

## 添付資料 8

### 技術研修資料



## 目 次

|  |     |
|--|-----|
| 第2年次 .....   | 1   |
| 「成果1:無収水削減技術の向上」に関わる研修 .....   | 1   |
| ワークショップ(2009年10月28日)参加者リスト .....   | 1   |
| ワークショップ(2009年10月28日)【発表資料】 .....   | 4   |
| 「成果2:無収水削減計画策定能力の向上」に関わる研修 .....   | 18  |
| BASIC MATERIAL FOR THE ELABORATION OF THE NON REVENUE WATER (NRW)<br>REDUCTION MANAGEMENT PLAN ..... | 18  |
| 1. Estructura de los problemas para la solución de problemas núcleo .....                            | 20  |
| 2. 無収水削減計画マニュアルの構成 .....   | 22  |
| 「成果3:節電計画策定能力の強化」に関わる研修 .....  | 23  |
| 2009年6月29日 パイロット施設の節電手法について1 .....   | 23  |
| 2009年7月6日 パイロット施設の節電手法について2 .....  | 35  |
| 2009年7月13日 水理解析について .....  | 46  |
| 2009年7月13日 パイロット施設の節電手法について3 .....   | 57  |
| 2009年7月20日 研修計画策定ワークショップ .....   | 64  |
| 第3年次 .....   | 97  |
| 「成果1:無収水削減技術の向上」に関わる研修 .....   | 97  |
| 2010年8月26日ワークショップ .....  | 97  |
| DETECTOR DE SONIDOS DIGITAL FUJI FSB-8D .....  | 108 |
| CORRELADOR DE SONIDOS DE FUGA FUJI LC-2500 .....   | 118 |
| LOCALIZADOR DE METALES FUJI F-90M .....  | 158 |
| LOCALIZADOR DE CABLES Y TUBERÍAS METALICAS FUJI PL - 960 .....                                       | 168 |
| FLUJOMETRO ULTRASONICO (PORTAFLOW-C) .....   | 189 |
| Dectector de Ruidos y Fugas FUJI HG-10AII .....  | 201 |
| MEDIDOR DE AGUA ELECTROMAGNETICO MODELO SERIE SU - MANUAL DE<br>INSTALACION .....                    | 212 |
| 「成果2:無収水削減計画策定能力の向上」に関わる研修 .....   | 215 |
| 「無収水削減対策長期計画」作成研修(第1回:2010年7月16日) .....  | 215 |
| 「成果3:節電計画策定能力の強化」に関わる研修 .....  | 283 |
| INDEX OF ENERGY SAVING EFFECT .....  | 283 |
| DETERMINADO LA EFICIENCIA .....  | 295 |



第2年次

「成果1:無収水削減技術の向上」に関わる研修  
ワークショップ(2009年10月28日)参加者リスト

**Taller del Segundo al Tercer Período del Segundo Año (None Revenue Water  
Activities of the 2<sup>nd</sup> Year)**

Lista de asistencia (Attendance List)

Work Team Name: **None Revenue Water Reduction Management**

Expert in charge: **Akihiko Okazaki**

Team Leader: **Arg. Yanet Diaz**

Lugar (Place): Multipurpose Hall, ANDA HQs

Fecha (Date): October 28<sup>th</sup>, 2009, 11:00 hrs

Favor de rellenar su nombre, cargo y organización en esta lista.

| No | Nombre en letra de molde<br>Name in Print | Cargo/Organización<br>Title / Organization | Firma/<br>Signature | Teléfono/<br>Phone Number<br>(Cell phone) | e-mail                 |
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Work Team Name: **None Revenue Water Action Team (Central Region)**

Expert in charge: **Akihiko Okazaki**

Team Leader: **Ing. Frederick Benítez**

Lugar (Place): Multipurpose Hall, ANDA HQs




Fecha (Date): October 28<sup>th</sup>, 2009, 11:00 hrs

| No | Nombre en letra de molde<br>Name in Print      | Cargo/Organización<br>Title / Organization | Firma/<br>Signature | Teléfono/<br>Phone Number<br>(Cell phone) | e-mail                    |
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| 6  | Neftali Batres                                 | Brigade Chief                              |                     | 7040-1293                                 |                           |
| 7  | Luis Hercules                                  | Cooperator                                 |                     |   |                           |

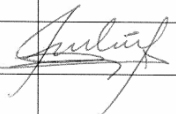
**Work Team Name: None Revenue Water Action Team (Metropolitan Region)**

Expert in charge: Akihiko Okazaki  
 Team Leader: Ing. José Israel Flores

Lugar (Place): Multipurpose Hall, ANDA HQs  
 Fecha (Date): October 28<sup>th</sup>, 2009, 11:00 hrs

| No | Nombre en letra de molde<br>Name in Print | Cargo/Organización<br>Title / Organization | Firma/<br>Signature   | Teléfono/<br>Phone Number<br>(Cell phone) | e-mail               |
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| 5  | Ricardo Vásquez                           | Billing Department Chief                   |   |   |                      |
| 6  | Mario Valiente                            | Practicality Sub-Manager                   |   |   |                      |
| 7  | Manuel Bernal                             | Plumber                                    |   |   |                      |

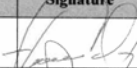






**Work Team Name: None Revenue Water Action Team (Eastern Region/Central Region)**

| No | Nombre en letra de molde<br>Name in Print | Cargo/Organización<br>Title / Organization | Firma/<br>Signature   | Teléfono/<br>Phone Number<br>(Cell phone) | e-mail             |
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**Work Team Name: None Revenue Water Action Team (Western Region)**

Expert in charge: Akihiko Okazaki  
 Team Leader: Ing. Angel Gabriel Valdés


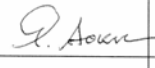








Lugar (Place): Multipurpose Hall, ANDA HQs  
 Fecha (Date): October 28<sup>th</sup>, 2009, 11:00hrs

| No | Nombre en letra de molde<br>Name in Print | Cargo/Organización<br>Title / Organization | Firma/<br>Signature   | Teléfono/<br>Phone Number<br>(Cell phone) | e-mail   |
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**JICA Expert Team Office**

Lugar (Place): Multipurpose Hall, ANDA HQs

Fecha (Date): October 28<sup>th</sup>, 2009

| No | Nombre en letra de molde<br>Name in Print   | Cargo/Organización<br>Title / Organization  | Firma/<br>Signature  | Teléfono/<br>Phone Number<br>(Cell phone) | e-mail |
|----|---|---|--|---|--------|
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| 2  | Yasuhiro Aoki   | JICA Expert   |   |   |        |
| 3  | Akihiko Okazaki   | JICA Expert   |   |   |        |
| 4  |  |  |  |   |        |
| 5  | Manuel Rivera   | Assistant   |   |   |        |
| 6  | Carola Leiva  | Assistant   |   |   |        |
| 7  |  |  |  |   |        |
| 8  | Emilio Sura   | Tranlator   |  |   |        |





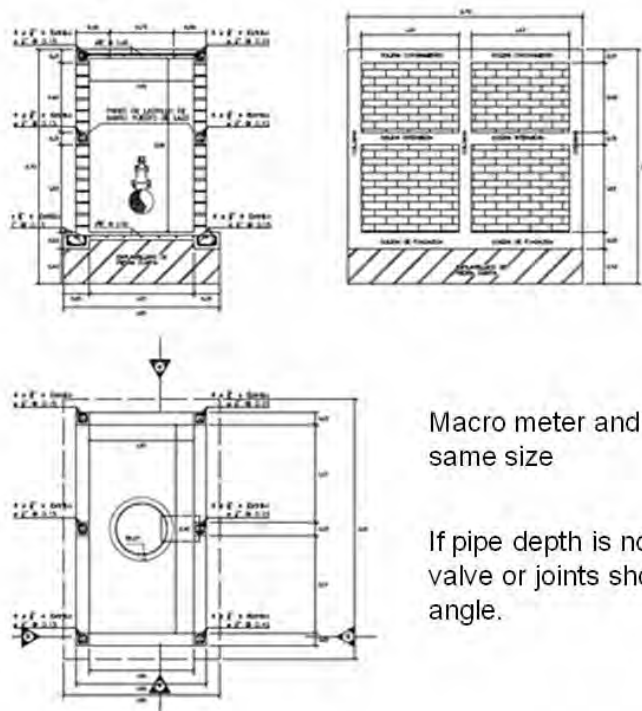
## Instalación o Reemplazo de Válvulas

➤ El sondeo de la funcionalidad de las válvulas del Bloque Modelo fue elaborado por ANDA durante el 1<sup>er</sup> Período.

|                         | Región Metropolitana | Región Central | Región Occidental |
|-------------------------|----------------------|----------------|-------------------|
| Instalación de Válvulas | 15                   | 17             | 26                |

➤ La instalación y reemplazo de válvulas deberá concluirse para el 15 de Enero de 2010

### Macro meter and Flow measurement pit



Macro meter and flow measurement pit are same size

If pipe depth is not enough from the ground, valve or joints should be adjusted to be lower angle.

## Instalación de Macro medidores

- La medición del flujo es la parte más importante del análisis de balance de agua.
- Es fácil conocer la cantidad de agua consumida por el bloque modelo.

|                   | Región Metropolitana | Región Central | Región Occidental |
|-------------------|----------------------|----------------|-------------------|
| Caja para Medidor | 1                    | 1              | 1                 |
| Pozo para MNF     | 3                    | 3              | 2                 |

## Instalación de Micro medidores

- Todos los micro medidores dentro del Bloque Modelo han sido revisado por ANDA
- Todos los medidores han sido catalogado como en buenas condiciones, reemplazo y otros.
- Los medidores bajo la categoría de reemplazo deben ser completados para el 15 de enero de 2010

|                                | Región Metropolitana | Región Central | Región Occidental |
|--------------------------------|----------------------|----------------|-------------------|
| Instalación de Micro medidores | 500                  | 486            | 360               |

## Instalación de Macro y Micro medidores

### Hoja de Balance de Agua del IWA

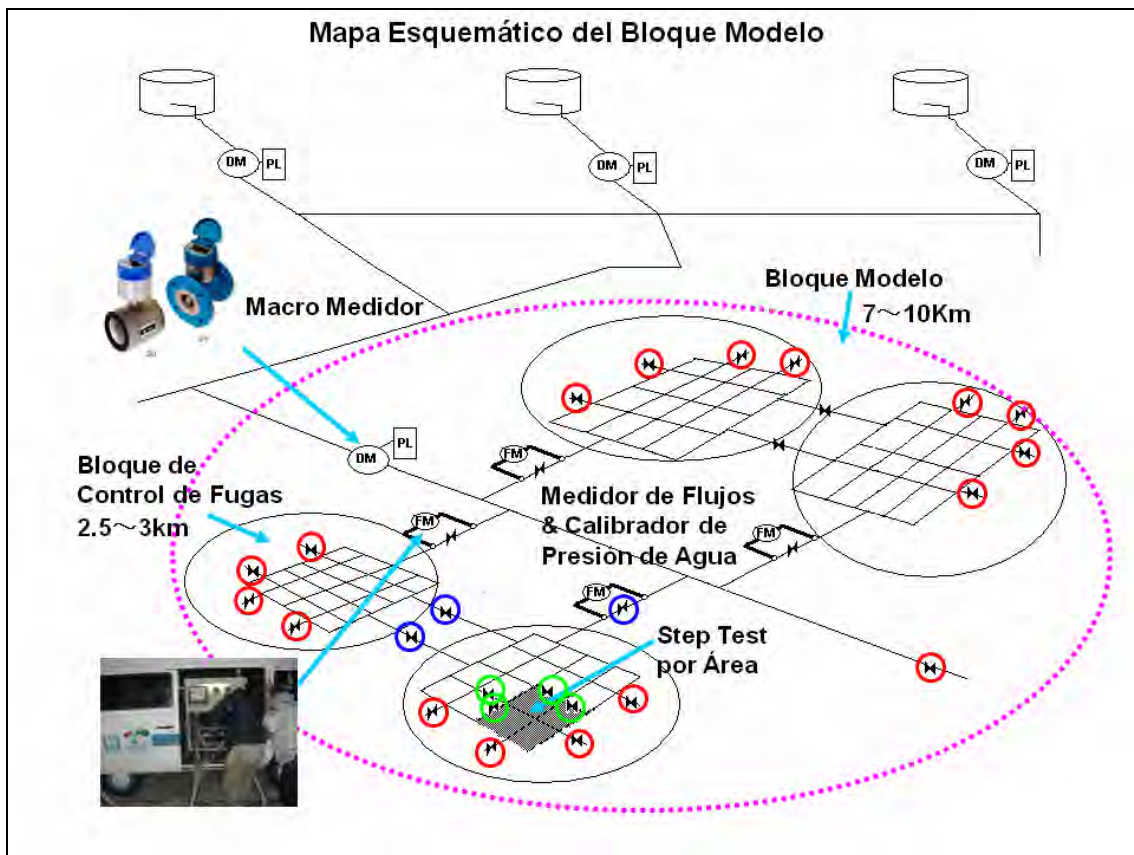
|  |                      |                                      |   |                   |
|--|----------------------|--------------------------------------|---|-------------------|
| Volumen de Entrada del Sistema                                 | Consumos Autorizados | Consumos Autorizados y Facturados    | Consumo Medido Facturado (incluyendo exportación de agua) | Agua Facturada    |
|  |                      |                                      | Consumo no Medido Facturado                               |                   |
|  |                      | Consumos Autorizados y No Facturados | Consumo Medido No Facturado                               | NRW WATER         |
|  |                      |                                      | Consumo No Medido No Facturado                            |                   |
|  | Pérdidas de Agua     | Pérdidas Aparentes                   | Consumo No Autorizado                                     | Agua no Facturada |
|  |                      |                                      | Medición Inexacta   |                   |
|  |                      | Pérdidas Reales                      | Fugas en la Principales de Transmisión y Distribución     |                   |
|  |                      |                                      | Fugas y Rebalses en los Tanques de Almacenamiento         |                   |
| Fugas en las Conexiones de Servicio hasta el Punto de Medición |                      |                                      |   |                   |

El Agua Facturada dentro del Bloque Modelo debe ser medido lo más exacto posible con el Macro y los Micro medidores.

Es por esto que es importante tener todos los medidores instalados.

## Bloque Modelo

- Aprenderemos las técnicas de cómo reducir el Agua No Facturada en un área ideal.
- El Bloque Modelo debe ser aislado de la red de distribución. Por esto es importante colocar válvulas de aislamiento en el área.



## Bloque Modelo

Región Metropolitana

Área: Bosques de la Paz

Longitud de la Red: 11,650m

Acometidas: 2,644

Bloques de Control de Fugas: 4

Cajas para Macro medidor: 1 8"

Pozos para el MNF: 3

Válvulas a instalar: 15

## Bloque Modelo: Bosques de la Paz



## Bloque Modelo

Región Central

Área: Tonacatepeque

Longitud de la Red: 7,300m

Acometidas: 1,306

Bloques de Control de Fugas: 3

Cajas para Macro medidor: 1 6"

Pozos para MNF: 3

Válvulas a instalar: 17

## Bloque Modelo: Tonacatepeque



## Bloque Modelo

Región Occidental

Área: Centro de Santa Ana (Entre 1<sup>era</sup> Calle y 11<sup>ava</sup> Calle, 4<sup>ta</sup> Avenida y 11<sup>ava</sup> Avenida)

Longitud de la Red: 4,700 m

Acometidas: 540

Bloques de Control de Fugas: 2

Caja para Macro medidor: 1 6"

Pozos para MNF: 2

Válvulas a instalar: 26

## Bloque Modelo: Centro de Santa Ana (Entre 1<sup>era</sup> Calle y 11<sup>ava</sup> Calle, 4<sup>ta</sup> Avenida y 11<sup>ava</sup> Avenida)

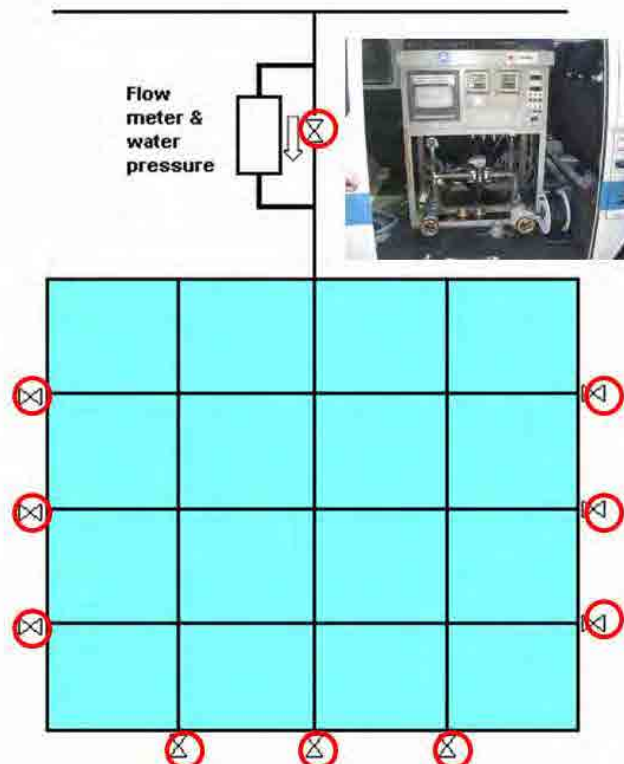


## Sondeo de MNF

- El porcentaje de MNF es un fiel reflejo del volumen de fugas en el Bloque de Control de Fugas
- Por esta razón, el sondeo de MNF debe de implementarse a media noche, ya que es cuando la mayoría de gente que vive dentro del bloque modelo se encuentra durmiendo

## Hoja de Balance de Agua de IWA

|  |                                      |                                   |   |                |
|--|--------------------------------------|-----------------------------------|---|----------------|
| Volumen de Entrada del Sistema                                 | Consumos Autorizados                 | Consumos Autorizados y Facturados | Consumo Medido Facturado (incluyendo exportación de agua) | Agua Facturada |
|  |                                      |                                   | Consumo no Medido Facturado                               |                |
|  | Consumos Autorizados y No Facturados | Consumo Medido No Facturado       | NRW WATER   |                |
|  |                                      | Consumo No Medido No Facturado    |   |                |
|  | Pérdidas Aparentes                   | Consumo No Autorizado             | Agua no Facturada   |                |
|  |                                      | Medición Inexacta                 |   |                |
|  | Pérdidas de Agua                     | Pérdidas Reales                   | Fugas en la Principales de Transmisión y Distribución     |                |
| Fugas y Rebalses en los Tanques de Almacenamiento              |                                      |                                   |   |                |
| Fugas en las Conexiones de Servicio hasta el Punto de Medición |                                      |                                   |   |                |





# Sondeo del Minimum Night Flow (MNF)

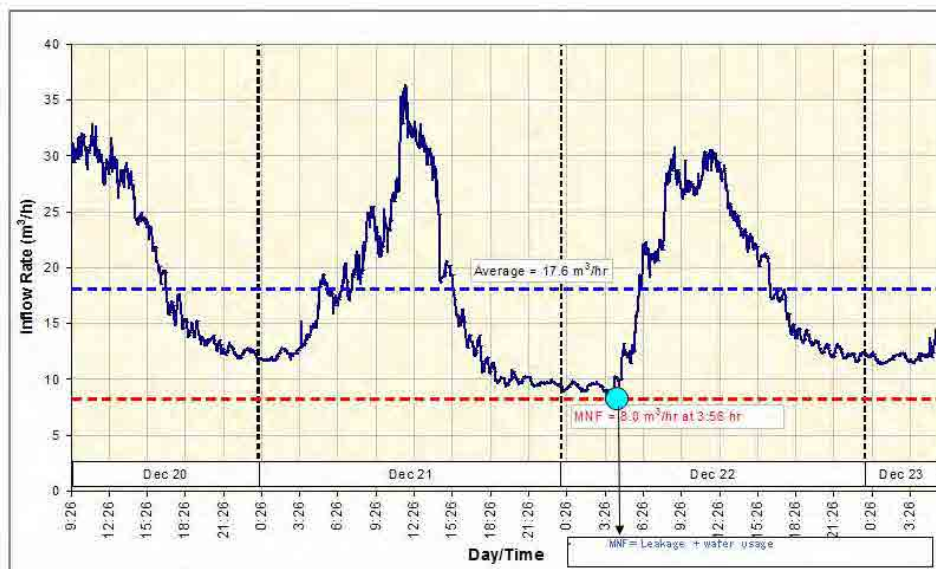
Caso en Brasil

Cámara de Válvulas

Medidor Magnético de Flujos & Presión del Agua

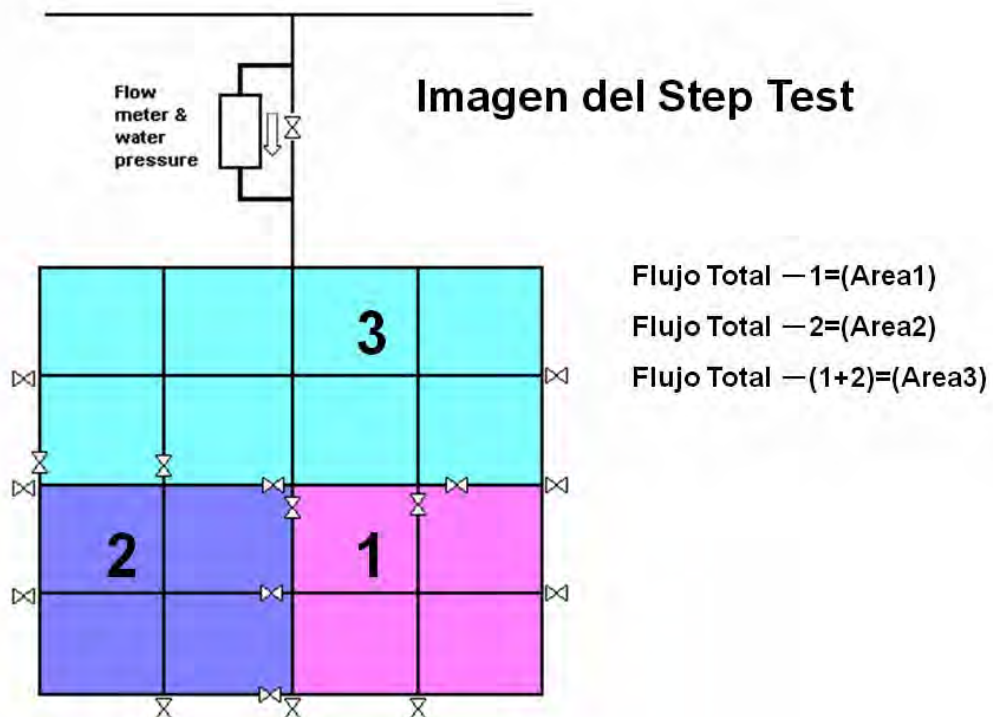


# Sondeo del Flujo Mínimo Nocturno (MNF)

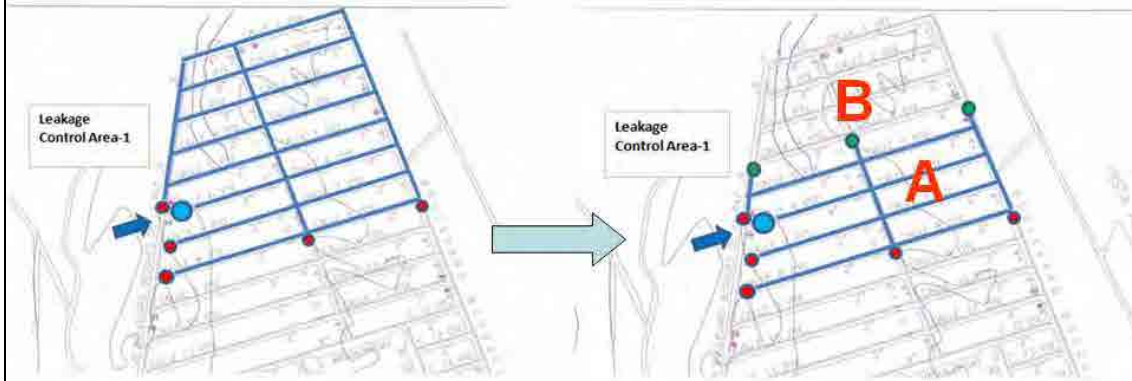


## Método del Step Test

- El Step Test es muy efectivo para detectar la cantidad y localización de las fugas.
- Se aísla una parte del área de control de fugas cerrando las válvulas fronterizas para identificar la reducción del volumen de agua así como el volumen de fugas dentro del área.



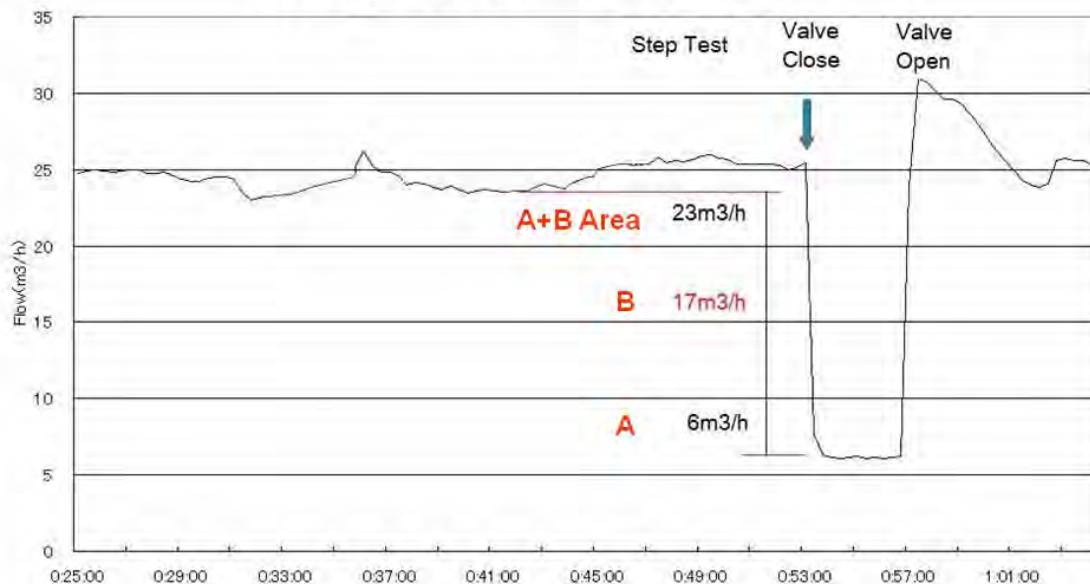
### Step Test en el Área-1 de Bosques de la Paz



Sondeo del MNF en el área de control de fugas – 1 del Bloque Modelo

En este caso, el área de control de fugas puede dividirse en A y B al cerrar las 3 válvulas para el Step Test.  
Si hay fugas dentro del área B, el volumen de MNF cambiará al cerrar las 3 válvulas.

### Imagen del Step Test



En éste caso, el MNF arroja un consumo de aprox. 23m<sup>3</sup>/h, cuando las válvulas se cierran, el MNF arroja una caída a 6m<sup>3</sup>/h. Si A es 6m<sup>3</sup>/h, B debería ser 17m<sup>3</sup>/h.

- El buen funcionamiento de las válvulas, el macro medidor y los micro medidores son muy importante para la medición del Agua Facturada.
- Las Pérdidas Reales dentro del Bloque Modelo se miden a través del Sondeo del MNF.
- La cantidad y ubicación de las fugas se miden a través del método del Step Test.

MUCHAS GRACIAS POR SU ATENCIÓN!

【写真】



「成果 2:無収水削減計画策定能力の向上」に関わる研修

## **BASIC MATERIAL FOR THE ELABORATION OF THE NON REVENUE WATER (NRW) REDUCTION MANAGEMENT PLAN**

### **BASIC MATERIAL FOR THE ELABORATION OF THE NON REVENUE WATER (NRW) REDUCTION MANAGEMENT PLAN**

*OVERALL GOAL: To have a long term NRW Reduction Management Plan*

*SCOPE: Optimize and ensure the required procedures to obtain the real production volumes, volume billed and NRW index*

*CURRENT SITUATION: The potable water supply systems lack adequate measuring systems (macro and micro measuring), controlled networks and by divided by sector, there is no updated land registry of the users (per type of service-household, commercial, industrial and special connections, illegal and irregular connections); therefore, the information and merchandizing system is not up to date. Additionally, there is no updated technical land registry, which does not allow controlling the three main components which are: Water volume produced, water volume billed, and NRW index.*

*OBJECTIVE FOR THE SECOND YEAR: Determine the current situation and identify the technical, administrative, legal, economic, and political institutional problems, as well as others related to NRW reduction.*

#### *LIST OF PROBLEMS IDENTIFIED:*

- 1. Lack of a NRW reduction management plan*
- 2. Lack of a strategy for the implementation of the NRW plan (sectors of the AMSS, small municipalities in the country, pilot projects, etc.)*
- 3. Lack of a specialized unit, duly equipped and trained for the follow up and control of the NRW index*
- 4. Lack of an institutional policy for the creation and strengthening of a specialized unit for the follow up and control of the NRW index*
- 5. Definition of the policy for legalization of illegal and irregular connections*
- 6. Definition of a policy to legalize illegal and irregular connections*
- 7. Definition of a policy for charging authorized consumption and lack of charging mainly for the municipalities*
- 8. Lack of economic resources for the implementation of a long term NRW reduction management plan*
- 9. No equipment or adequate tools which enable the implementation of the NRW reduction plan*
- 10. The deteriorated state of the potable water supply systems increases the implementation costs of the NRW plan, due to the repair of damaged sections, valves, joints and meters*
- 11. Lack of annual budget assigned for the NRW follow up and control*
- 12. Lack of updated and reliable information of the volume produced, volume billed and NRW index*
- 13. The information of the merchandizing system is not up to date (per type of user-residential, commercial, industrial, special connections), illegal and irregular connections average billed per direct connections., etc*

14. *There are no geo-referenced drawings of the networks and connections*
15. *There is no mathematic model of the distribution networks*
16. *There are no maps of the pressure and service hours per sectors*
17. *Lack of defined sectors of the service*
18. *Revision of valid norms (tariff decree, technical norms for design and construction of aqueduct and sanitary sewerage systems, for the installation of new services, macro and micro measuring)*
19. *Routes for measuring, notification and sequences of measuring are not defined and/or updated*
20. *Lack of updated drawings with location of valves, hydrants and extensions of the distribution networks*
21. *Lack of control programs for losses per defined sectors, distribution networks, distribution tanks; with indicators of the number of repairs per km/month, number of meter repairs, direct connections, unknown connections, damaged meters, etc.*
22. *There are no measuring bank (bench) meters, which does not allow us to calibrate or repair them*
23. *Among many other problems we shall identify in the process*

#### *PROCEDURES*

1. *Identification of sectors per pressure zones*
2. *Diagnosis of the sectors or supply systems to divide by sectors (functioning profile of the systems).*
3. *Identification of the physical and operation state of the components of the supply system (pumping plants, electric sub-station, and control boards).*

## 1. Estructura de los problemas para la solución de problemas núcleo

### Estructura de los problemas para la solución de problemas núcleo

課題解決へ向けた問題の構造化について

### Structurization of Problems for Core Problem Solution

#### ■Listado de problemas y categorización

#### ■問題点の列挙とそのカテゴライズ

#### ■Listing Problems and their categorization

#### ■Estructura de los problemas

Aclarar la relación entre los fenómenos (problemas) y las causas y motivo de su relación, e identificar las causas reales.

Aspectos: ¿Es esto un fenómeno ó una causa? ¿Qué tipo de relación? ¿Es una causa real y no un fenómeno? ¿Qué tan importante es? ¿Es antinomia? Fuerte relación ó débil.

#### ■問題の構造化

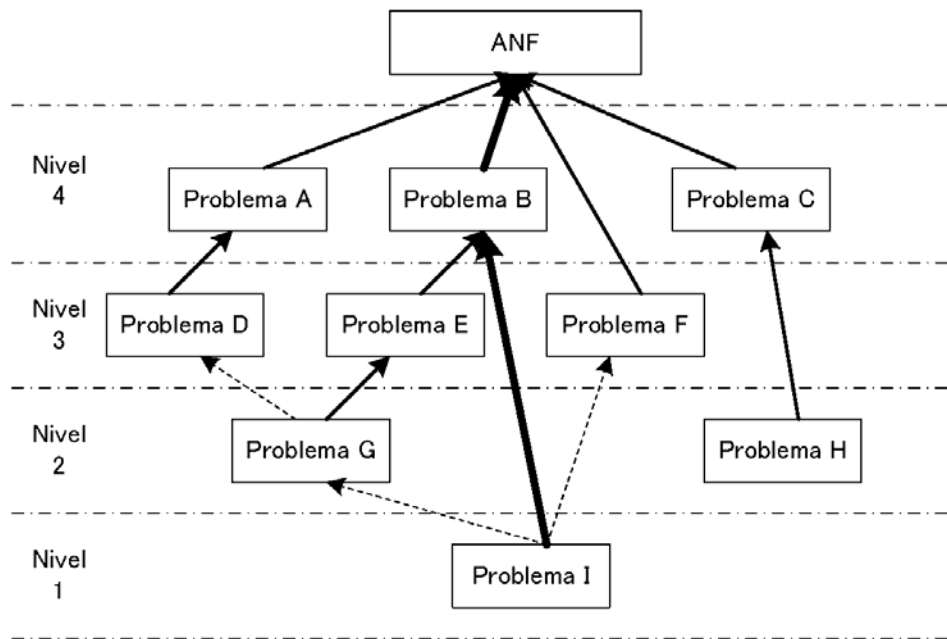
現象（問題点）とその原因に因果関係を明らかにし、その関係を明示し、真の原因を特定する。  
視点：現象か原因か、因果関係はないか、真の原因か、重要性、二律背反とならないか、など  
＊できれば、KJ法のような図が欲しいところだ。下図参照：関係の強弱、重要性が明らかにする。

#### ■Structurization of Problems

Clarify causal link among phenomenon (problem) and causes and account for their relationship, and identify true causes

Aspects: Is this a phenomenon or cause? What kind of relationship? Is this true cause instead of phenomenon? How about importance? Is this antinomy (trade-off)? Strong relation or weak relation.





■Listado de problemas núcleo (problemas a ser solucionados)

De la figura anterior, los problemas núcleo (problemas a solventar) deben ser listados y aclarados en cuanto a su prioridad e importancia.

Aspects: ¿Existen contramedidas? ¿Son realistas las contramedidas?

■課題（解決すべき問題）の抽出

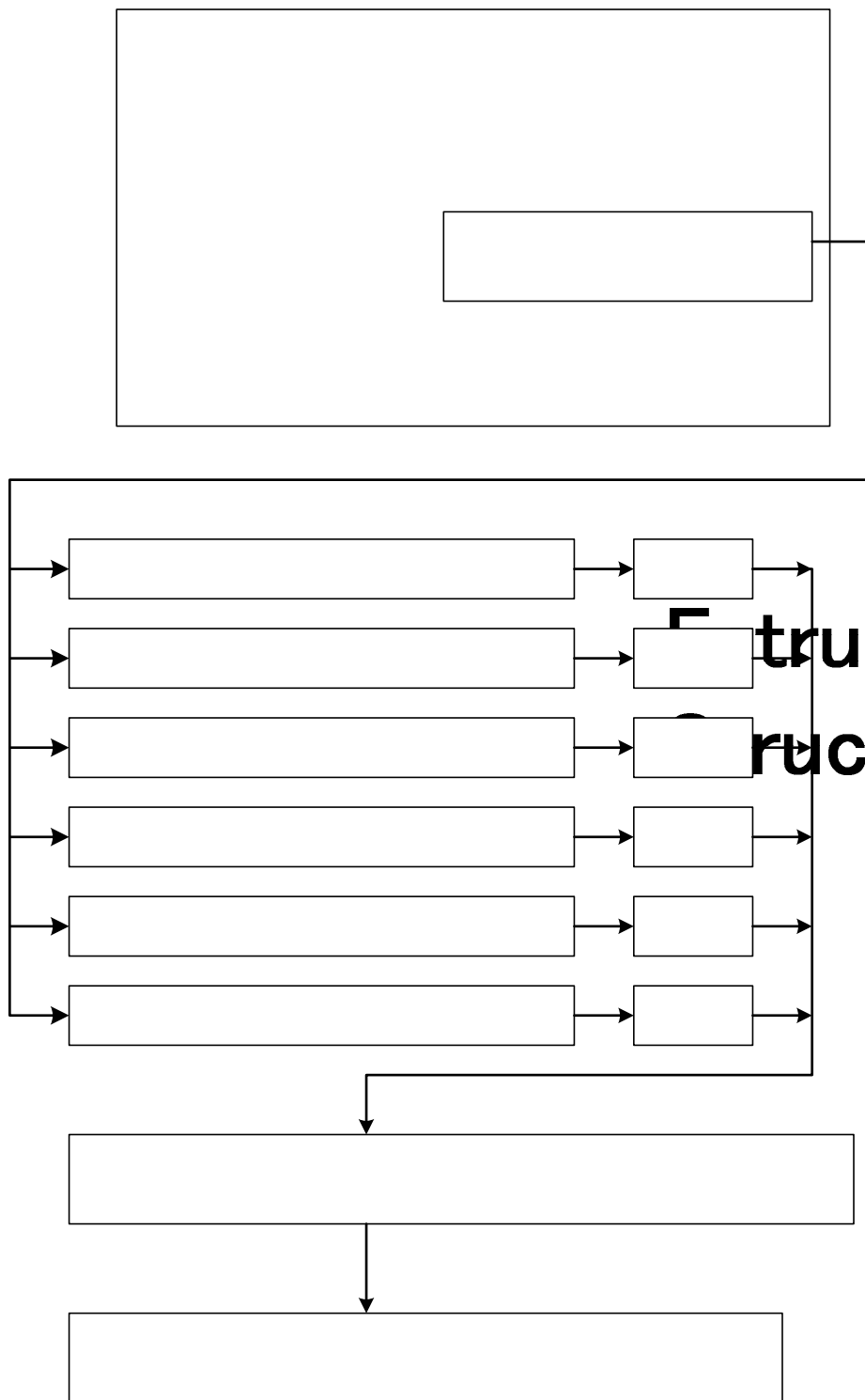
上の図に基づき、下記視点から、課題（解決すべき問題）を抽出し、優先順位を明らかにする。  
 視点：対策が存在するか、実行可能性、重要性、直接性、真の原因であるか、優先順位の設定、など

■Listing-up Core Problems (problems to be solved)

From above figure, Core problems (problems to be solved) should be listed up and clarify their priorities and importance.

Aspects: Are there any countermeasures? Is countermeasure realistic?

## 2. 無収水削減計画マニュアルの構成



estructura del  
structure of M

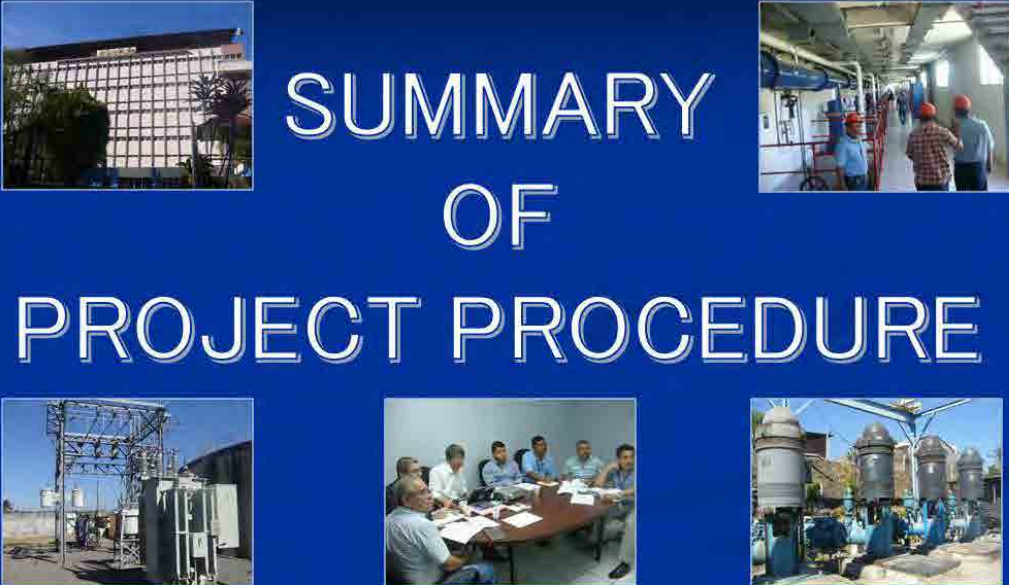
Capítulo  
Chapter

1.1  
1.1

「成果 3: 節電計画策定能力の強化」に関わる研修

2009年6月29日 パイロット施設の節電手法について 1

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*



**SUMMARY  
OF  
PROJECT PROCEDURE**

June 29 2009 ver.1 1

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

**Our Project ?**

**Building the Base of  
the Energy Efficiency Improvement  
for All Facility of ANDA**

**... is Your Goal**

2

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ Introduction

Before that, an exercise...

3

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ Introduction

■ Exercise

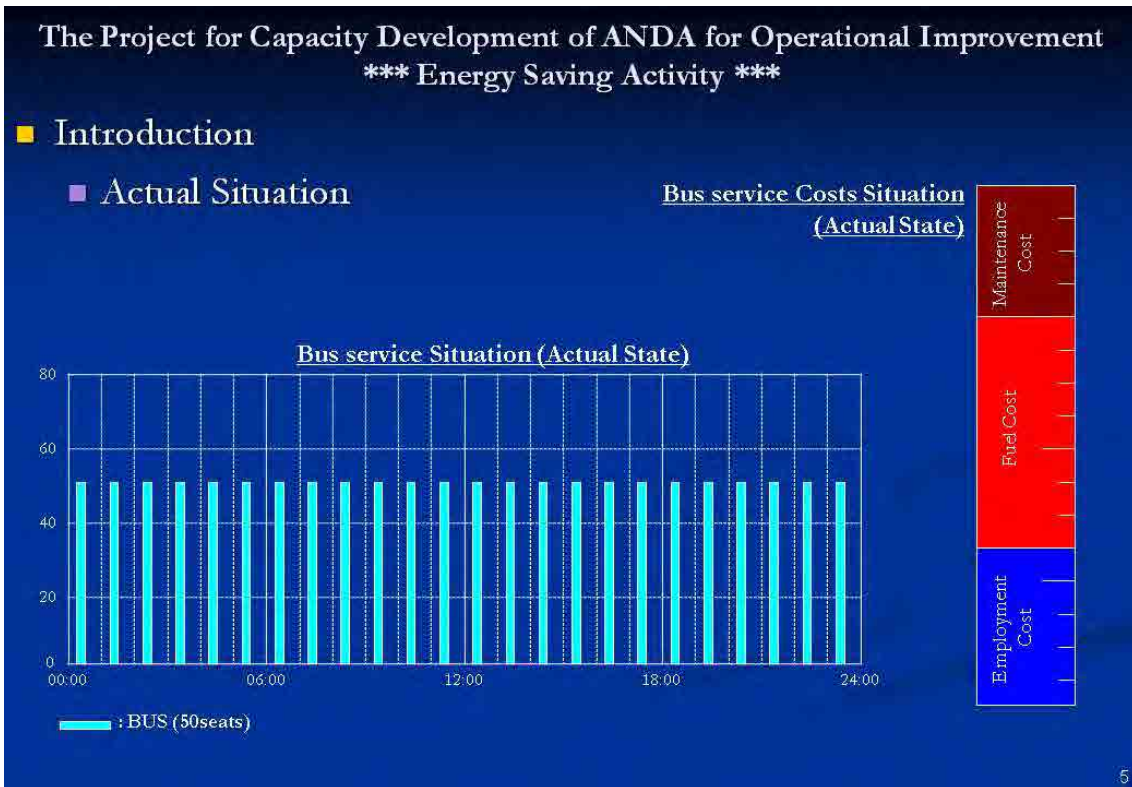
- You are a Bus company's President
- Problem is Cost reduction
- Conditions
  - Round-the-Clock Service (24 / 24 hours)
  - One round trip per hour between San Salvador to Airport (24 round trips a day)
  - Unknown Number of Passengers
  - Superannuated Buses ( 50 seats)
  - Too much Speed by Driver
  - Chronic Traffic Jam



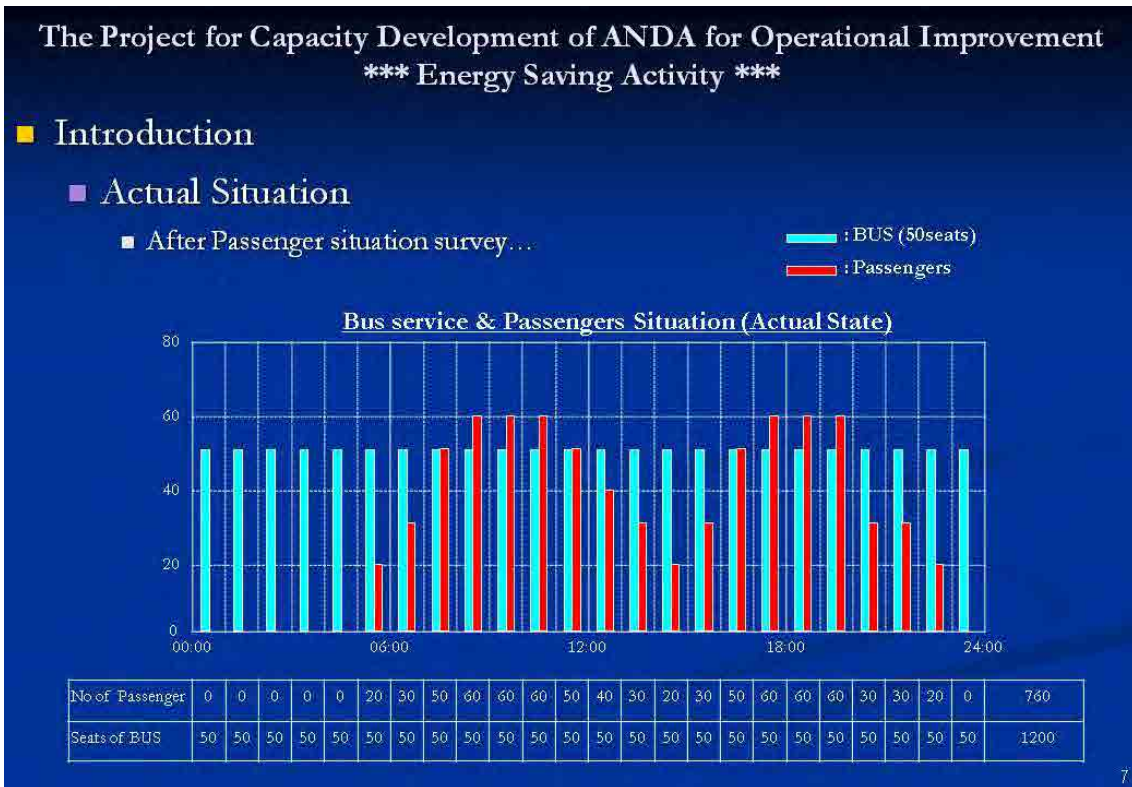
■ How is it solved?



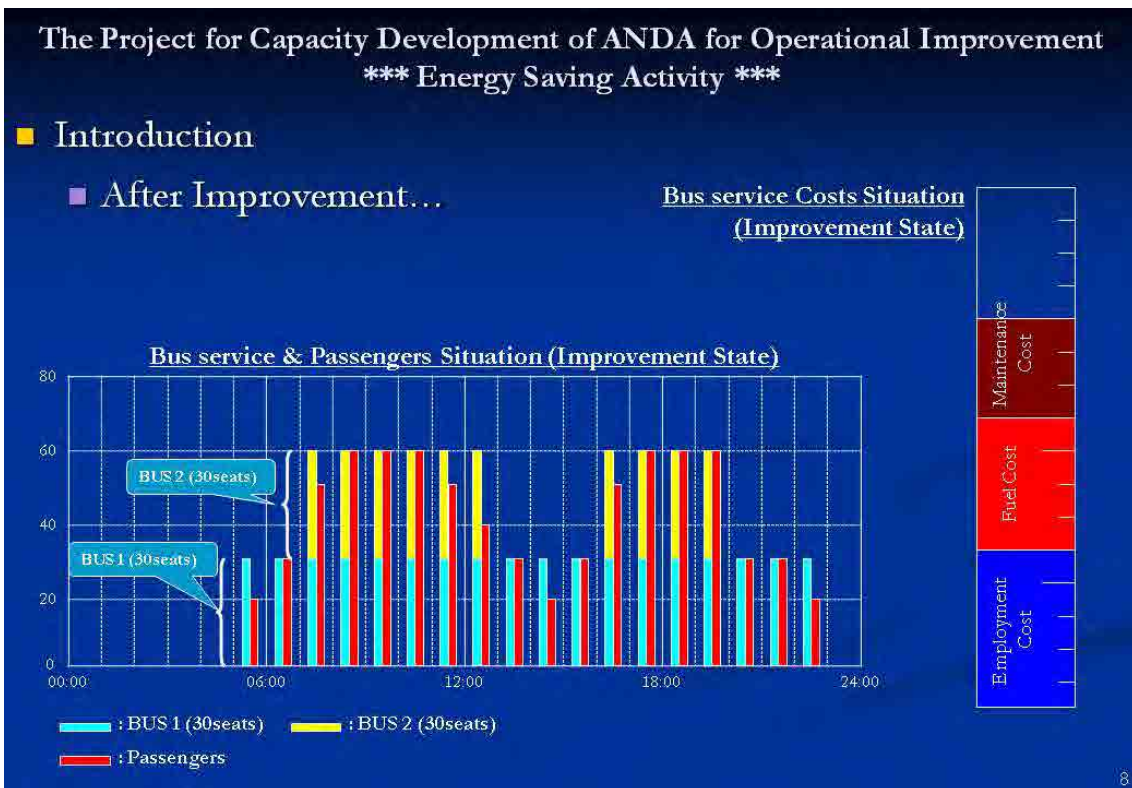
4



- The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*
- Introduction
- Actual Situation → Measures
- Round-the-Clock Service (24 / 24 hours)
    - → Minimize Service Time
  - One round trip per hour between San Salvador to Airport (24 round trips a day)
    - → Minimize Operation
  - Unknown number of Passengers
    - → Execution of Number of Passengers Survey
  - Superannuated Buses (50 seats)
    - → Chang to high-mileage small buses (30 seats x 2)
  - Too much Speed by Driver
    - → Drive for good fuel cost
  - Chronic Traffic Jam
    - → Road shall be widened by the Government
- 6



7



8

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ Introduction

You have already understood what it means...

9

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ Introduction

|  |  |   |
|--|--|---|
| <ul style="list-style-type: none"> <li>■ Bus Company                             <ul style="list-style-type: none"> <li>■ Round-the-Clock Service (24 / 24 hours)                                     <ul style="list-style-type: none"> <li>■ → Minimize Service Time</li> </ul> </li> <li>■ One round trip per hour between San Salvador to Airport (24 round trips a day)                                     <ul style="list-style-type: none"> <li>■ → Minimize Operation</li> </ul> </li> <li>■ Unknown number of Passengers                                     <ul style="list-style-type: none"> <li>■ → Execution of Number of Passengers Survey</li> </ul> </li> <li>■ Superannuated Buses (50 seats)                                     <ul style="list-style-type: none"> <li>■ → Change to high-mileage small buses (30 seats x 2)</li> </ul> </li> <li>■ Too much Speed by Driver                                     <ul style="list-style-type: none"> <li>■ → Drive for good fuel cost</li> </ul> </li> <li>■ Chronic Traffic Jam                                     <ul style="list-style-type: none"> <li>■ → Road shall be widened by the Government</li> </ul> </li> </ul> </li> </ul> |  | <ul style="list-style-type: none"> <li>■ ANDA Facilities                             <ul style="list-style-type: none"> <li>■ Running Time of Pumps                                     <ul style="list-style-type: none"> <li>■ → Minimize Service Time (ex. In case of Transmission System)</li> </ul> </li> <li>■ Number of Pumps                                     <ul style="list-style-type: none"> <li>■ → Minimize Operation</li> </ul> </li> <li>■ Unknown Water Service Demand                                     <ul style="list-style-type: none"> <li>■ → Execution of Demand Survey</li> </ul> </li> <li>■ Inefficiency Equipments Loss                                     <ul style="list-style-type: none"> <li>■ → Change to high-efficiency equipments</li> </ul> </li> <li>■ Too much Pump Water Head                                     <ul style="list-style-type: none"> <li>■ → Appropriate Water Head</li> </ul> </li> <li>■ Piping Loss / Water Leak                                     <ul style="list-style-type: none"> <li>■ → Appropriate Pipe size</li> <li>■ → Pipe Repair</li> </ul> </li> </ul> </li> </ul> |
|--|--|---|

10

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ Introduction

First of all, it is important to fully understand what you have to do to achieve this project...

11

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ Steps of Briefings for Project Members

- 1. Outline
- 2. Project Schedule
- 3. What is Energy Efficiency
- 4. Roles of Members for Actual Situation Survey
- 5. Procedure of Field Tests
- 6. Selection of Pilot Facilities ( Inefficiency Facilities in AMSS)
- 7. Energy Efficiency Measures Technique
- 8. Simulation of Effect of Measures
- 9. Execution of Measures
- 10. Assessment of Effect of Measures

12



The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ Steps of Briefings for Project Members

- 11. Roles of Members for Making Energy Efficiency Manual
- 12. Roles of Members for Making Energy Efficiency Plan for All Facilities of ANDA
- 13. Analysis of Transmission Line
- 14. Analysis of Distribution Pipe Network
- 15. Simulation of Efficiency Improvement for Water Transmission line and Distribution pipe network
- 16. Roles of Members for Making Water Transmission and Distribution Improvement Plan

13

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ Steps of Briefings for Project Members

- 1. Outline Today's Briefing
- 2. Project Schedule
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- 10. Assessment of Effect of Measures

14

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ 1. Outline

- Period of Project?
  - February 2009 – December 2011
- What is our mission?
  - Making Manual of Energy Efficiency Improvement
  - Making Energy Efficiency Improvement Plan for all facility of ANDA
  - Hydraulic Analysis of Transmission line and Distribution pipe network
  - Making Water Transmission and Distribution Improvement Plan
  - Informing all of ANDA staff of the Plans
- How are Manual and Plans made?
  - Making Manual and Plans through Field Tests and Trainings

15

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ 1. Outline

- What kind of Field Test?
  - Verification of Solutions for selected facilities which are inefficiency
  - Simulation of Efficiency Improvement for Water Transmission line and Distribution pipe network
- Where are Field Tests and Trainings executed?
  - Field Tests : at Selected Facilities in AMSS
  - Trainings : at Selected Facilities and ANDA office
- When are Field Tests and Trainings executed?
  - Field Tests : July 2009 – July 2010
  - Trainings : in each case for project period

16

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

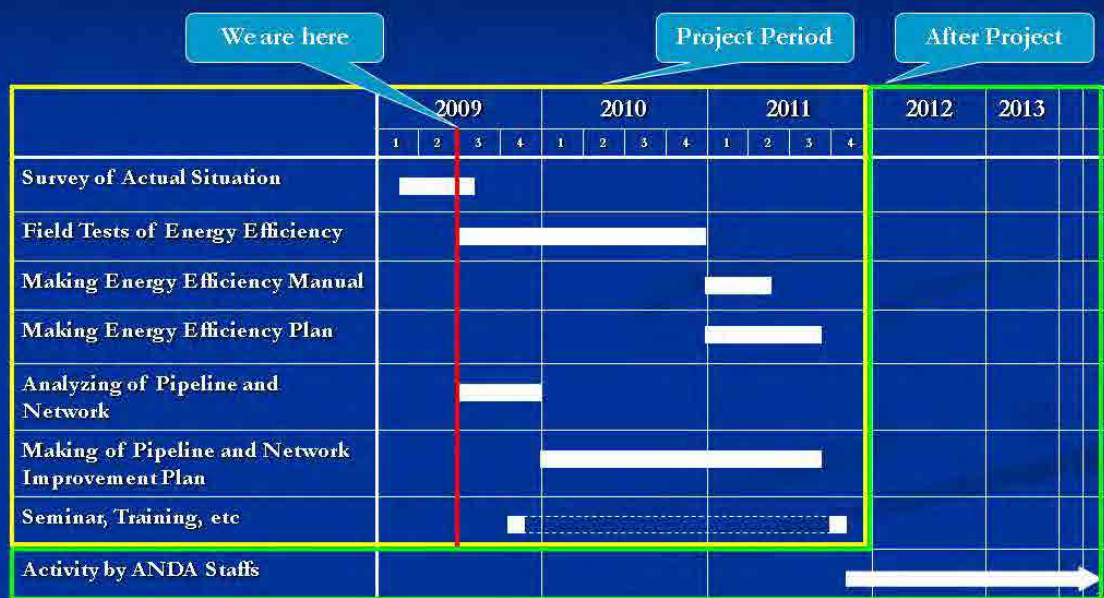
1. Outline

- What is Our Output ?
  - Energy Efficiency Improvement Manual of ANDA
  - Energy Efficiency Improvement Plan for All Facility of ANDA
  - Water Transmission and Distribution Improvement Plan of ANDA
- What is Index of Project?
  - Improved Power Consumption Data
- What is the Final Goal?
  - ANDA's Power Consumption Efficiency is improved
  - ANDA Head Office formulates a budget proposal in accordance with Power Efficiency Improvement Plan

17

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

2. Project Schedule



The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 3. What is Energy Efficiency

■ **INPUT** x Energy Transduction = **OUTPUT**



Factor of Energy Transduction is same thing as Energy Efficiency

■ **INPUT** x Energy Efficiency = **OUTPUT**



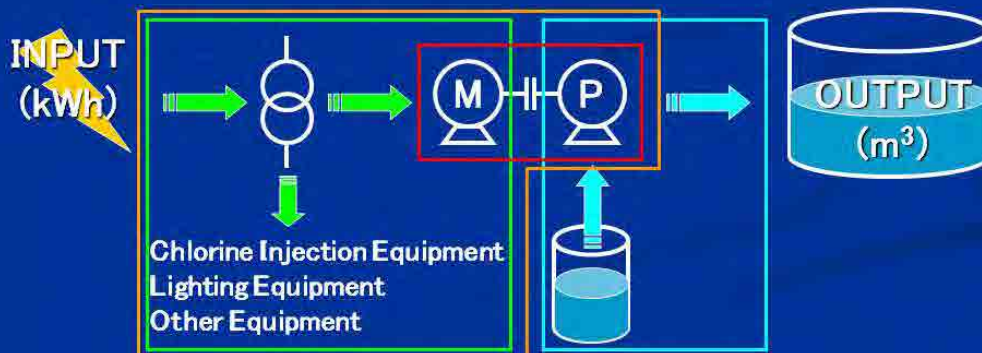
■ **INPUT** - **LOSS** = **OUTPUT**

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 3. What is Energy Efficiency

■ In Case of Pumping Station...

**INPUT** -  $\left[ \begin{array}{l} +\text{Electrical Loss} \\ +\text{Mechanical Loss} \\ +\text{Thermal Loss} \\ +\text{Piping Loss} \end{array} \right] = \text{OUTPUT}$



The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

- 3. What is Energy Efficiency
  - In Case of Pumping Station...



21

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

- 4. Roles of Members for Actual Situation Survey  
( For the Next Week )

Our Target Facilities of Actual Situation Survey...

- + Large Facility, Medium Facility, Small Facility
- + Pumping Facility, Water Transmission Facility, Water Distribution Facility
- + High Power Consumption Facility
- + Low Power Factor Facility
- + Low Load Factor Facility
- + High Piping Loss Area
- + Same Area as NRW Model Area
- + etc.

22

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ 4. Roles of Members for Actual Situation Survey  
( For the Next Week )

Please assign the following roles of members for actual situation survey until next weekly meeting...

- + Survey Manager
- + Survey Planner
- + Power Analyzer Controller
- + Data Collector (s)
- + Survey Assistant (s)

23

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ 4. Roles of Members for Actual Situation Survey

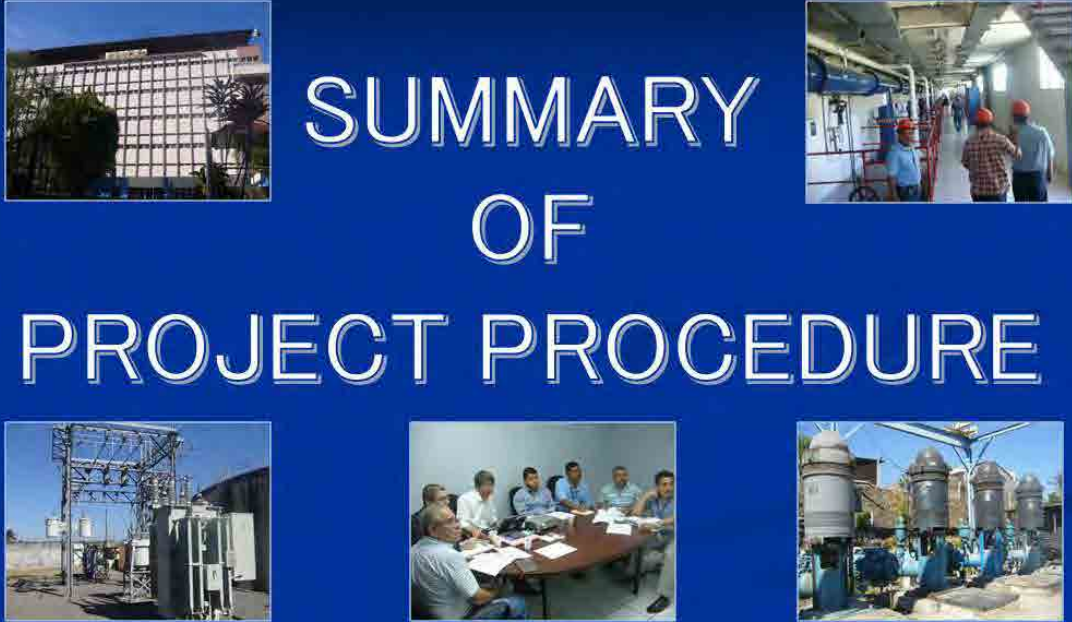
To Be Continued...



J. YAMAMOTO, NSC JAPAN 24

2009年7月6日 パイロット施設の節電手法について 2

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*



# SUMMARY OF PROJECT PROCEDURE

July 6 2009 rev.2 1

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

- Steps of Briefings for Project Members
  - 1. Outline
  - 2. Project Schedule
  - 3. What is Energy Efficiency
  - 4. Roles of Members for Actual Situation Survey
  - 5. Procedure of Field Tests
  - 6. Selection of Pilot Facilities ( Inefficiency Facilities in AMSS)
  - 7. Energy Efficiency Measures Technique
  - 8. Simulation of Effect of Measures
  - 9. Execution of Measures
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2

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ Steps of Briefings for Project Members

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3

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ Steps of Briefings for Project Members

- 1. Outline
- 2. Project Schedule
- 3. What is Energy Efficiency
- 4. Roles of Members for Actual Situation Survey Today's Briefing
- 5. Procedure of Field Tests
- 6. Selection of Pilot Facilities ( Inefficiency Facilities in AMSS )
- 7. Energy Efficiency Measures Technique
- 8. Simulation of Effect of Measures
- 9. Execution of Measures
- 10. Assessment of Effect of Measures

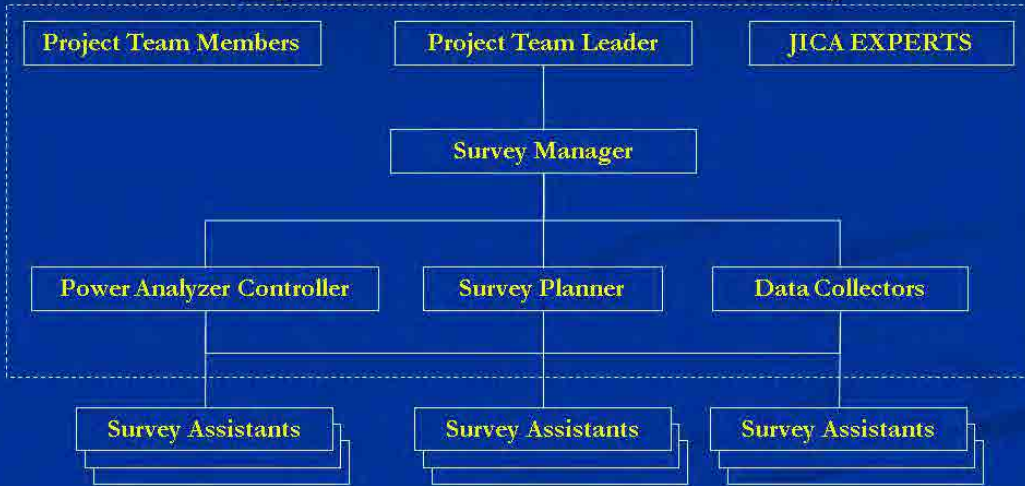
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The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 4. Roles of Members for Actual Situation Survey

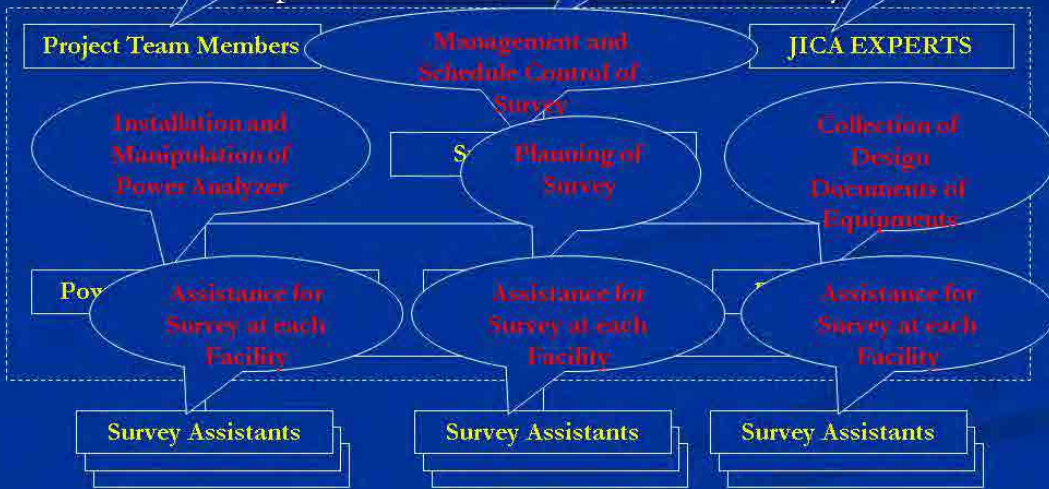
Implementation Structure of Actual Situation Survey



The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 4. Roles of Members for Actual Situation Survey

Implementation Structure of Actual Situation Survey



The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 5. Procedure of Field Test

- Step1-1: Selection of Target Facilities → Survey Planner
  - i** ■ Which Pumping Station? Why Choose it?
- Step1-2: Collection of Design Materials → Data Collectors
  - i** ■ Electrical Diagram?
  - How many Transformers? / How many Pumps? / How many Motors?
  - How is Chlorine Injection System? / How is Lighting?
  - Flow Meter exists? / Pressure Sensor exists?
- Step1-3: Preparation of Survey Plan → Survey Planner
  - i** ■ Order of Surveyed Facilities? → Power Analyzer Controller
  - Period of Survey for each Facility?
  - Which data is collected? (Voltage, Current, kW, kVA, kWh, Power Factor, etc.)
  - Which point is selected for Data Collecting?  
 ( Incoming line, Secondary terminal of Transformer, Feeder of Pumps, etc.)
  - Who collects data every day? How?

7

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 5. Procedure of Field Test

- Step1-4: Execution of Survey → Survey Planner
  - Installation of Measurement Devices → Power Analyzer Controller  
 ( Power Analyzer, Flow meter, Pressures sensor) → Data Collectors
  - i** ■ Collecting data every day → Survey Assistants
- Step2-1: Analysis of Collected Data 1 → Survey Planner
  - Total Power Consumption? → Power Analyzer Controller
  - Power Consumption of each Equipment?
  - Total Power Factor?
  - Power Factor of each Equipment?
  - Total Water Flow? / Water Flow of each Pump?
  - Operation time of each Pump?
  - Hydraulic Pressure of each situation?

8

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 5. Procedure of Field Test

- Step2-2: Analysis of Collected Data 2
  - Energy Consumption Index? → Survey Manager
  - Actual Needed Power? → Survey Planner
  - Wasted Power Consumption? → Power Analyzer Controller
  - Project Members
  
- Step2-3: Analysis of Collection Data 3
  - What kind of Wasted Power Consumption? → Survey Manager
  - What is a Reason why Wasted Power Consumption is generated? → Survey Planner
  - Power Analyzer Controller
  - Project Members

9

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 5. Procedure of Field Test

- Step3-1: Selection of Measures
  - Which Measures will be able to reduce Wasted Power Consumption? → Survey Manager
  - Survey Planner
  - Power Analyzer Controller
  - Data Collector
  - Project Members
  - Is it feasible in this Survey period?
  - Collection of Catalogue of Energy Efficiency Improvement Equipments
  - Collection of Quotation of Equipments
  
- Step3-2: Simulation of Effect
  - How much budget for Measures is required? → Survey Manager
  - Survey Planner
  - Power Analyzer Controller
  - Project Members
  - How much Power Consumption will be reduced?
  - How much cost for maintenance is required?
  - Cost-Benefit performance?
  - Target Index?

10

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 5. Procedure of Field Test

- Step3-3: Selection of Pilot Facilities
  - Result of Simulation? → Survey Manager
  - Which Pumping Station is good as pilot Facility? → Survey Planner
  - Facilities are selected → Power Analyzer Controller
  - based on ANDA's long-term strategy → Project Members
  - Making Test Schedule for Pilot Facilities? → Maintenance Department
  - Coordination with Maintenance Department?
  
- Step3-4: Procurement of Equipments for Measures by JICA
  - Specification of Purchased Equipments? → Survey Manager
  - Quotation of Purchased Equipments? → Survey Planner
  - Delivery date of Purchased Equipments? → Power Analyzer Controller
  - Installation work of Purchased Equipments? → JICA Experts

11

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 5. Procedure of Field Test

- Step4-1: Execution of Energy Efficiency Improvement
  - Execution of Measures? → Survey Manager
  - Efficiency Improvement of Operation? → Survey Planner
  - Installation of Energy Efficiency Improvement Equipments? → Power Analyzer Controller
  - Coordination with Maintenance Department? → Project Members
  - Maintenance Department
  - Survey Assistants
  
- Step4-2: Execution of Verification
  - Installation of Measurement Devices (Power Analyzer, Flow meter, Pressures sensor) → Survey Manager
  - Survey Planner
  - Power Analyzer Controller
  - Collecting data every day

12

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 5. Procedure of Field Test

- Step4-3: Analysis of Collected Data 4
  - Total Power Consumption? → Survey Manager
  - Power Consumption of each Equipment? → Survey Planner
  - Total Power Factor? → Power Analyzer Controller
  - Total Water Flow? / Water Flow of each Pump? → Project Members
  - Operation time of each Pump?
  - Hydraulic Pressure of each situation?
  - Energy Consumption Index?
  
- Step5: Evaluation of Impact of Measures
  - Comparison of Simulation and Result? → Survey Manager
  - Consequence Analysis of each Measures? → Survey Planner
  - Cost-Benefit Performance of each Measures? → Power Analyzer Controller
  - Making Report of Field Test → Project Members

13

The Project for Capacity Development of ANDA for Operational Improvement  
 \*\*\* Energy Saving Activity \*\*\*

■ 6. Selection of Pilot Facilities

Suitable Facility for Pilot Facilities are as follows;

- + Large Facility, Medium Facility, Small Facility  
 (Typical Facility convenient for making Manual)
- + Pumping Facility, Water Transmission Facility, Water Distribution Facility  
 (Typical Facility convenient for making Manual)
- + Facilities where effect can be expected in Simulation Result
- + Facilities are selected based on ANDA's long-term strategy
- + Facilities in which Maintenance Department can cooperate
- + High Power Consumption Facility
- + Low Power Factor Facility
- + Low Load Factor Facility
- + Facilities where flowing quantity and pressure can be measured
- + High Piping Loss Area
- + Same Area as NRW Model Area

14

The Project for Capacity Development of ANDA for Operational Improvement  
\*\*\* Energy Saving Activity \*\*\*

■ 7. Energy Efficiency Measures Technique

To Be Continued...



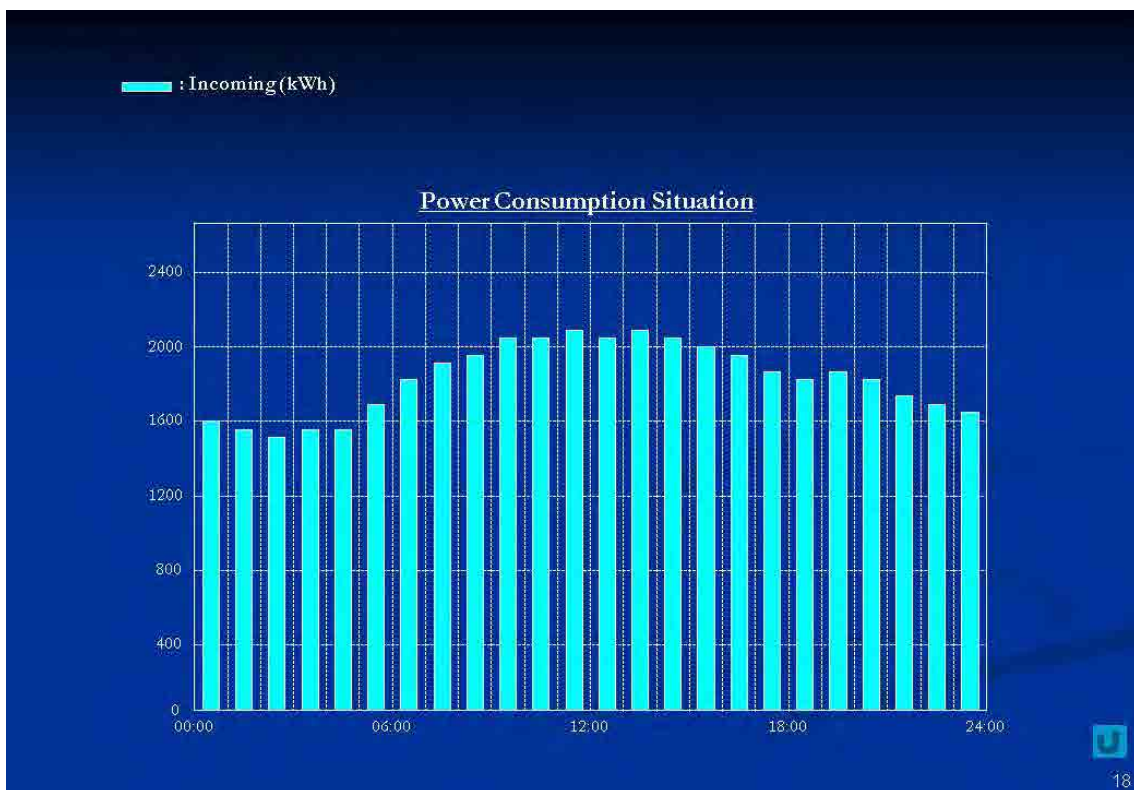
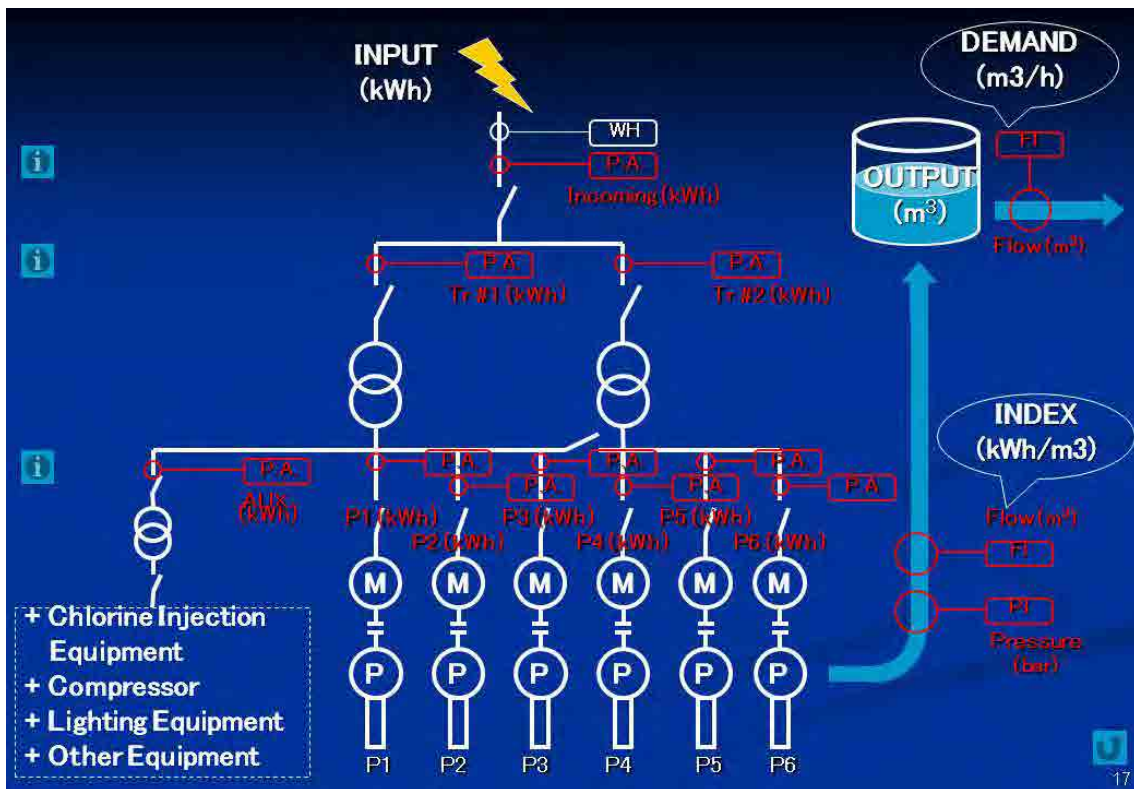
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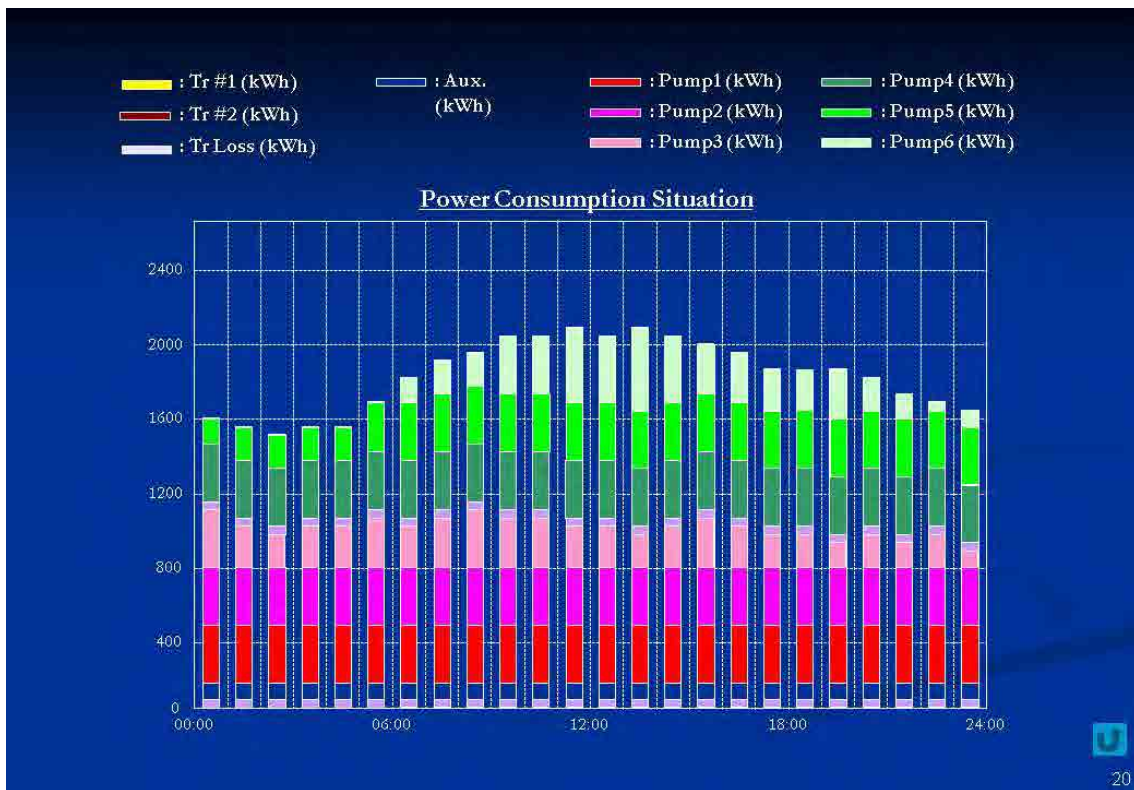
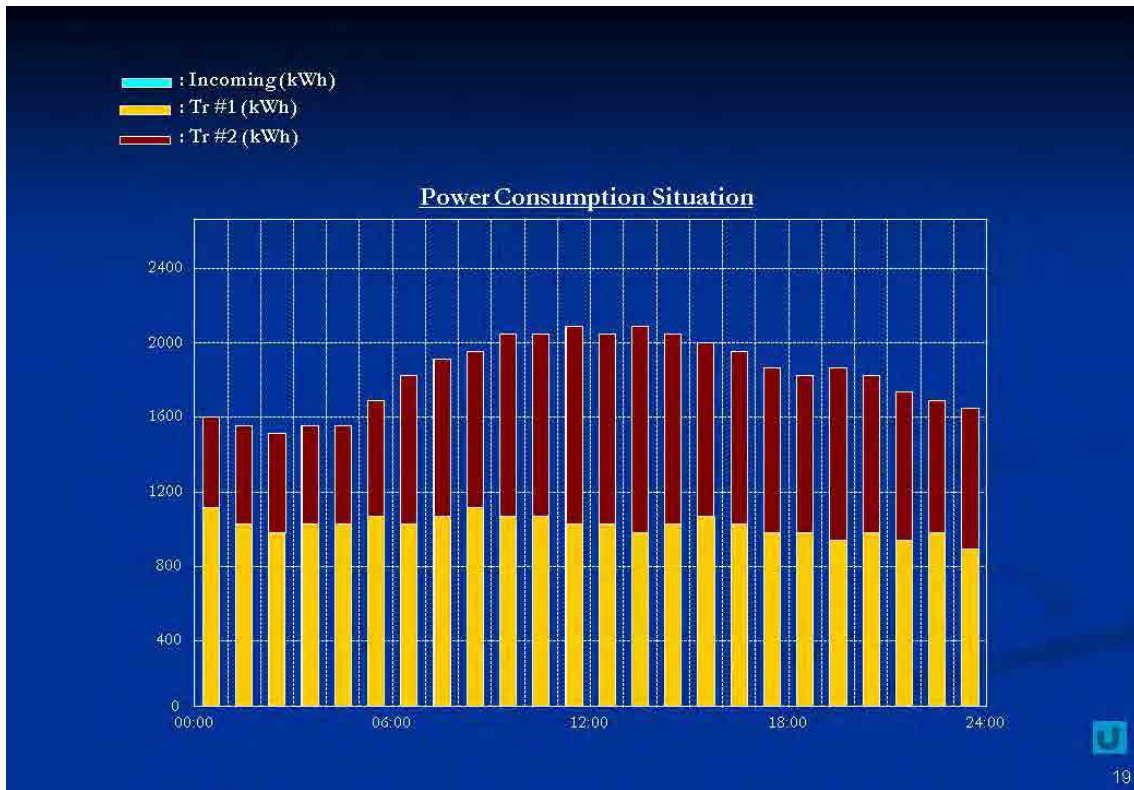
Suitable Target Facilities for Actual Situation Survey are ...

- + Large Facility, Medium Facility, Small Facility  
(Typical Facility convenient for making Manual)
- + Pumping Facility, Water Transmission Facility, Water Distribution Facility  
(Typical Facility convenient for making Manual)
- + Facilities where power consumption data is measured everyday (every hour)
- + Facilities where flowing quantity and pressure can be measured
- + High Power Consumption Facility
- + Low Power Factor Facility
- + Low Load Factor Facility
- + High Pump Water Supply Volume
- + High Piping Loss Area
- + Same Area as NRW Model Area
- + Facilities where problems have already turned out




16

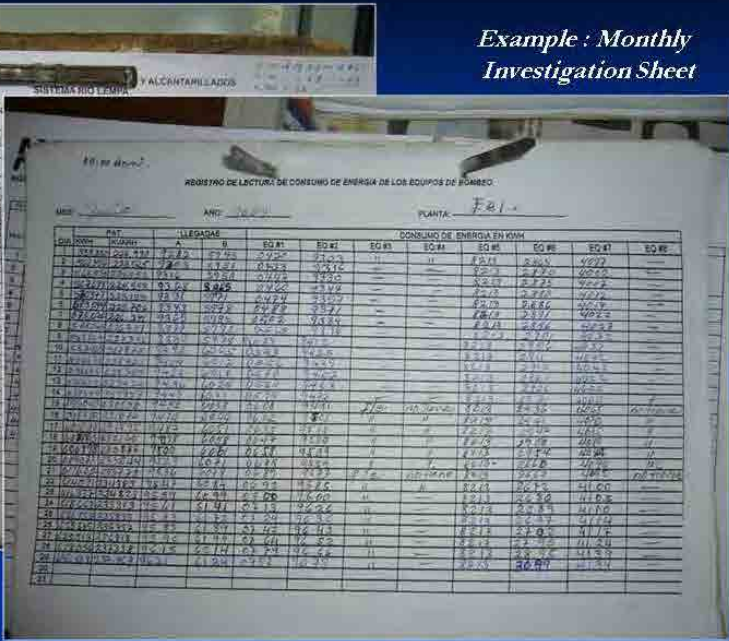









**Example : Daily Investigation Sheet**




**Example : Monthly Investigation Sheet**

 21

### Field Test Schedule (DRAFT)

|         | 2009 |   |   |   | 2010 |   |   |   | 2011 |   |   |   |  |  |  |  |
|---------|------|---|---|---|------|---|---|---|------|---|---|---|--|--|--|--|
|         | 1    | 2 | 3 | 4 | 1    | 2 | 3 | 4 | 1    | 2 | 3 | 4 |  |  |  |  |
| Step1-1 |      | ■ |   |   |      |   |   |   |      |   |   |   |  |  |  |  |
| Step1-2 |      | ■ |   |   |      |   |   |   |      |   |   |   |  |  |  |  |
| Step1-3 |      | ■ |   |   |      |   |   |   |      |   |   |   |  |  |  |  |
| Step1-4 |      | ▬ |   |   |      |   |   |   |      |   |   |   |  |  |  |  |
| Step2-1 |      |   |   | ■ |      |   |   |   |      |   |   |   |  |  |  |  |
| Step2-2 |      |   |   | ■ |      |   |   |   |      |   |   |   |  |  |  |  |
| Step2-3 |      |   |   | ■ |      |   |   |   |      |   |   |   |  |  |  |  |
| Step3-1 |      |   |   | ■ |      |   |   |   |      |   |   |   |  |  |  |  |
| Step3-2 |      |   |   | ■ |      |   |   |   |      |   |   |   |  |  |  |  |
| Step3-3 |      |   |   | ■ |      |   |   |   |      |   |   |   |  |  |  |  |
| Step3-4 |      |   |   | ■ |      |   |   |   |      |   |   |   |  |  |  |  |
| Step4-1 |      |   |   |   | ■    |   |   |   |      |   |   |   |  |  |  |  |
| Step4-2 |      |   |   |   | ▬    |   |   |   |      |   |   |   |  |  |  |  |
| Step4-3 |      |   |   |   |      |   | ■ |   |      |   |   |   |  |  |  |  |
| Step5   |      |   |   |   |      |   |   | ▬ |      |   |   |   |  |  |  |  |

Note : This schedule table will be revised to the detail scheduling by the Project Team Members.

 22