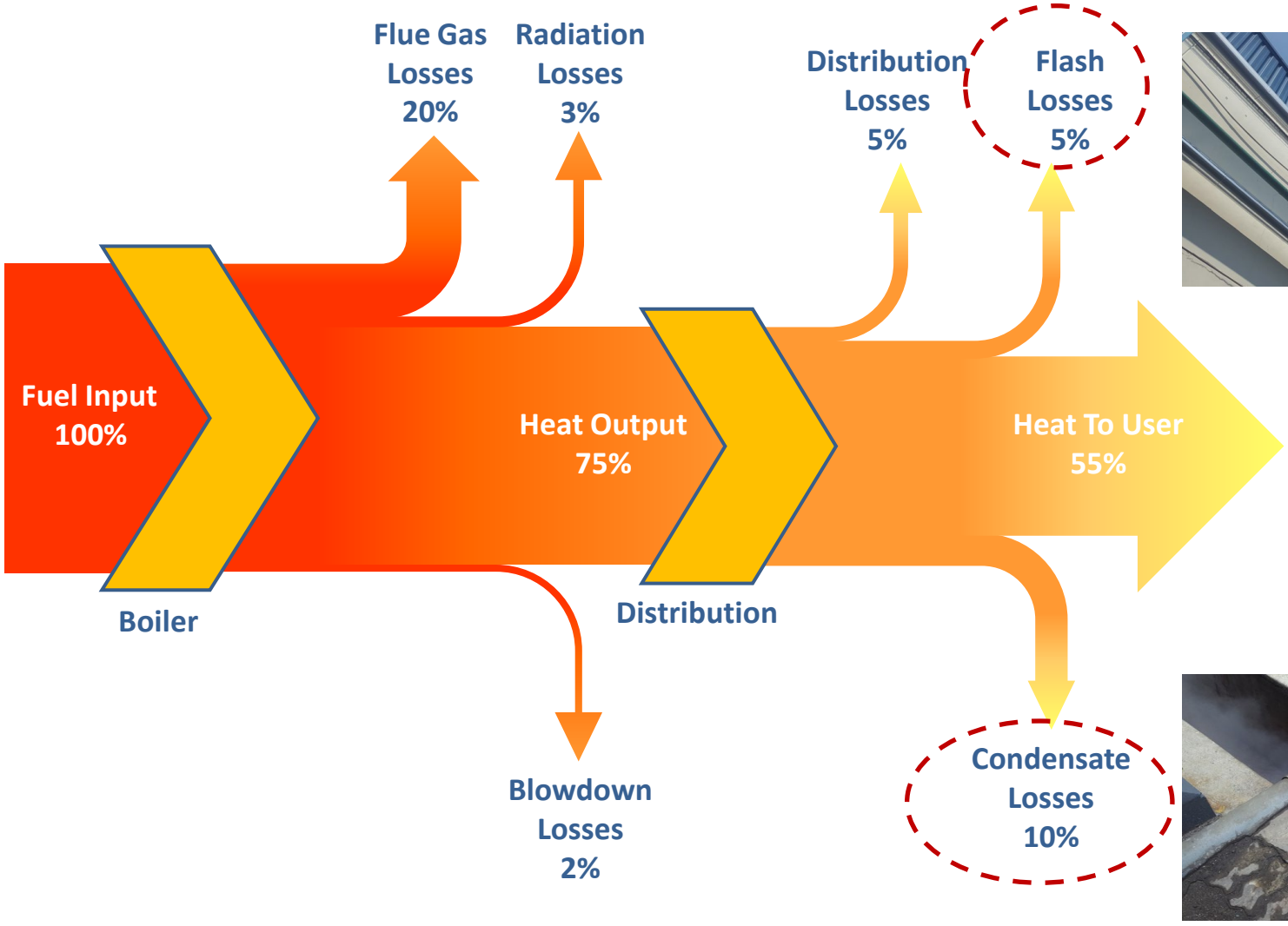


STEAM TRAP POPULATION BASE ON MANUFACTURE



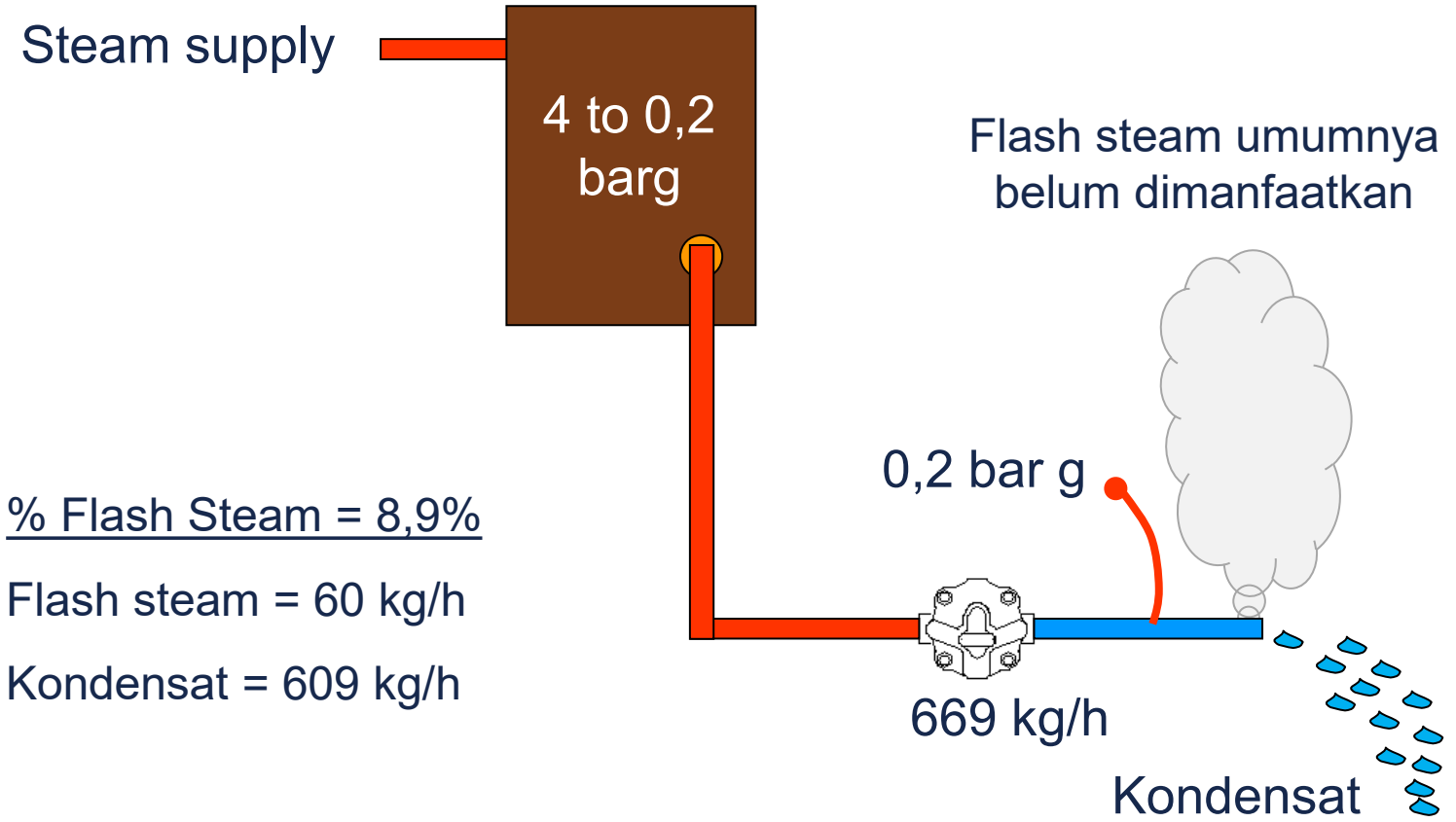
SISTEM DAUR ULANG PANAS KONDENSAT DAN FLASH STEAM

TEKNIK KONSERVASI ENERGI PADA DISTRIBUSI STEAM



Pembentukan Kondensat & Flash Steam

Flash steam is a natural occurrence when condensate drops in pressure after leaving a steam trap. The condensate is at steam temperature and cannot maintain this temperature at a lower pressure. This results in the condensate flashing off into steam to lose the excess heat.



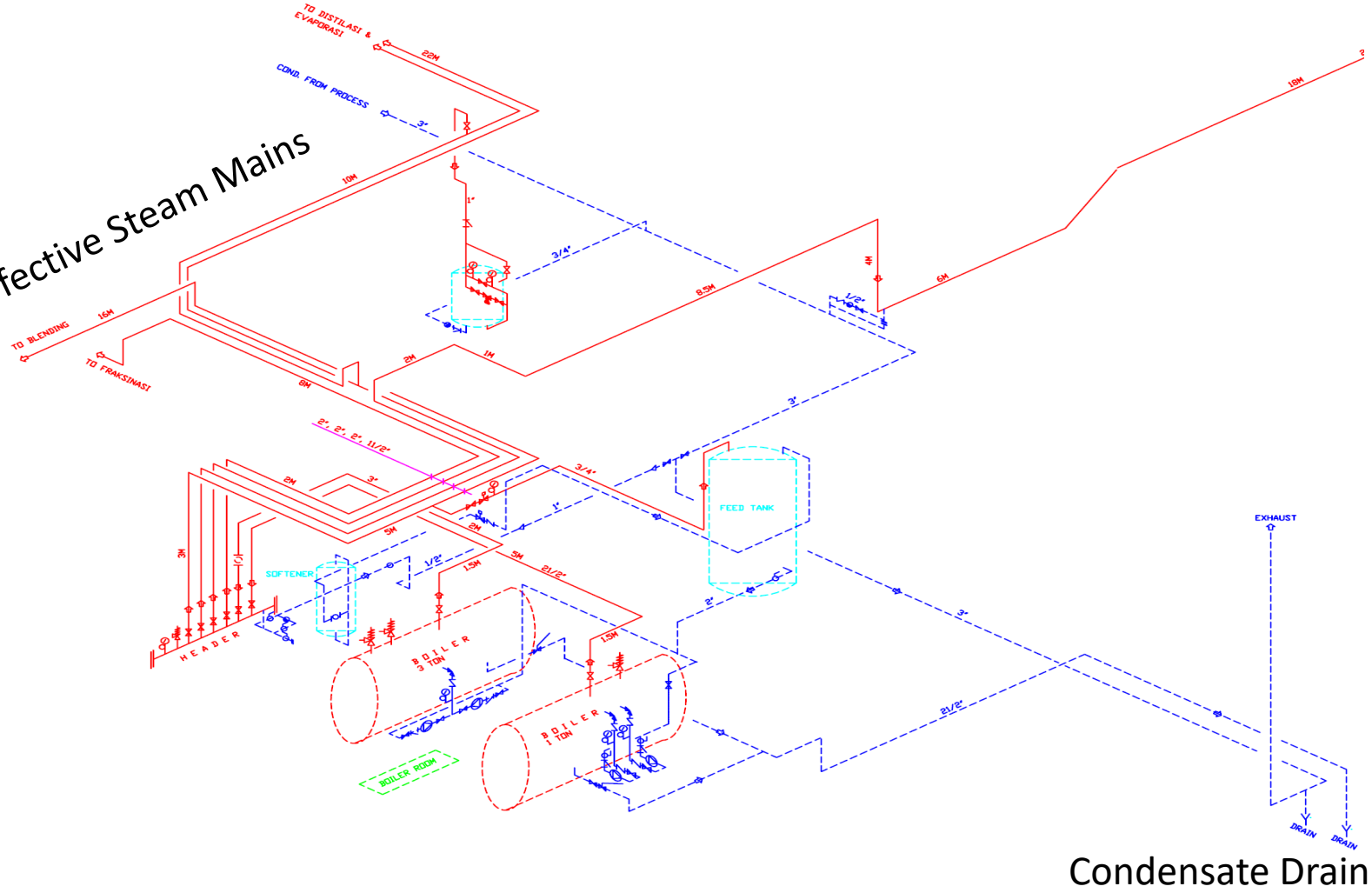
% Flash Steam = 8,9%

Flash steam = 60 kg/h

Kondensat = 609 kg/h

Pembuangan Kondensat Panas

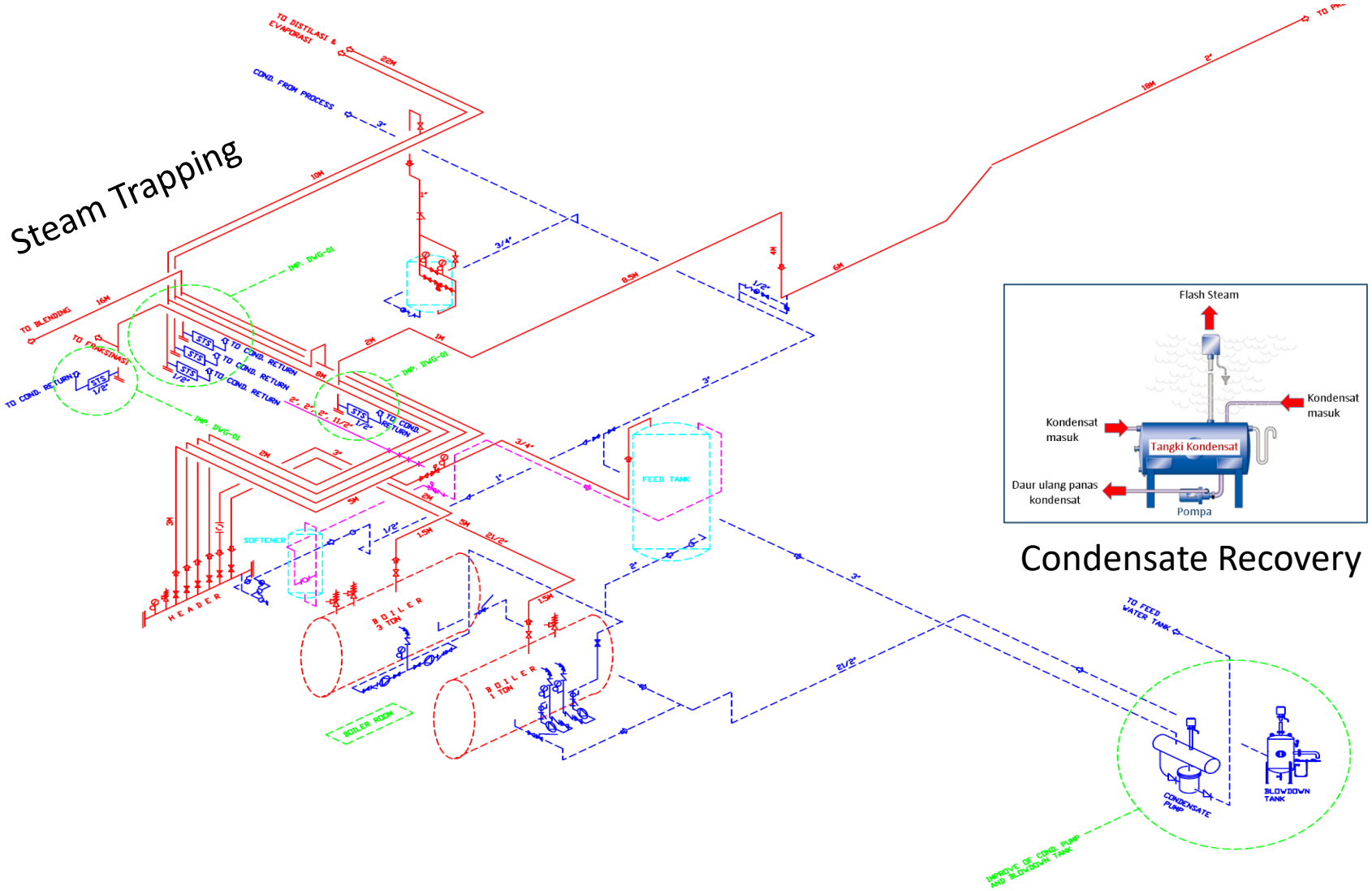
Ineffective Steam Mains



Condensate Drain

Daur Ulang Kondensat Panas

Steam Trapping



Condensate Recovery

Sistem Daur Ulang Panas Kondensat

Design, supply and installation of condensate pump and piping return for energy recovery

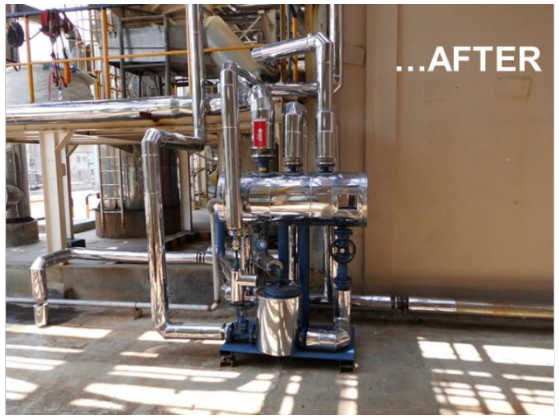
Before …..

Electric centrifugal pump is installed with hot condensate tank, unable to pump high temperature fluids, because of cavitation

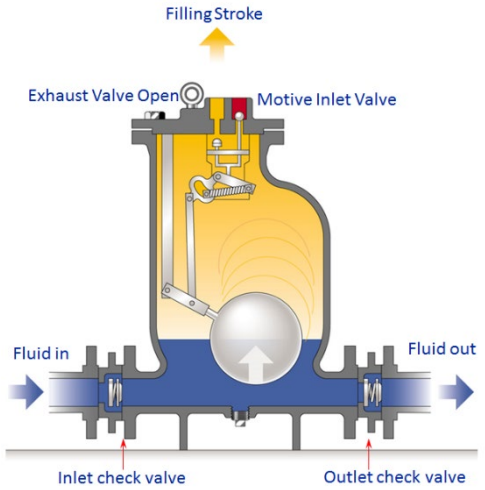
After …..

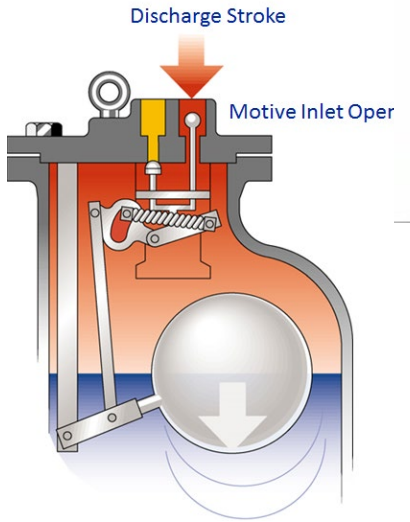
Mechanical pump c/w receiver was installed successfully and working excellently to return back hot condensate to feed water tank

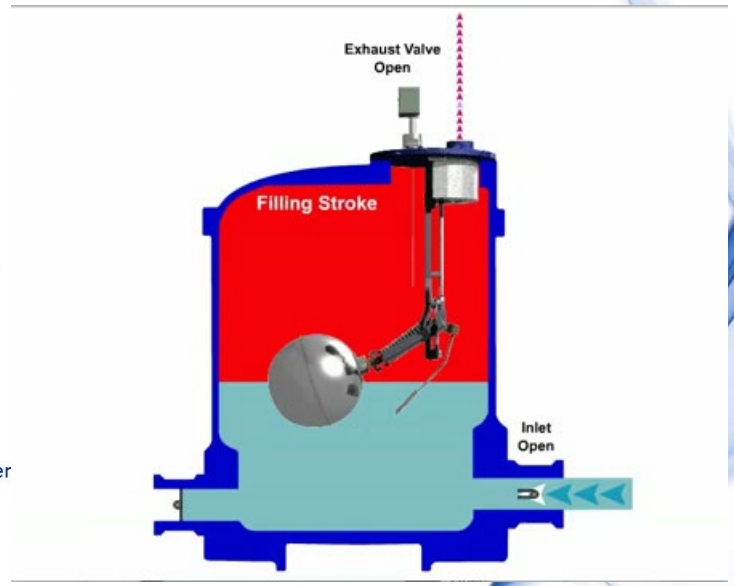
Sentrifugal pump and bigger condensate tank



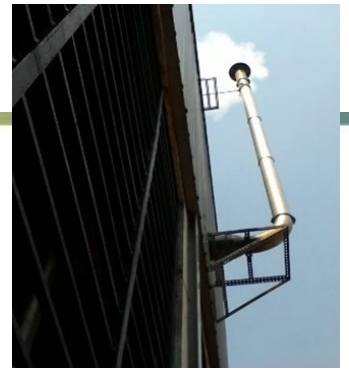
Mechanical Pump with compact condensate receiver tank
Removed bigger condensate tank, less space





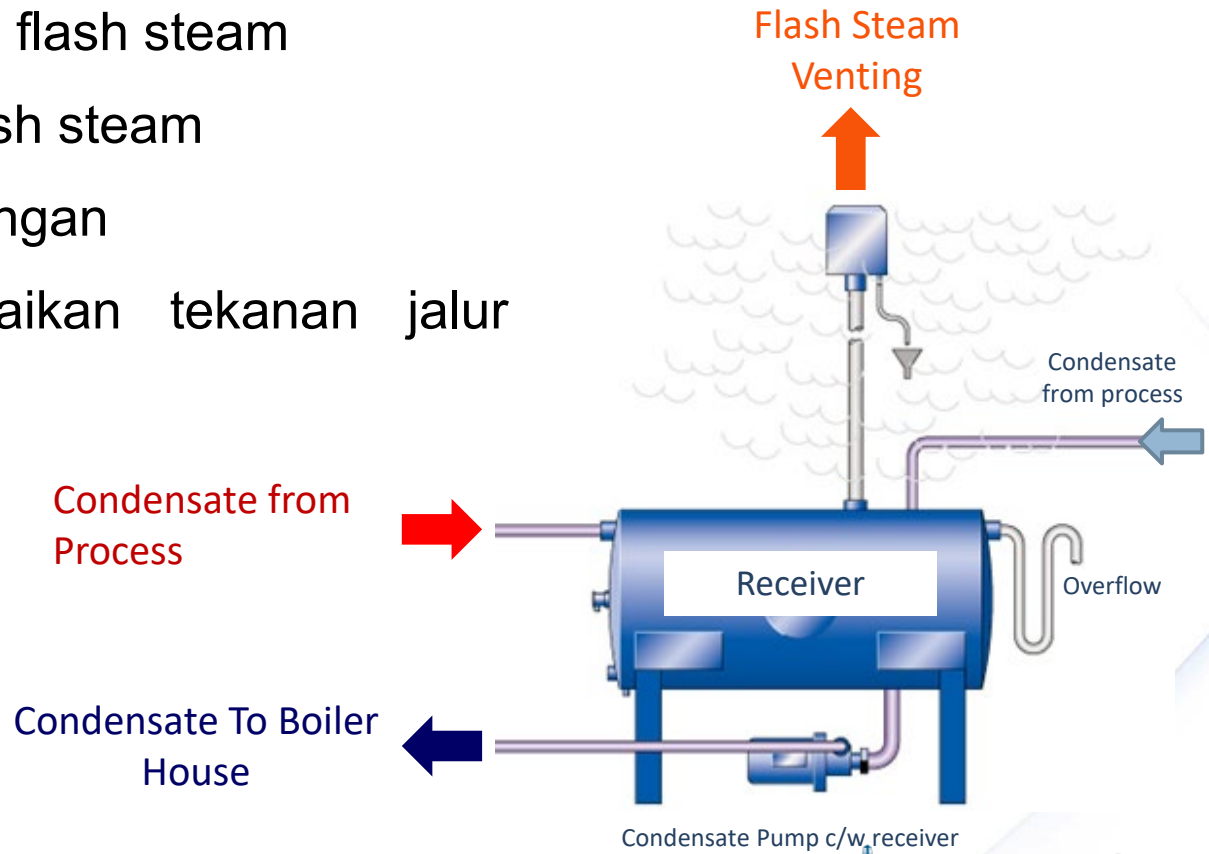


Rugi-rugi *Flash Steam*



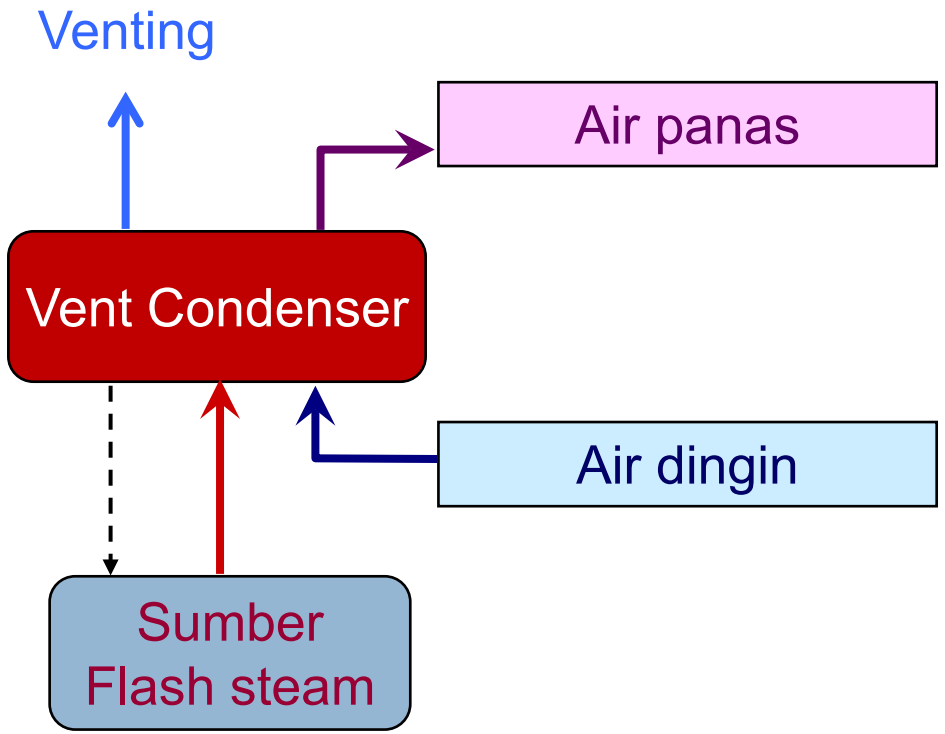
Problema terbentuknya flash steam :

- Rugi-rugi panas terbawa flash steam
- Rugi-rugi air terbawa flash steam
- Isu safety dan isu lingkungan
- Berdampak pada kenaikan tekanan jalur kondensat

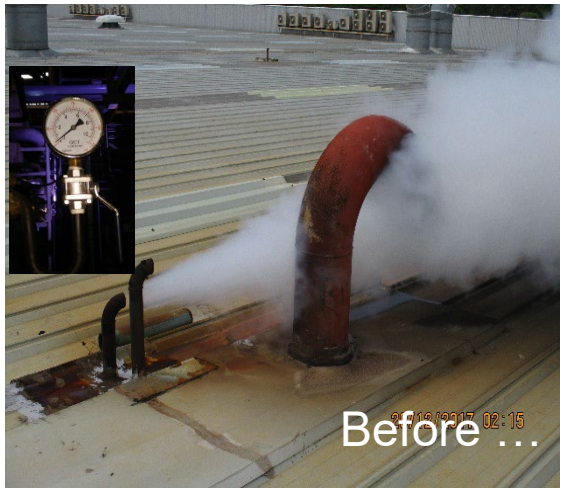


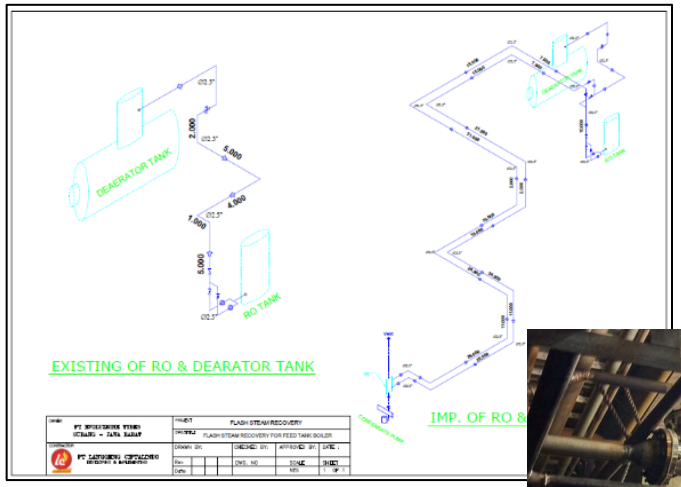
Pembuangan Panas Flash Steam

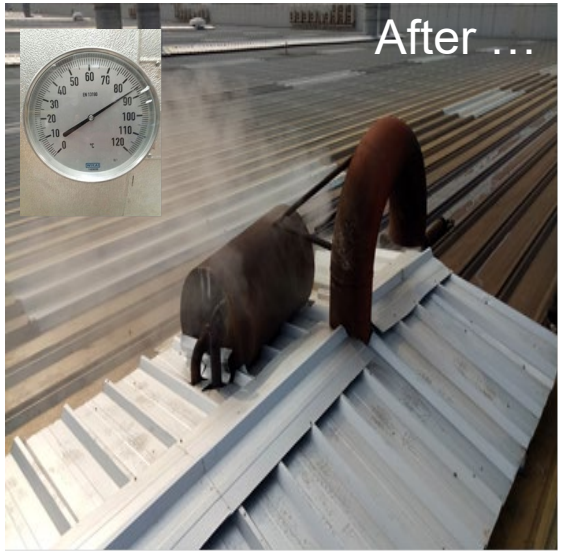
Potensi pemanfaatan flash steam sebagai pemanas *awal (pre-heat) water make up* dengan bantuan *flash steam condenser*

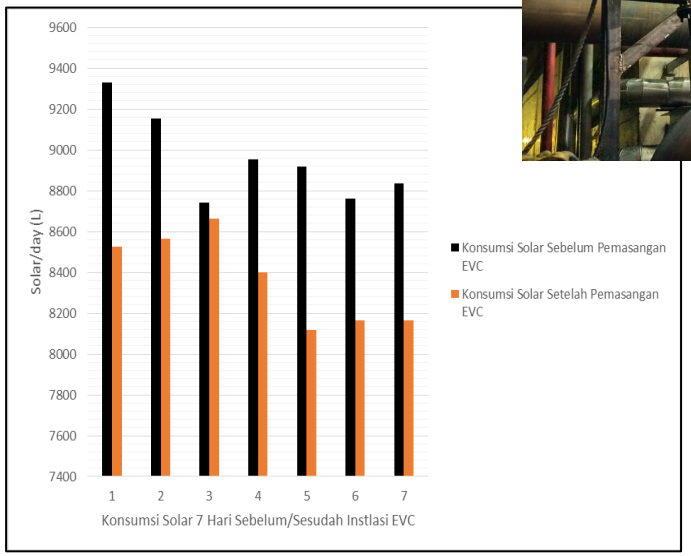


Vented Steam Recovery Project









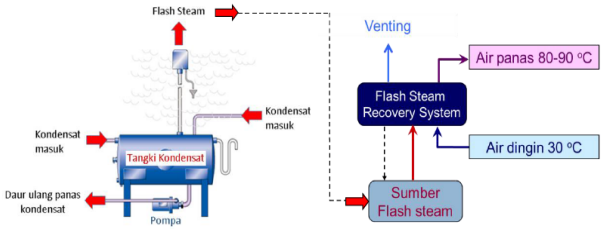
SUCCESS STORY

PENGHEMATAN ENERGI PADA SISTEM UAP

DENGAN TEKNOLOGI *FLASH STEAM RECOVERY SYSTEM*

PENDAHULUAN

Industri ban menggunakan uap (*steam*) sebagai pemanas produk mesin *curing* di bagian *inner* dan *platten* pada tekanan 15 dan 8 barg. Penurunan kondensat dari 8 ke 0,3 barg (107 °C) dari bagian *platten* telah menghasilkan *flash steam* dari tangki kondensat. Selama ini panas *flash steam* belum dimanfaatkan. Untuk itu, tim utilitas perlu melakukan usaha konservasi energi dengan cara daur ulang panas *flash steam* sebagai pemanas awal *boiler water make up*. Sistem daur ulang panas *flash steam* disajikan pada gambar berikut.



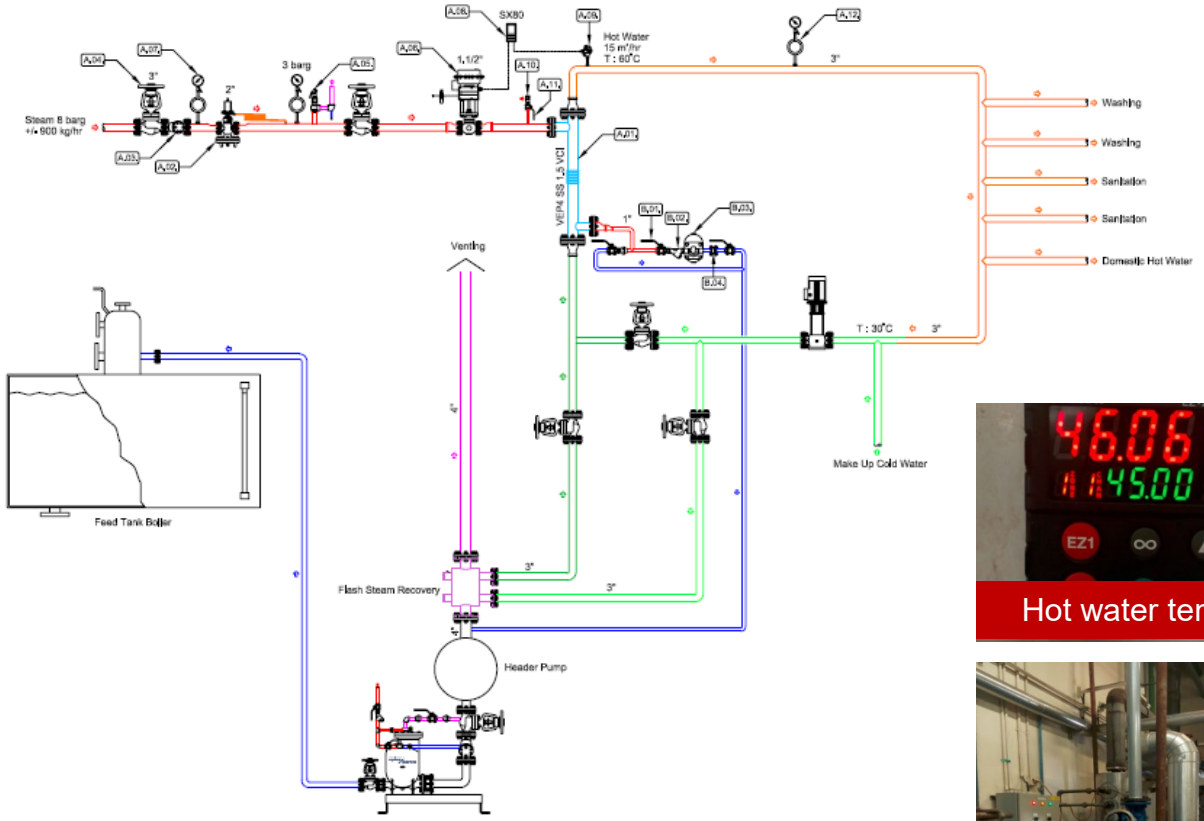
TEKNOLOGI EFISIENSI ENERGI

Flash Steam Recovery System adalah sistem/perangkat yang dirancang untuk mendaur ulang panas dari *flash steam* secara atmosferik dengan menggunakan piranti penukar panas. Panas *flash steam* dapat dimanfaatkan sebagai pemanas awal air umpan segar (*fresh water make up*) sebelum masuk ke tangki air umpan boiler.

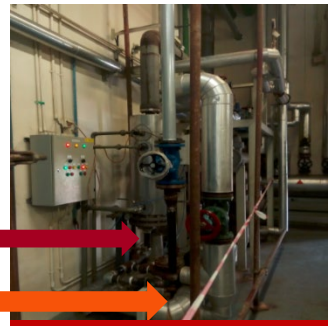
HASIL IMPLEMENTASI

Nilai investasi sebesar Rp 600.000.000 telah dialokasikan untuk pengadaan piranti penukar panas, valve, asesoris, insulasi, dan pekerjaan pipa steam dan kondensat. Hasil evaluasi dari implementasi ini telah menghemat bahan bakar solar sebesar 6,5% karena kenaikan temperatur air umpan dari 30 menjadi 80-90 °C, belum termasuk penghematan air RO dan kondensat panas. Investasi ini sangat menarik karena memberikan *payback period* yang kurang dari 6 bulan.

Daur Ulang Panas Flash Steam



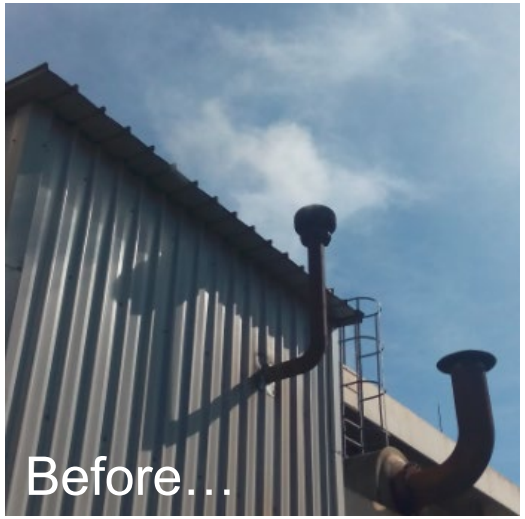
Hot water temp.



Installation result

Heat Exchanger

Flash steam line



No more venting steam

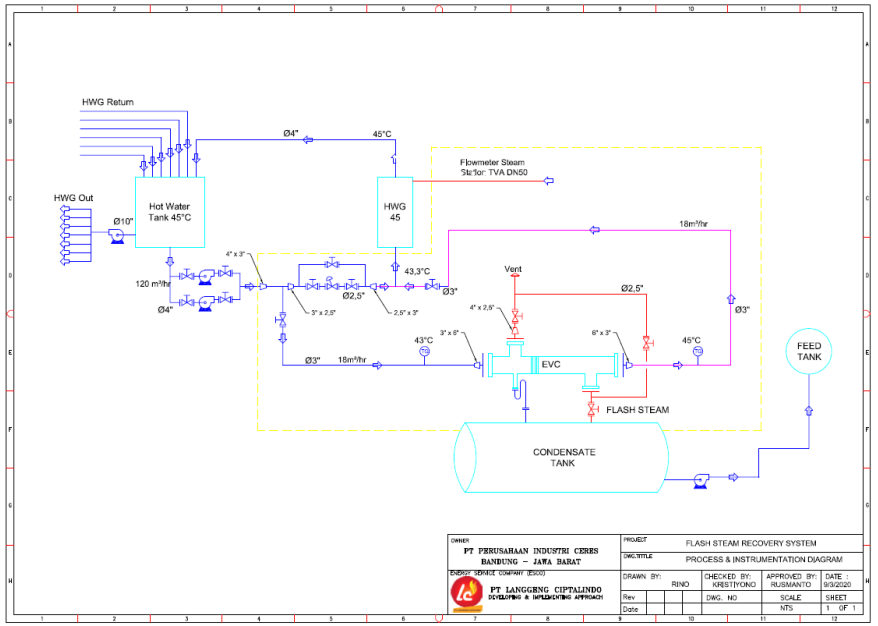
Excess Steam Recovery

The utilization of excess steam exhausted from process as heat source to generate hot water or other liquid or gas using steam condenser.

Steam to Water

Exhaust Temp In/Out	110 C/ 100 C
Water Temp In/Out	30 C/ 83 C
Exhaust Mass Flow	7,000 Kg/h
Water Mass Flow	70,000 Kg/h
Weight of unit	1,500 Kg
Exhaust pressure drop	2,500 Pa
Energy Recovered	4,378 KW
Recovered Energy Value	IDR 3,849M p.a.

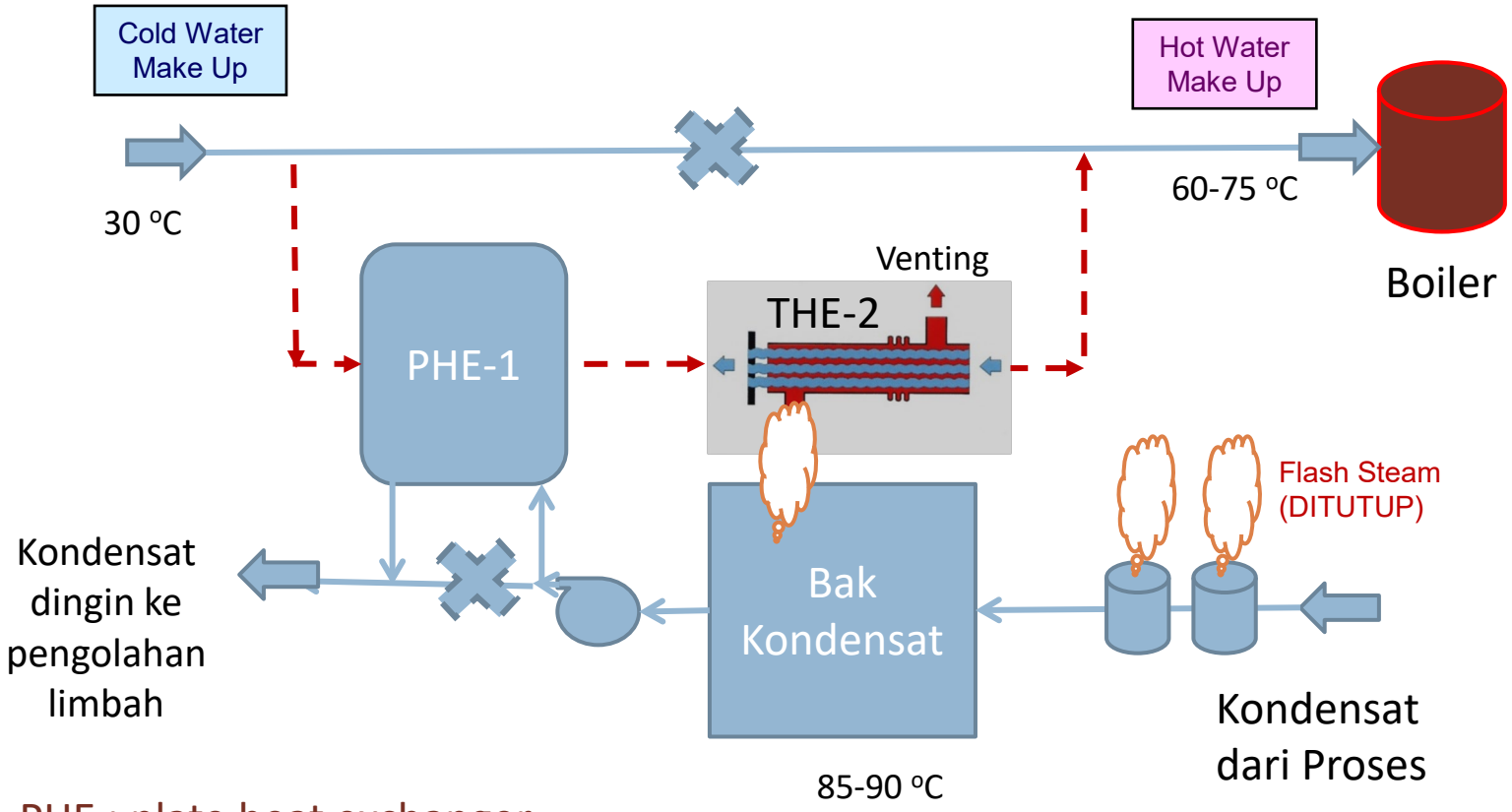
Flash Steam Recovery System



Flash Steam Recovery System to Generate Domestic Hot Water

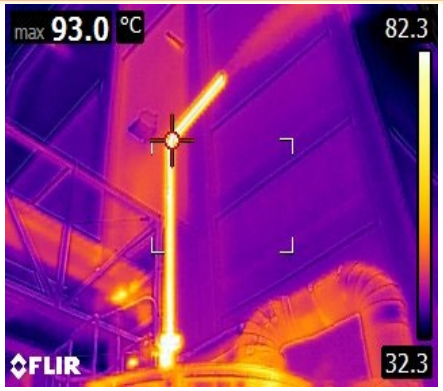
Daur Ulang Kondensat Panas dan Flash Steam

Instalasi system daur ulang panas kondensat dan flash steam dengan Plate heat exchanger (PHE) dan *Vent Condenser* pemanas water make up.

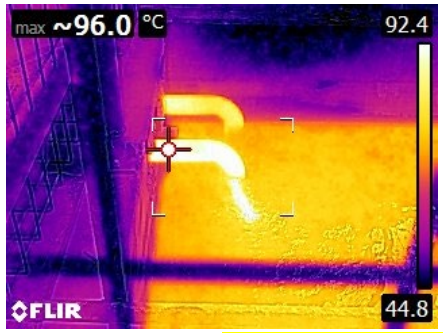


PHE : plate heat exchanger
THE : tubular hear exchanger

Flash Steam and Residual Blowdown Heat Recovery System



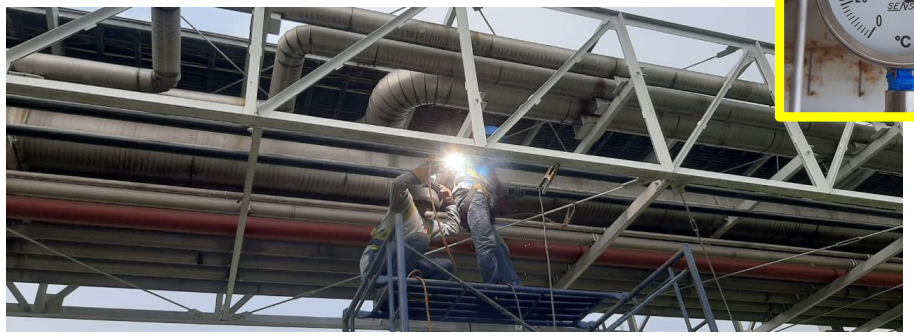
Flash Steam Losses

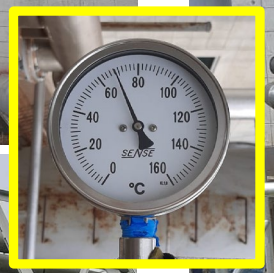


Residual Blowdown Losses

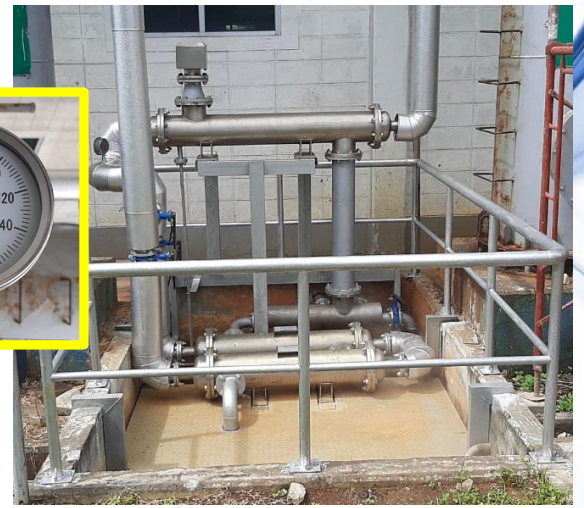
Before

After



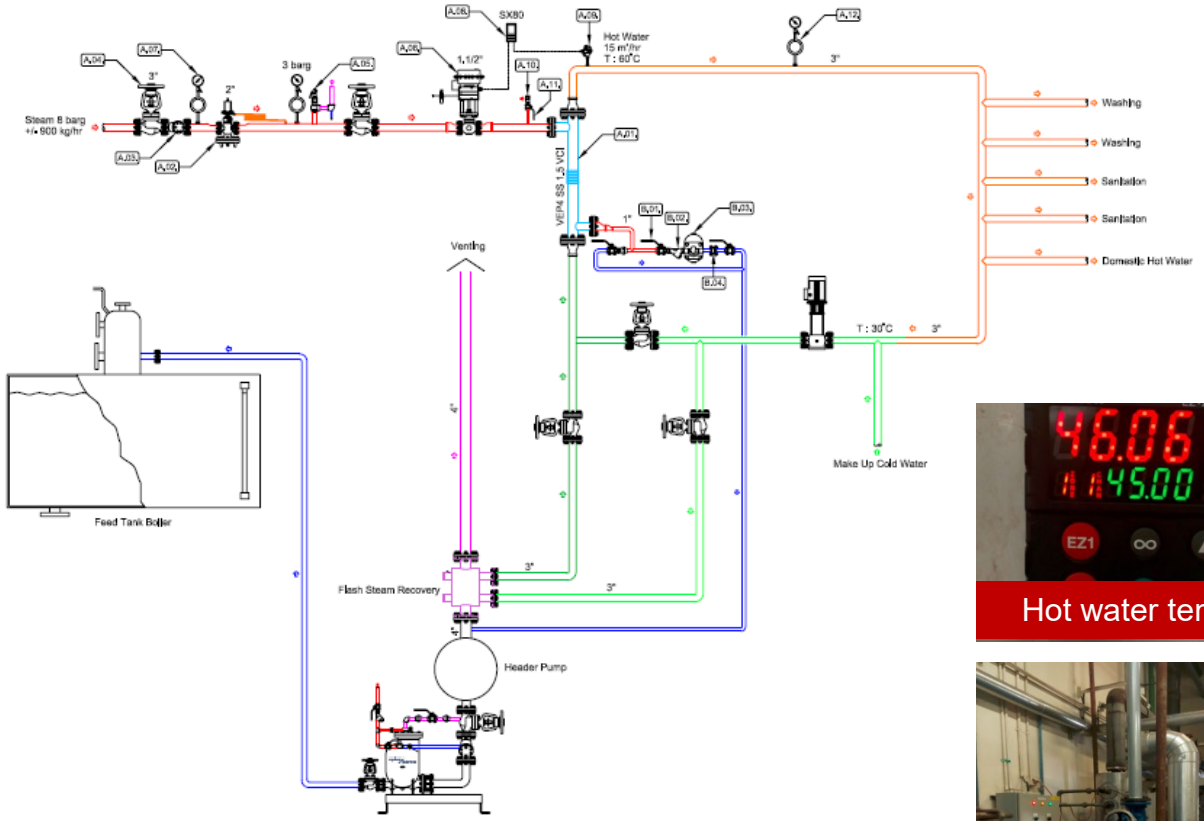


Flash Steam Condenser

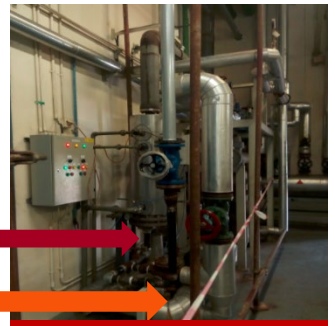


Residual Blowdown Heat Recovery

Daur Ulang Panas Flash Steam



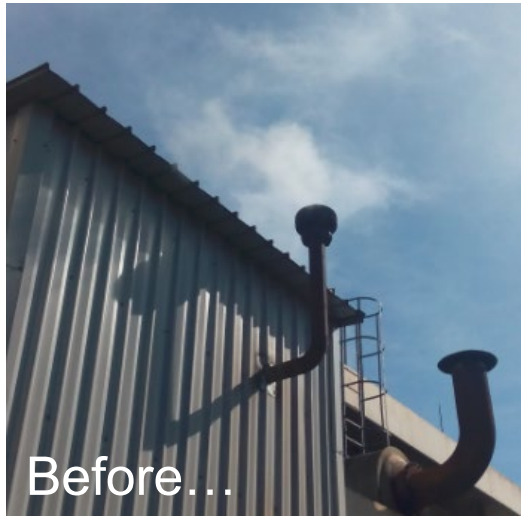
Hot water temp.



Installation result

Heat Exchanger

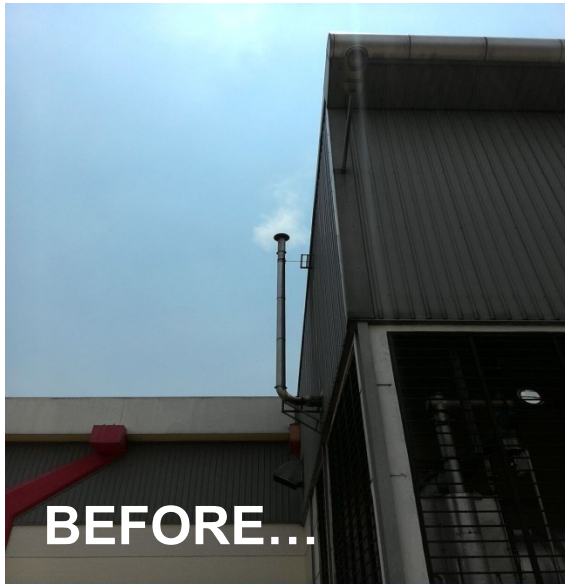
Flash steam line

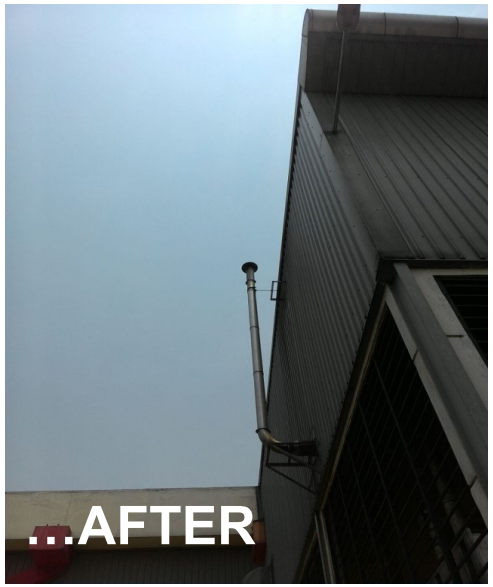


No more venting steam

Before and After Project Implementation

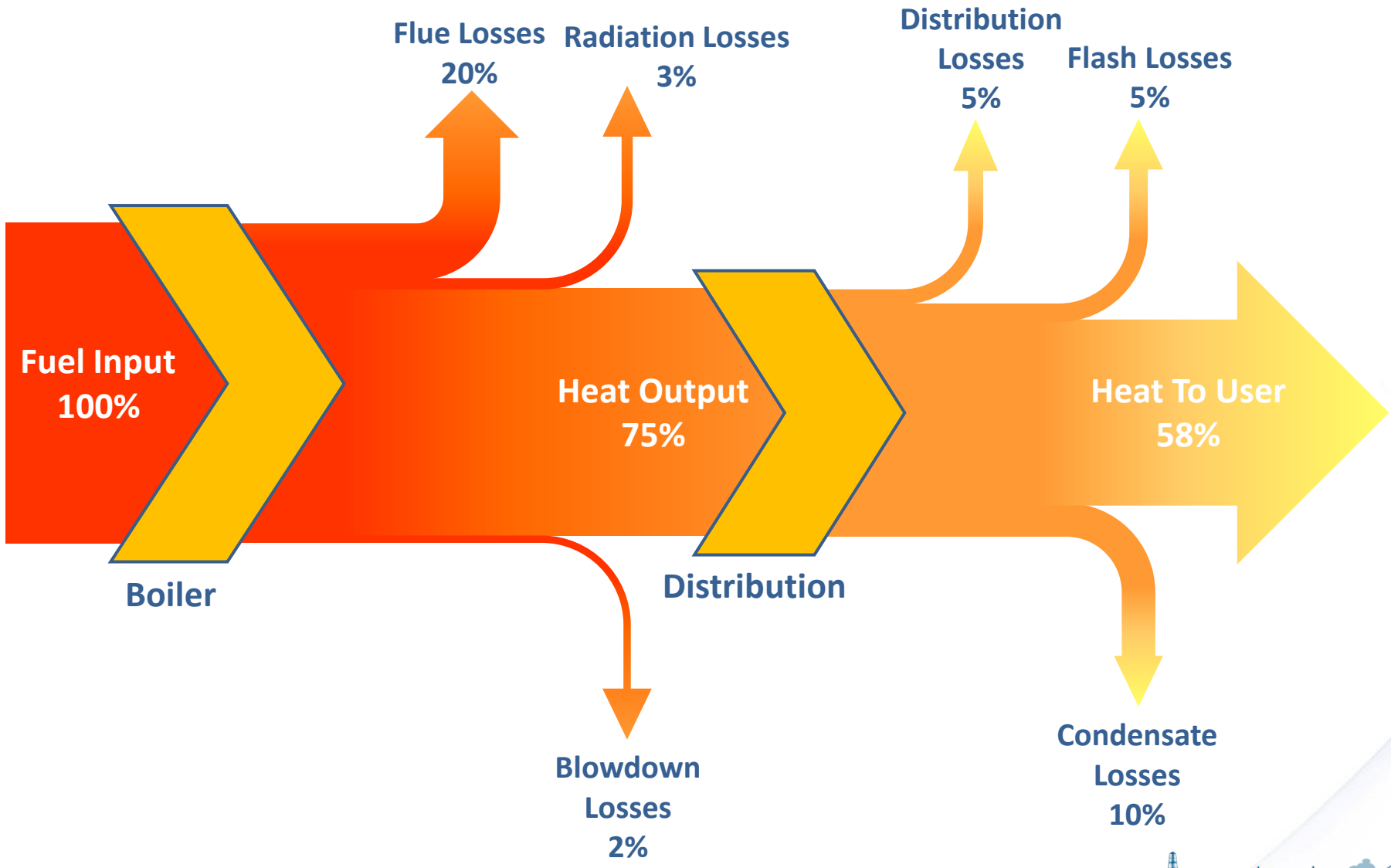
BEFORE…



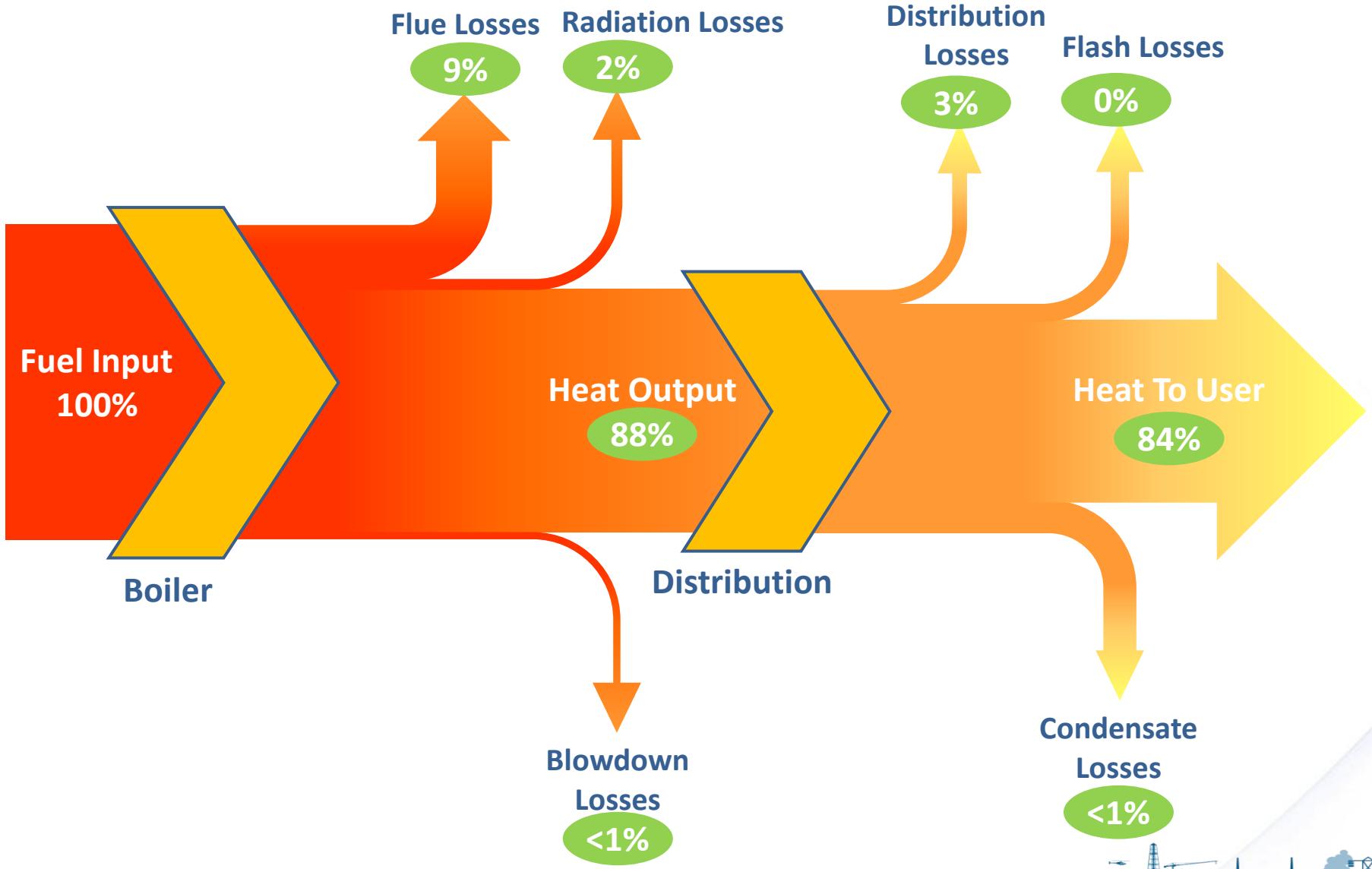


…AFTER

Typical Losses

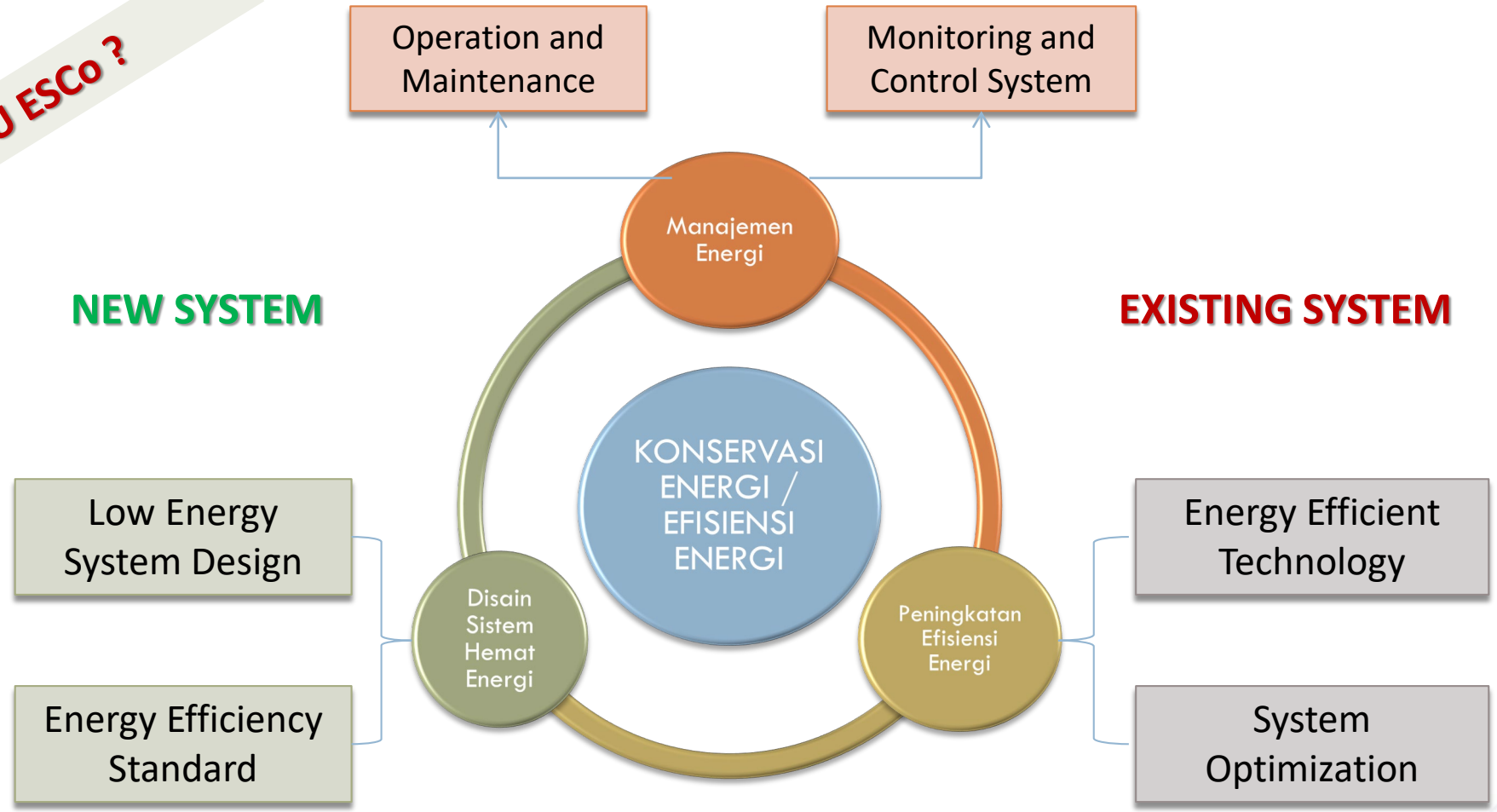


Ideal System



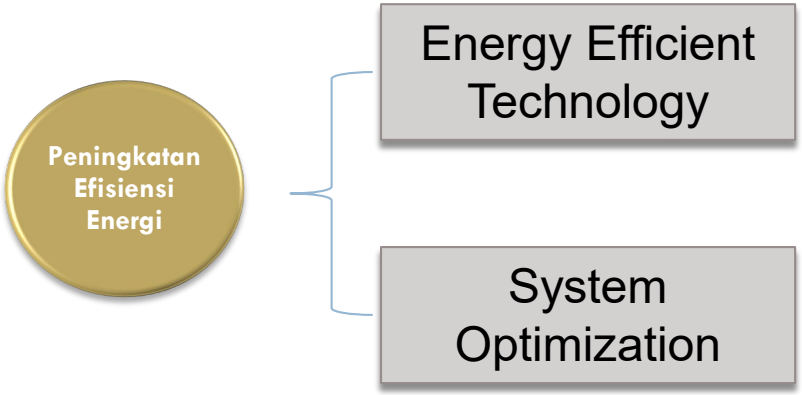
Pendekatan Program Efisiensi Energi

PERLU ESCo ?



Source : BPPT Opsi Teknologi Efisien Energi Mendukung Implementasi Mekanisme ESCO

(1) Existing System



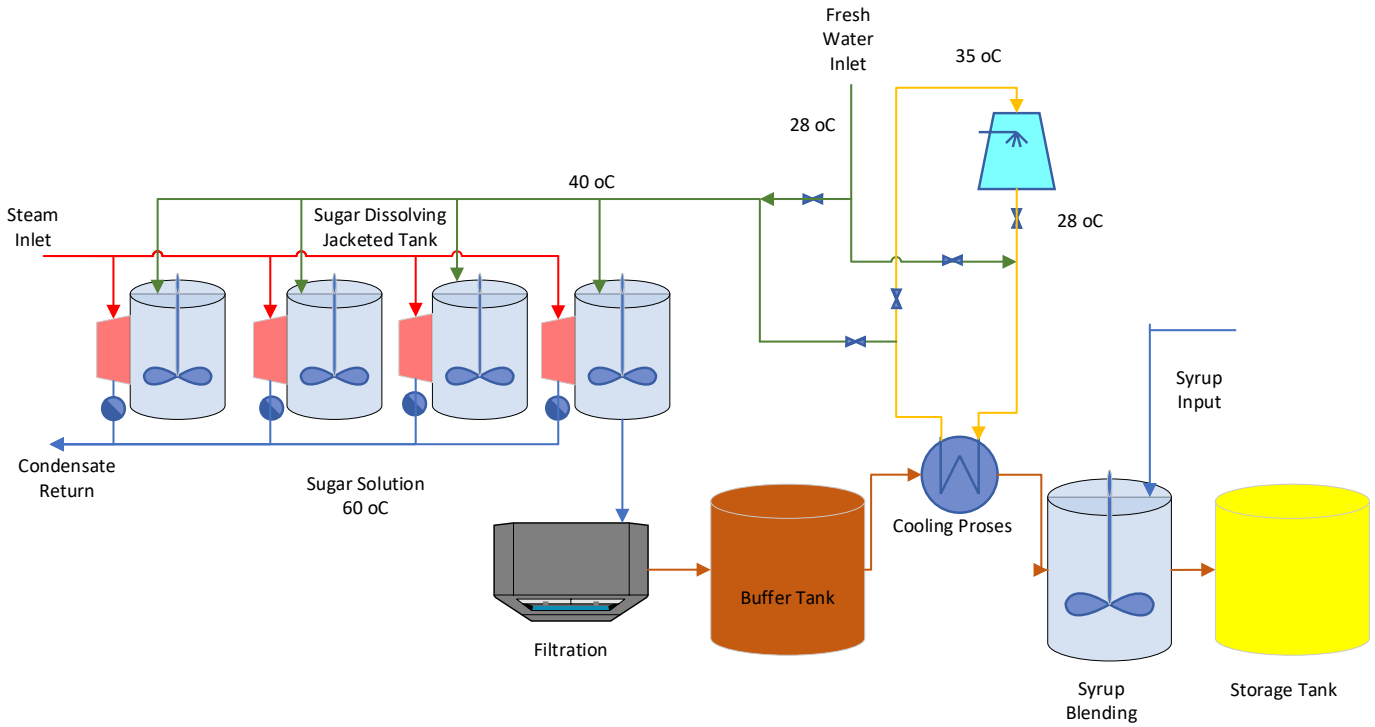
Peluang energy saving initiatives :

- Energy conservation list (sistem utilitas, proses, energy flow)
- Pendampingan EC list assesment
- Knowledge transfer/Pelatihan TKE
- Update dan penerapan teknologi hemat energi dari vendor assesment
- Process integration/optimization
- Sistem utilitas (generation, distribution, user, recovery)

Steam System - Energy Conservation List
Steam Trap Monitoring System
Automation – Building Management System (BMS) - Boilers in BMS
Boiler O2 control
Steam system equipment upgrade - burner air preheating
Steam system equipment upgrade - two-tier control for staging of multiple boilers
Steam system equipment upgrade - Solar boilers Feed water preheater
Steam system equipment upgrade - intallation of Venturi steam traps
Steam system equipment upgrade - replacement of boilers with more efficient
Steam system equipment upgrade - replacement of burners with more efficient
Steam system equipment upgrade - burner air intake from the top of boiler house
Steam system equipment upgrade - Insulation of boiler surface
Steam system equipment upgrade - Insulation of steam traps
Steam system equipment upgrade - installation of RO Reverse Osmosis system for boiler Feed water
Steam system equipment upgrade - Insulation of return condensate lines
Thermal insulation in Primary equipment
Heat Recovery in Steam System - precooler for Economizer feed water
Heat Recovery in Steam System - Open condensate tank Vent Condenser
Heat Recovery in Steam system - Condensing Economizer
Heat Recovery in steam system – Flash Steam
Heat Recovery in Steam System - Deaerator Vent Condenser
Heat Recovery in steam system – Blowdown Heat exchanger
Heat Recovery in steam system – Flash Steam
Boilers - Automatic Blowdown - Time or actual steam production controlled Bottom blowdown

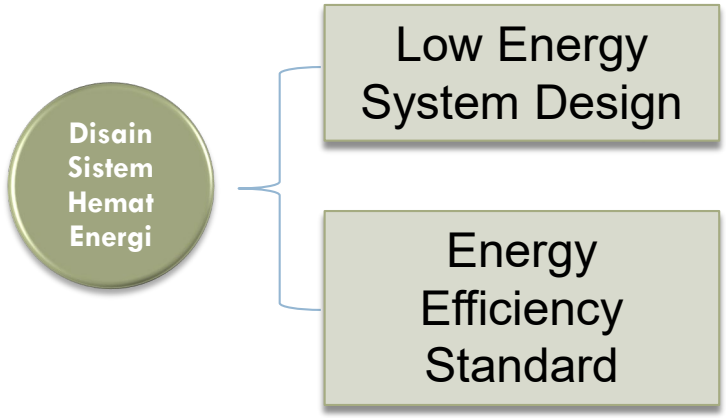
Heating Cooling Process Integration

Preheat Feedwater using Product Cooling Process



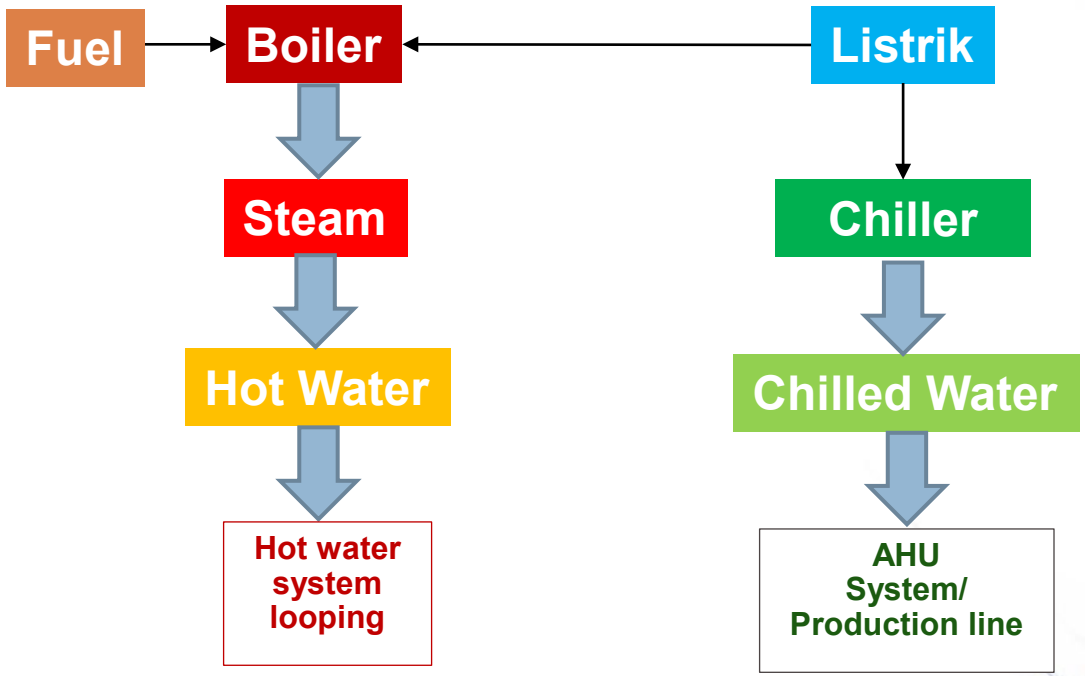
- Feedwater preheating using heat exchanger during cooling process rather than using cooling water from cooling tower.
- This way will save steam consumption in sugar dissolving jacketed tank.
- Estimated total capital investment : Rp 250 million
- Payback period up to 2,7 year

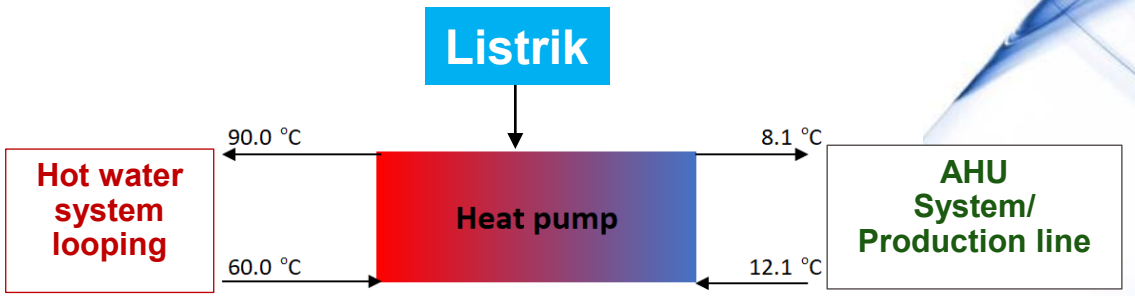
(2) New System



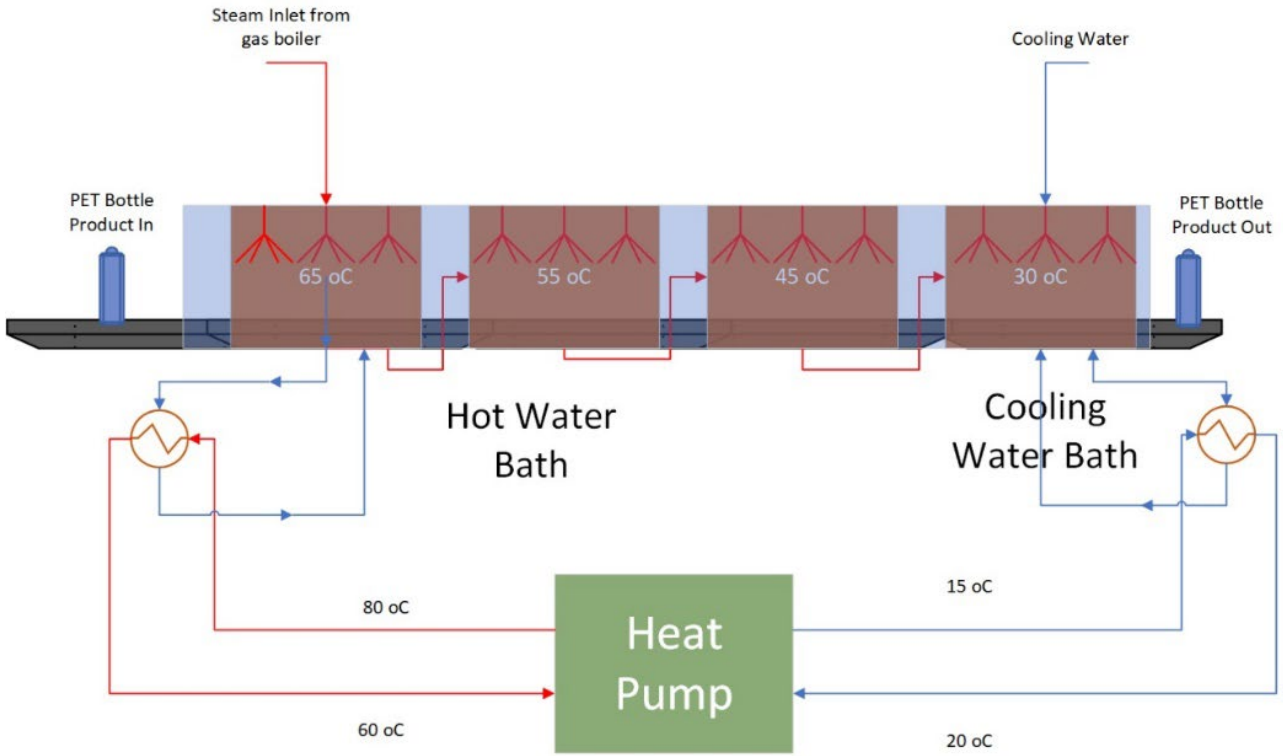
Peluang energy saving initiatives :

- Pendampingan perancangan proses
- Daftar teknologi hemat energi
- Teknologi terkini dari Vendor assesment
- Best Available Technology (BAT)
- Best/Good Engineering Practices (GEP)
- Process Integration/optimization
- Carbon tax/net zero emission
- Electrifikasi menggunakan REC (renewable energy certificate)



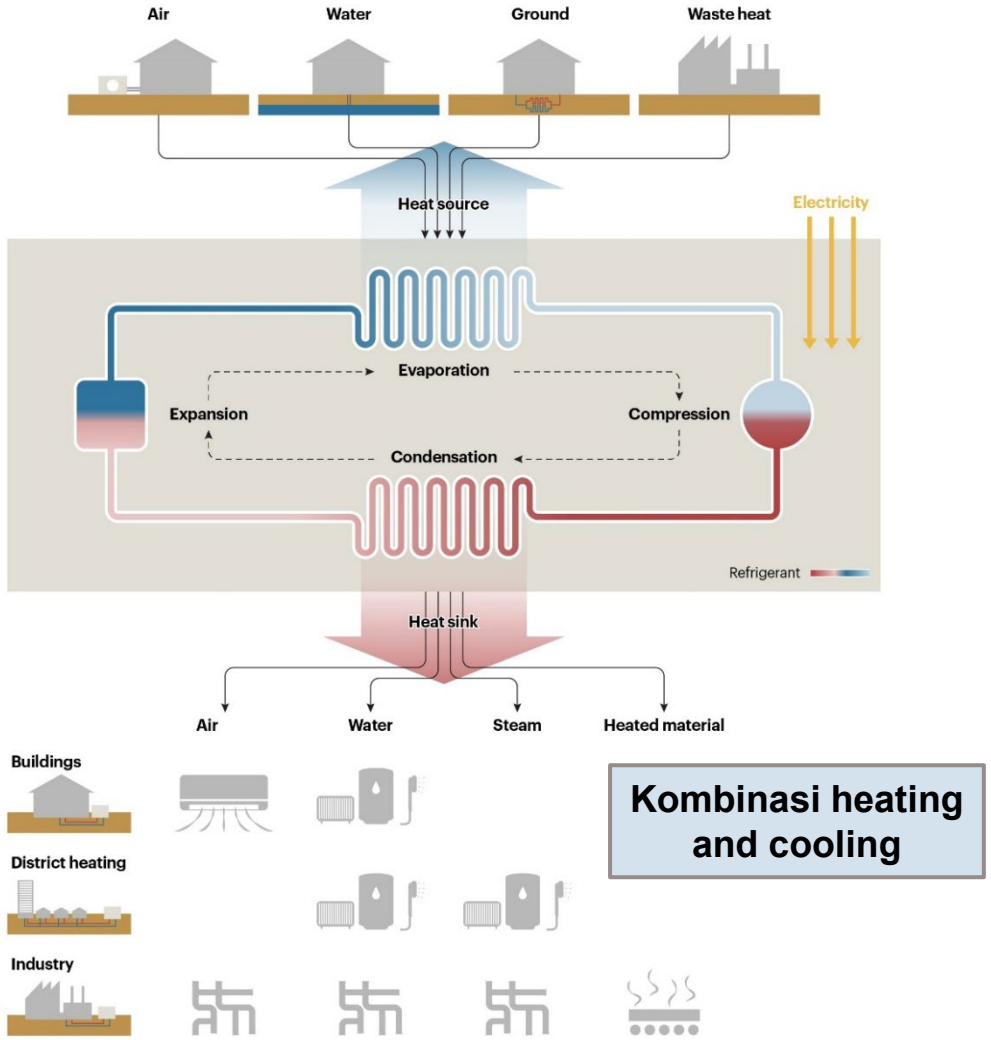


Electrification of Process : Pasteurization



- Current Condition : hot water generation using direct steam injection and cooling water water from cooling system
- Proposed Condition : Install heat pump to produce hot water and chilled water simultaneously with single electric energy source
- Estimated total capital investment : Rp 1,940 million
- Payback period up to 3.8 years

Hot and Cooling Water System Using Heat Pump Technology



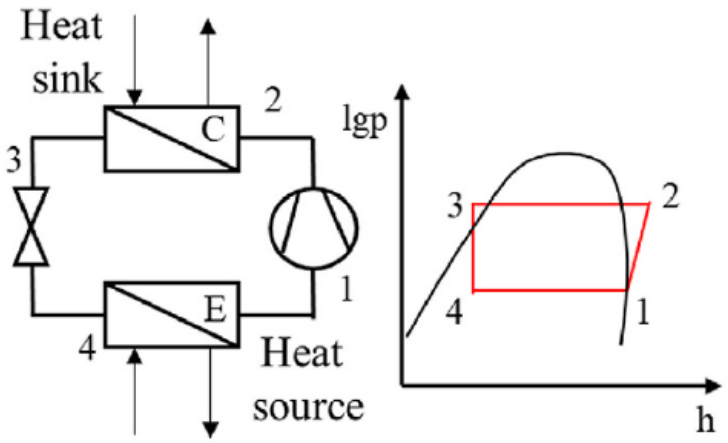
Kombinasi heating and cooling

Source : International Energy Agency

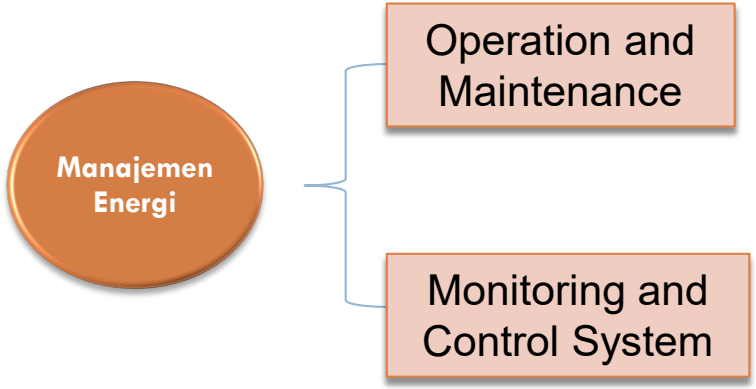
Heat pump merupakan teknologi yang memanfaatkan siklus refrijeran untuk membangkitkan air panas melalui kondensor dengan sumber energi listrik pada kompresor. Heat pump dapat dioperasikan secara kombinasi dengan memanfaatkan evaporator untuk membangkitkan chilled water.

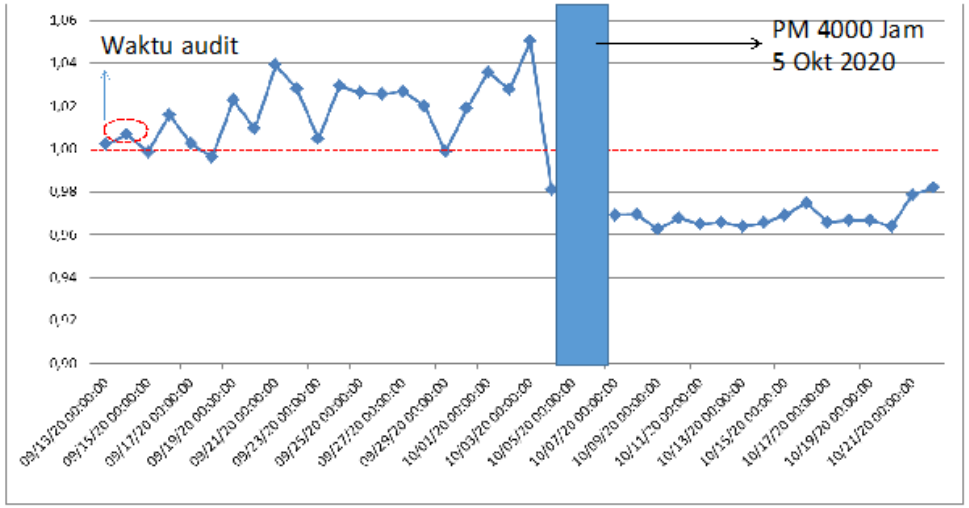
Keunggulan teknologi ini :

- Lebih efisien dan aman dibanding dari *electric water heater* konvensional
- Terjamin ketersediaannya dibanding *solar water heater* yang tergantung cuaca
- Lebih ramah lingkungan dan mudah pemasangannya dibanding *gas water heater*



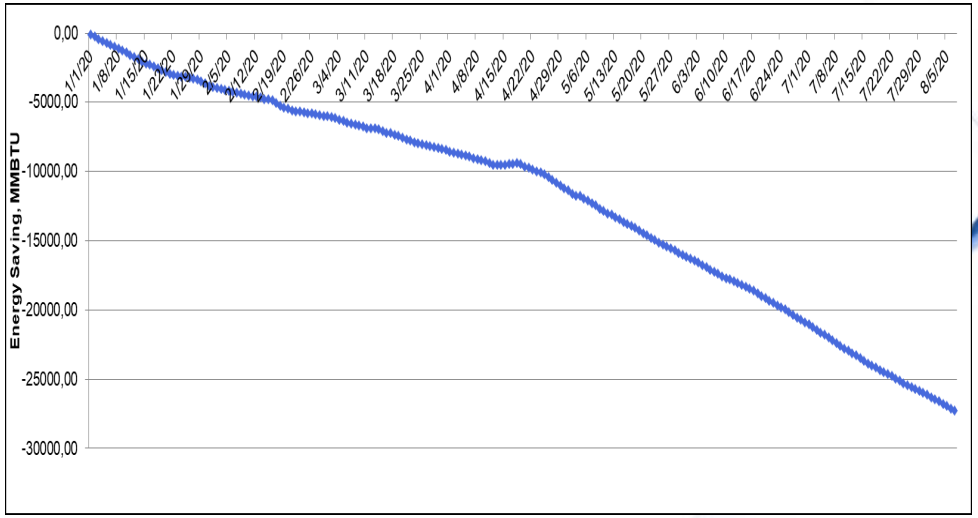
(3) Manajemen Energi





Peluang energy saving initiatives :

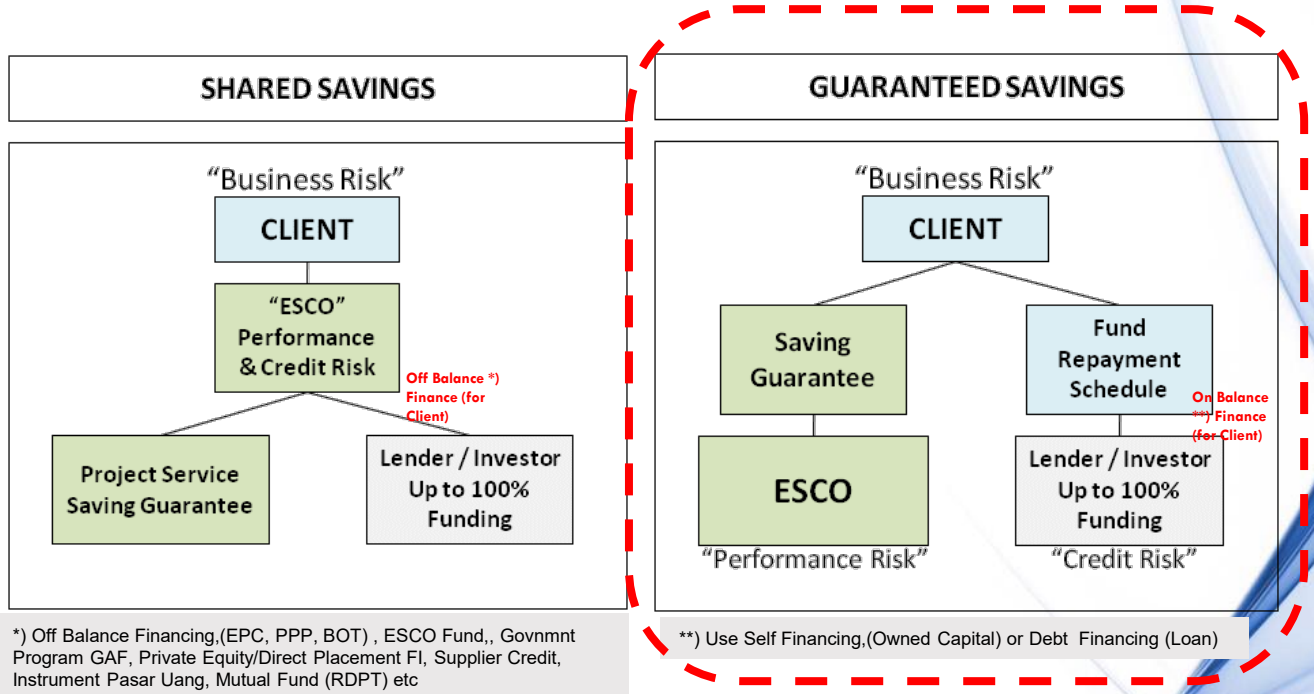
- Pendampingan manajemen energi
- Fasilitas energy monitoring
- Energi Performance Indicator (EnPI)
- Energy Baseline (EnB)
- EnPI View Monitoring
- Internet of Think (IoT)
- Artificial Intelligent (AI)



Energy Service Company (ESCo)

An **energy service company** (**ESCo**) is a business that provides a broad range of energy solutions including designs and implementation of energy savings projects, retrofitting, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management.

A newer breed of ESCO includes innovative financing methods, such as off-balance sheet mechanisms which own a range of applicable equipment configured in such a way as to reduce the energy cost of a building. The ESCO starts by performing an analysis of the property, designs an energy efficient solution, installs the required elements, and maintains the system to ensure energy savings during the payback period. The savings in energy costs are often used to pay back the capital investment of the project over a five- to twenty-year period, or reinvested into the building to allow for capital upgrades that may otherwise be unfeasible.



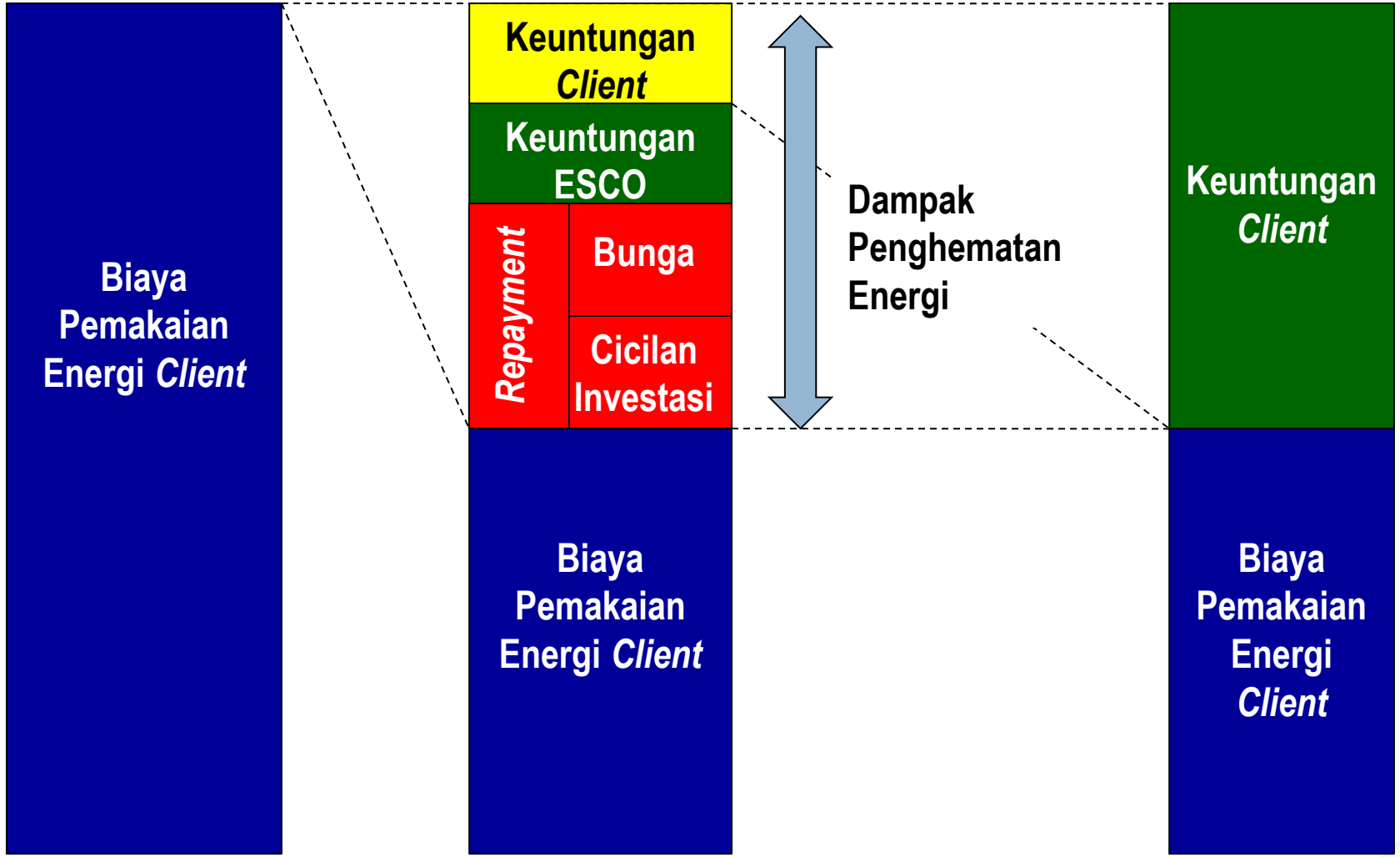
*) Off Balance Financing,(EPC, PPP, BOT) , ESCO Fund,, Govnmnt Program GAF, Private Equity/Direct Placement FI, Supplier Credit, Instrument Pasar Uang, Mutual Fund (RDPT) etc

**) Use Self Financing,(Owned Capital) or Debt Financing (Loan)

Share Saving, ESCO merancang dan melakukan investasi Aset EE, mengoperasikan Aset selama periode kontrak ESCO. Client membayar berdasarkan Energy Performance Contract (EPC). Client bertindak stanby buyer Aset bila Kontrak tidak diselesaikan sesuai periode. Aset milik ESCO bila tidak terjadi akuisisi diakhir periode. Esco dibayar dari Pembagian Hasil Saving.

Guaranteed Saving, Client investasi Asset, ESCO merancang, membangun dan mengoperasikan Asset. Client membayar Esco service berdasarkan Energy Performance Contract (EPC). ESCO bertindak sebagai garantor Performance Energy Saving sesuai EPC. Esco dibayar sesuai ketentuan EPC dari Hasil Saving

SKEMA ESCO (ENERGY SERVICES COMPANY)



Contents

- Company Profile
- Government Regulation
- Energy Audit
- Energy Efficiency Project
- **Key Success**

KEY SUCCESS

Step 1

***BACKGROUD / DRIVING FORCE* YANG KUAT**

Cost reduction, Emission reduction, Harga bahan baku naik, Harga pasar di bawah HPP, Permintaan Customer, …

Step 2

KOMITMEN MANAJEMEN

Kebijakan, Membentuk team, Menyediakan anggaran, Energi menjadi poin skoring proses inovasi, ...

Step 3

EnPI dan EnB YANG SESUAI DAN TEPAT

Merujuk ke ISO 50006.

Step 4

TIM YANG KOMPETEN

Menentukan kompetensi yang diperlukan khususnya yang mempengaruhi kinerja energi dan EnMS. Memastikan orang-orang ini kompeten atas dasar pendidikan, pelatihan, keterampilan atau pengalaman yang sesuai

Step 5

DATA (TERSEDIA, AKURAT, TEPAT DAN BENAR)

Menetapkan titik ukur yang tepat. Kalibrasi dan/atau validasi alat ukur .

Step 6

EnPI VIEW

SEU Online monitoring, threshold limit, dan alarm.

Step 7

AUDIT ENERGI

Penghematan energi secara konsisten dan berkelanjutan

Step 8

PENDAMPINGAN DARI EXPERT
(*certified energy auditor/lead auditor ISO50001/50006*)

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Developing & Implementing Approach

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Thank You!
GRUNDFOS
Possibility in every drop