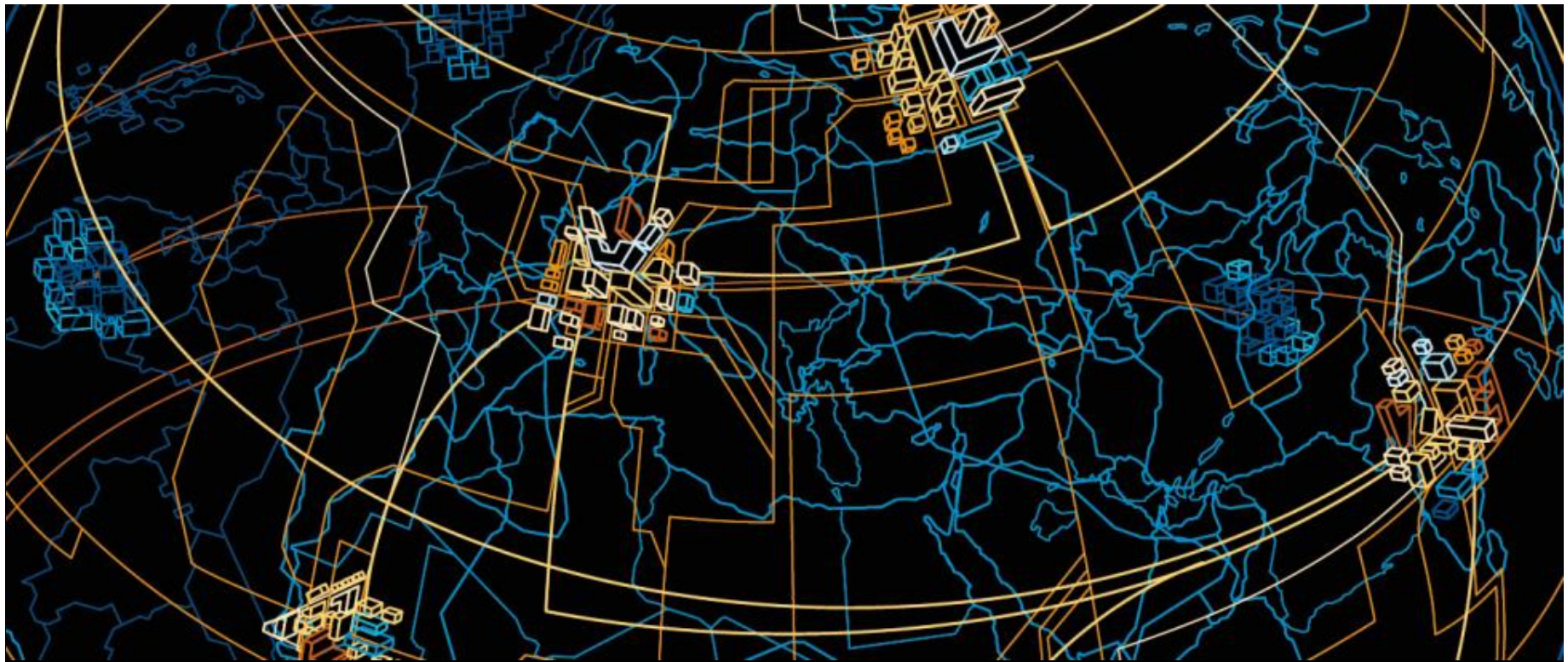


Sept 10, 2012 Alex D'Anci, QO – Operations Development Group

3.1.3 – Quick Changeover / SMED Process (AVIX)



April 2012

Introducing ABB

ABB Group presentation

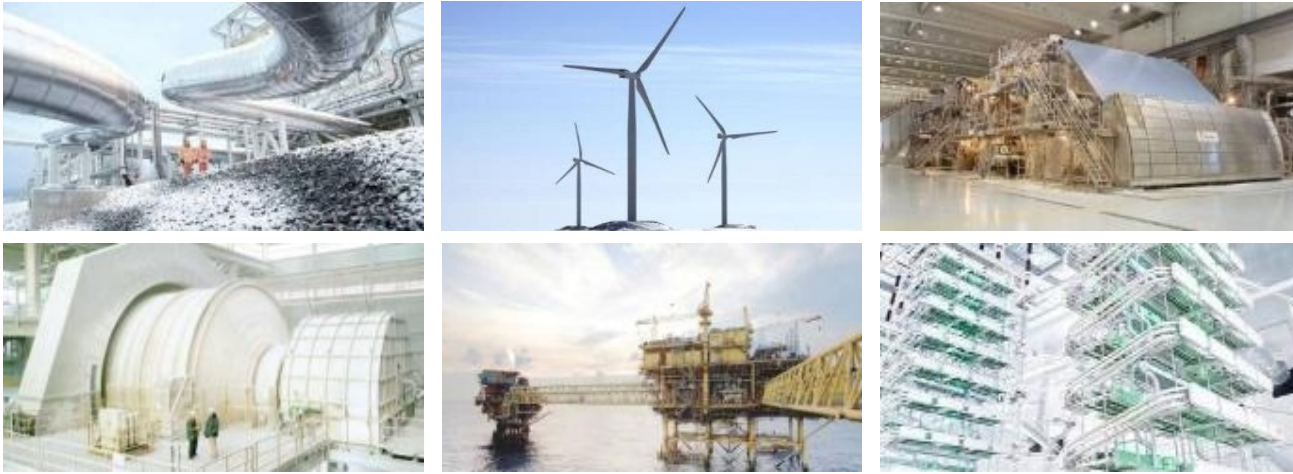
A global leader in power and automation technologies

Leading market positions in main businesses



- 135,000 employees in about 100 countries
- \$38 billion in revenue (2011)
- Formed in 1988 merger of Swiss and Swedish engineering companies
- Predecessors founded in 1883 and 1891
- Publicly owned company with head office in Switzerland




Power and productivity for a better world ABB's vision



As one of the world's leading engineering companies, we help our customers to use electrical power efficiently, to increase industrial productivity and to lower environmental impact in a sustainable way.

How ABB is organized

Five global divisions

				
Power Products	Power Systems	Discrete Automation and Motion	Low Voltage Products	Process Automation
\$10.9 billion 35,300 employees	\$8.1 billion 19,600 employees	\$8.8 billion 28,500 employees	\$5.3 billion 21,400 employees	\$8.3 billion 28,300 employees

(2011 revenues, consolidated)

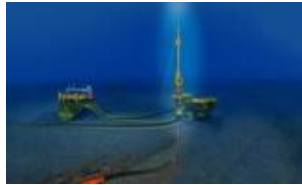
▪ ABB's portfolio covers:

- Electricals, automation, controls and instrumentation for power generation and industrial processes
- Power transmission
- Distribution solutions
- Low-voltage products
- Motors and drives
- Intelligent building systems
- Robots and robot systems
- Services to improve customers productivity and reliability

Power and automation are all around us You will find ABB technology...



orbiting the earth and working beneath it,



crossing oceans and on the sea bed,



in the fields that grow our crops and
packing the food we eat,



on the trains we ride and in the facilities
that process our water,



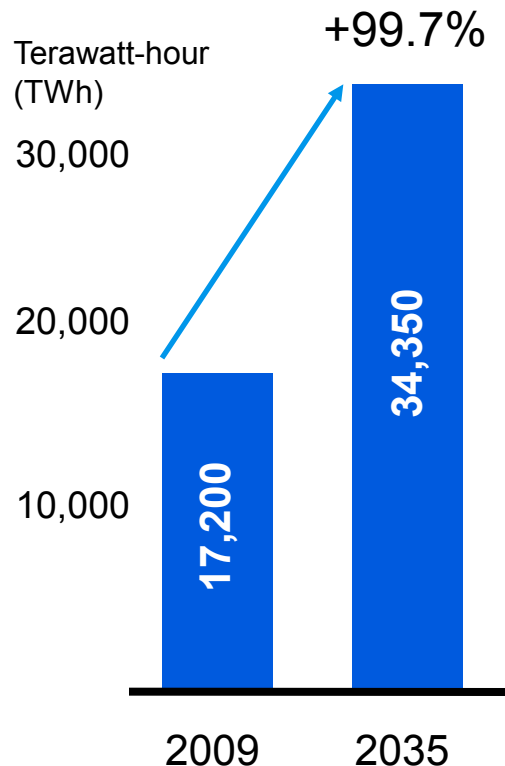
in the plants that generate our power and
in our homes, offices and factories

Tackling society's challenges on path to low-carbon era

Helping customers do more using less

Rise in electricity demand by 2035
(under current policies)

Source: IEA, World Energy Outlook 2011



Electricity demand is calculated as the total gross electricity generated less own use in the production of electricity and transmission, and distribution losses.

ABB power and automation solutions are:

- Meeting rising demand for electricity
- Increasing energy efficiency and reducing CO₂ emissions
- Improving productivity to raise competitiveness of businesses and utilities

Improving capacity, reliability and efficiency in the grid

A pioneer in smart technologies

Challenge

ABB solution



- **China:** deliver 6,400 MW of hydropower over 2,000 km

- Transmission at ultrahigh voltage
- Minimal losses with direct current solution



- **US:** Increase capacity and reliability for Texas utility

- World's largest installation enabling existing lines to carry more power
- Also enables integration of renewable energy



- **India:** Improve reliability in grid serving state of Karnataka (pop. 53 million)

- Network management with real-time control
- Key building block for smart grid

Renewable energy

Key growth driver for both power and automation



- Generation and transmission solutions for:
 - Hydro
 - Wind
 - Solar
 - Wave

Project examples

- Xiangjiaba-Shanghai (China)
- Wind Capital (US)
- Totana solar (Spain)
- Pelamis wave energy (Portugal)

ABB scope

- Grid connection
- Transformers
- Turnkey execution
- Customized generators

Boosting productivity and energy efficiency

Example: Stora Enso, world's biggest paper maker



- Skoghall mill, Sweden:
 - No. 1 maker of board for drink cartons
- Two-year revamp boosted productivity and cut CO₂ by 170,000 tons/year
- ABB provided key control systems:
 - For boiler, collecting and analyzing data on pressure, flow, temperature, etc. from thousands of instruments
 - For total control over power supply with real-time data

Leading power system's biggest-ever transformation

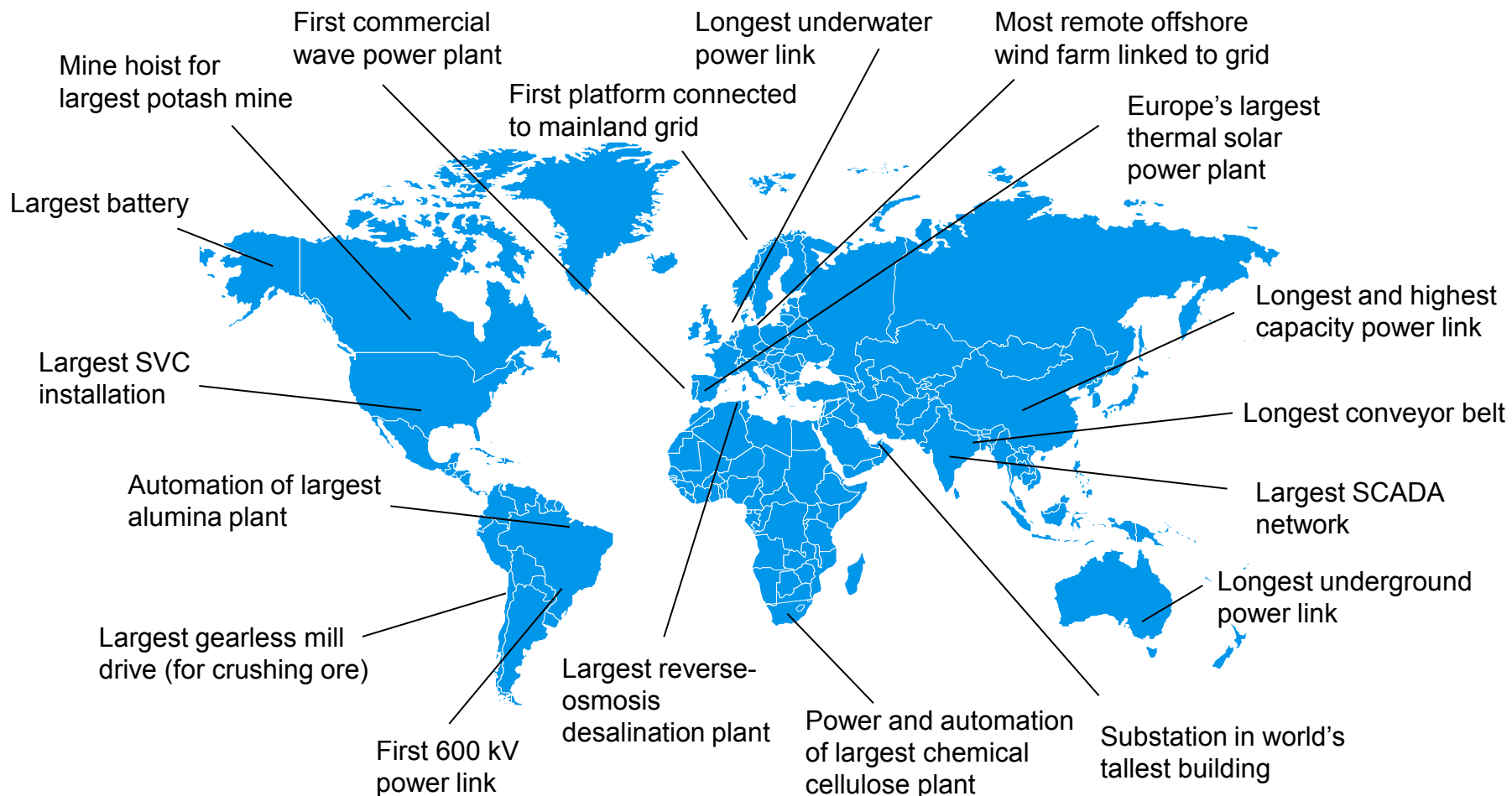
Smarter, greener grid for more efficiency and reliability



- Merging power and automation technologies makes electricity network more reliable, flexible, secure and efficient. Smart grid benefits include:
 - Lower power consumption
 - Greater use of renewable energy
- ABB's broad offering in both power and automation technologies positions it uniquely to support this evolution
- Transformation of grid to take place over several decades

Ground-breaking and nation-building projects

Pushing the boundaries of technology



Shaping the world we know today through innovation

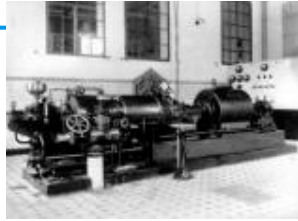
Pioneering technology since 1883

Founding fathers



1900

Steam turbine



1920

Turbochargers



1930

Gas turbine



1940

Electrical drive system for locomotives



1950

Industrial robot



Gas-insulated switchgear



1970

Gearless motor drives



1960

HVDC



1980

Variable-speed motor drives



Electric propulsion systems



1990

2000

Extended control systems

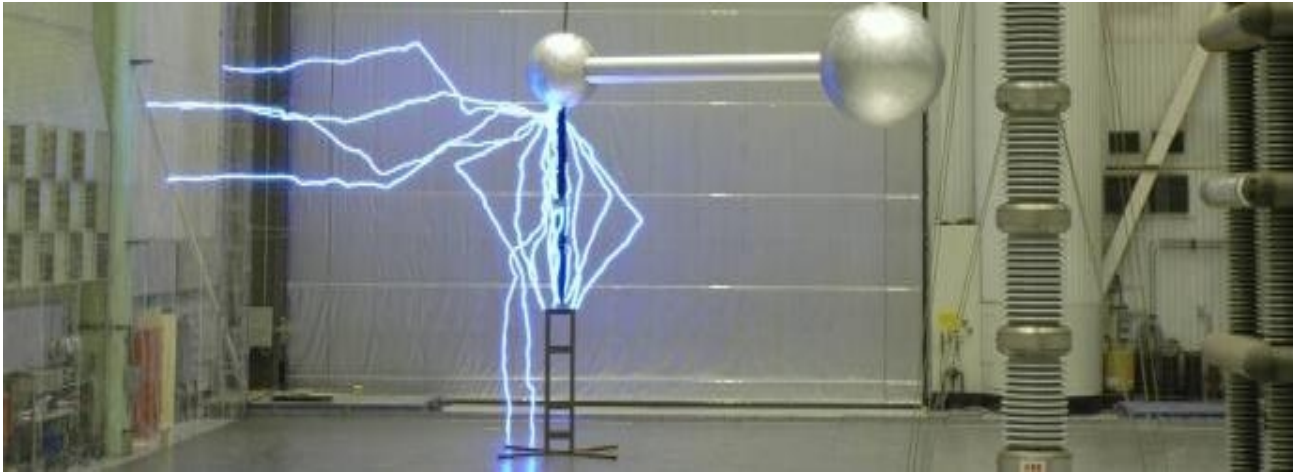


Ultrahigh voltage



Innovation is key to ABB's competitive advantage

Leadership built on consistent R&D investment



- More than \$1.3 billion invested annually in R&D
- 7,500 scientists and engineers
- Collaboration with 70 universities
 - MIT (US), Tsinghua (China), KTH Royal Institute of Technology (Sweden), Indian Institute of Technology (New Delhi), ETH (Switzerland), Karlsruhe (Germany), AGH University of Science and Technology (Poland)

Fashioning the world we will live in tomorrow

Tackling challenges with customers and partners



- R&D programs focus on incremental and breakthrough developments to address challenges including:
 - Integrating renewable power sources into the grid
 - Enhancing power network efficiency, reliability and flexibility
 - Improving industrial resource efficiency and asset productivity
 - Optimizing flexibility and reliability

Developing sustainability of products and operations

Lowering environmental impact and costs



Sustainability in product development

- Focus on resource and energy efficiency of equipment over life cycle
- Independently verified Environmental Product Declarations for main products



Sustainability in ABB's operations

- Cuts targeted in use of energy, raw materials, hazardous substances
 - eg, China: 63% cut in energy use per unit of revenue between 2002 and 2010

People make the difference

The best want to work in a first-class environment



- ABB is one of the world's most global companies
- A culture of openness, flexibility and inclusiveness helps to attract top performers
- ABB strives for excellence in personal development, operational execution, health and safety, business ethics
- A Group-wide staff development program aims to bring a culture of leadership to every level of the organization

Committed to the highest standards of business ethics Integrity as bedrock of ABB's global culture

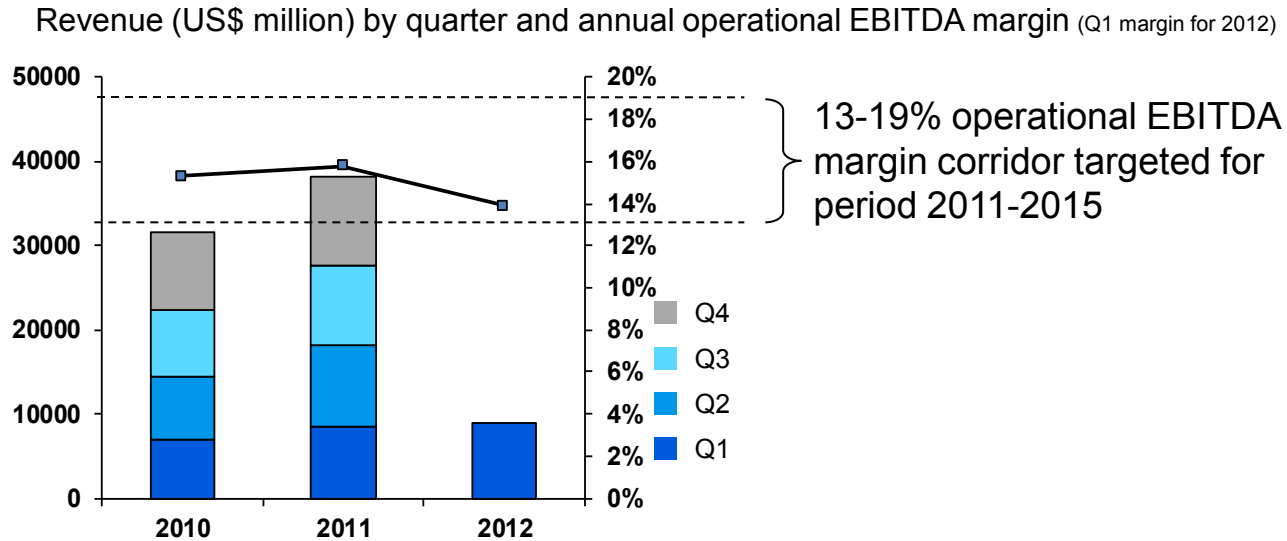
“Whatever change may be going on in the world around us, one thing remains unchanged: ABB's commitment to maintain the highest standards of business ethics and integrity.”

CEO Joe Hogan in ABB's Code of Conduct

- Code of Conduct defines relationships with all stakeholders
- Employees acknowledge Code of Conduct and take compulsory training courses
 - Zero tolerance toward violations
 - Several reporting options in place for employees to report suspected violations; each report thoroughly investigated

A successful business and a reliable partner

Strong financial position is competitive advantage



Main investments 2011/12		Main acquisitions and investments	
Plant expansion	New plant	2011	2012
Switzerland Sweden, Italy, China, India, Estonia	Brazil China, Bulgaria, US, India	Baldor, Obvient, Epyon, Validus, Mincom, Trasfor , Lorentzen & Wettre, Novatec Solar**, Ecotality**, Aquamarine Power**	Newave

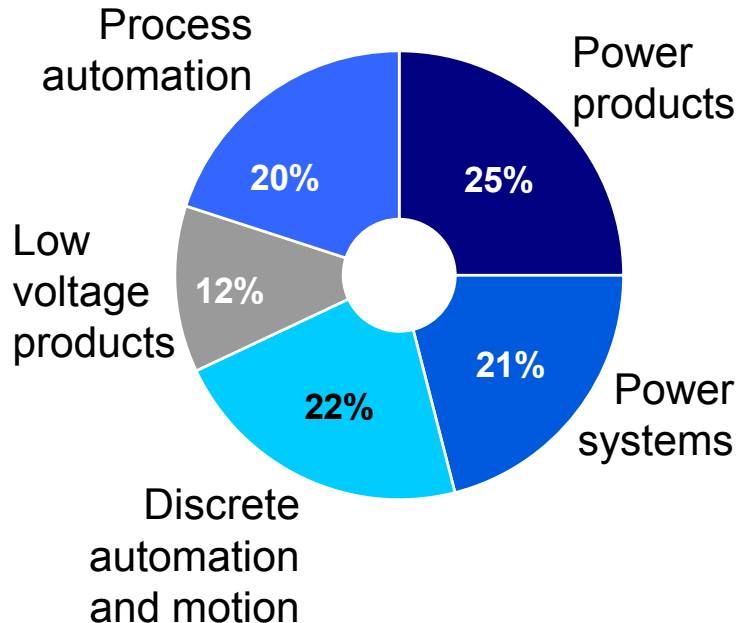
**ABB equity investments

Well-balanced business and geographic portfolio

Capturing growth opportunities, wherever they arise

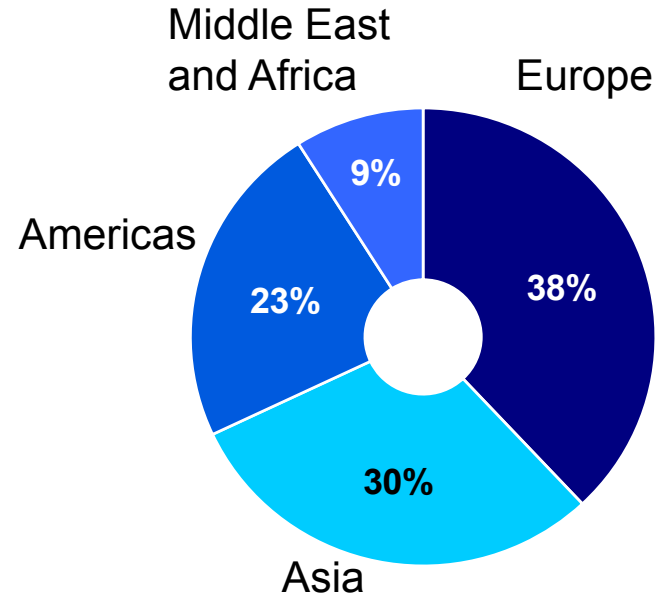
Orders by division

% of total orders 2011 (non-consolidated)



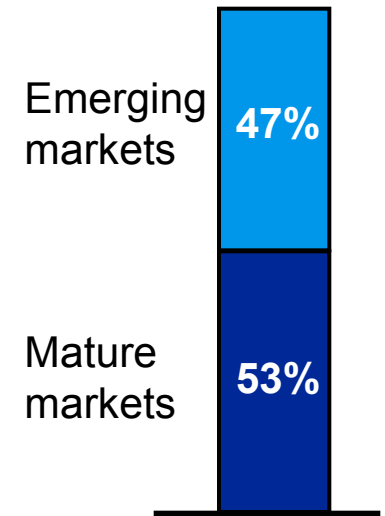
Orders by region

% of total orders 2011



Share of employees

2011



Innovation, passion and diversity are hallmarks of ABB



“ABB is a dynamic, multicultural team that spans the globe, working in a fascinating world of high technology.”

“Our portfolio is vast, but the benefits are straightforward: we help to provide reliable power supplies and improve productivity, while lowering environmental impact.”

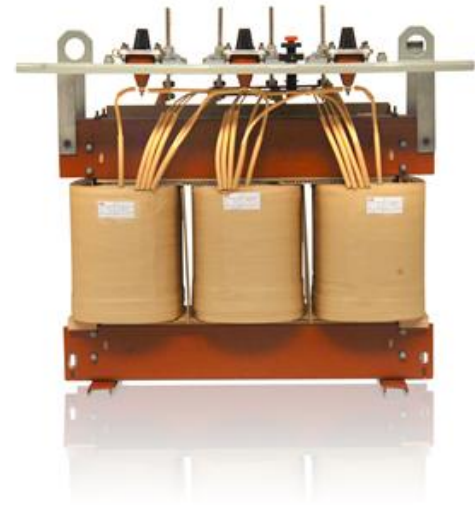
CEO Joe Hogan



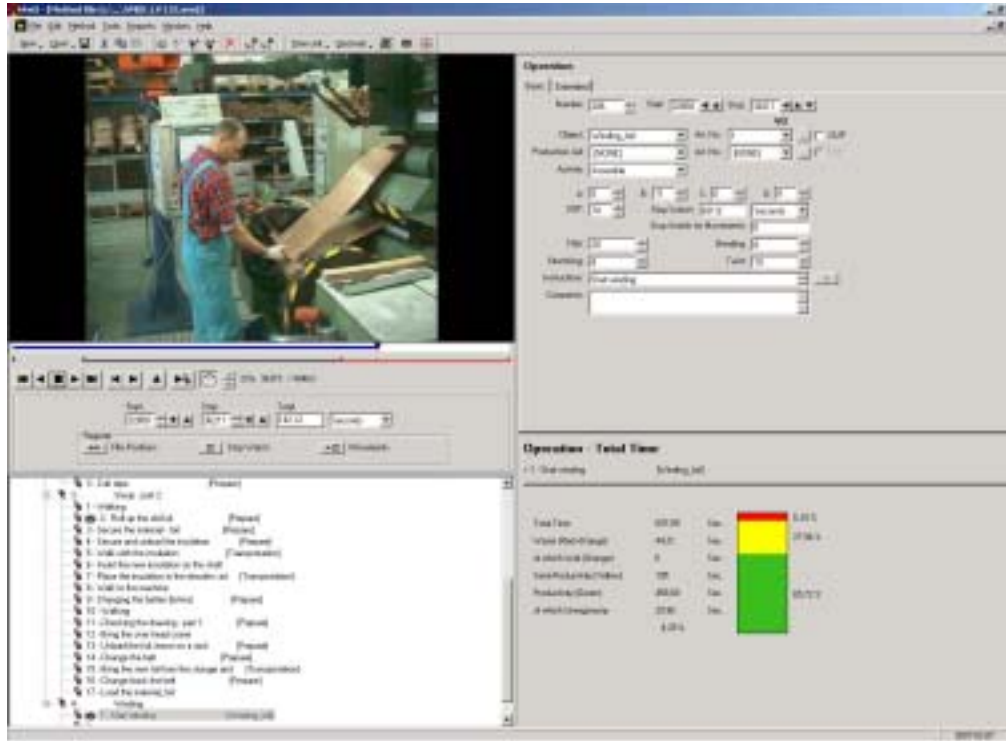
SMED Analysis with AVIX

<http://www.avix.eu/en.html>

Distribution Transformers



AviX introduction



Areas of use:

- Time and motion studies
- Productivity and efficiency studies
- Cost and optimization calculations
- Ergonomic studies
- Standardized methods studies
- Optimize layout
- Optimize used method for a workstation
- Optimize tooling for a workstation
- SMED
- Kaizen
- Benchmarking
- Elevate the constraint
- Training for new operators
- Presentation of actual and future situation

Advantages:

- Parts productive operations from waste
- Easy to learn, implement
- Easy to explain and communicate results
- User friendly

AviX introduction

Why AviX - summary?

- **See and eliminate waste**, find your improvement potential in a structure way (methods, layout and design)
- Calculate standardized production times
- **What** you do, is more important than doing something regardless of what
- Support innovation
- The method analysis shall be easily understood by all employees within the company. Same language
- Collect and store all data in one place

Eliminate known and unknown waste in a structured and systematic way to make your operations more profitable and improved work environment

Work smarter - Not harder



Step 1 - Video filming



The engineer (co-worker) films the current work methods – gaining information of how the work is performed.

- Explain the filmed operator the purpose

Step 2 - Preparation and Analysis



The people doing the work on the shop-floor with engineer analyze the video (divide into task, operations, etc). Looking for potential areas to improve.

Step 3 - Analysis and Improvements



1. The video is being analyzed with operators - looking for potential areas to improve. Remember to take notes of the ideas, solutions.
2. Talk over new solutions

Use Creativity and Problem Solving Tools

- Brainstorming
- 5 WHY
- Ishikava chart,
- Current reality tree
- Six Thinking Hats, etc.



ABB

Step 4 - Follow through



Involve operators in implementing changes. This way they will have a higher incentive to really make the necessary changes.

Write new procedures

Within a lot of companies that have started to use AviX, the improvements that were talked about before, suddenly get realized.

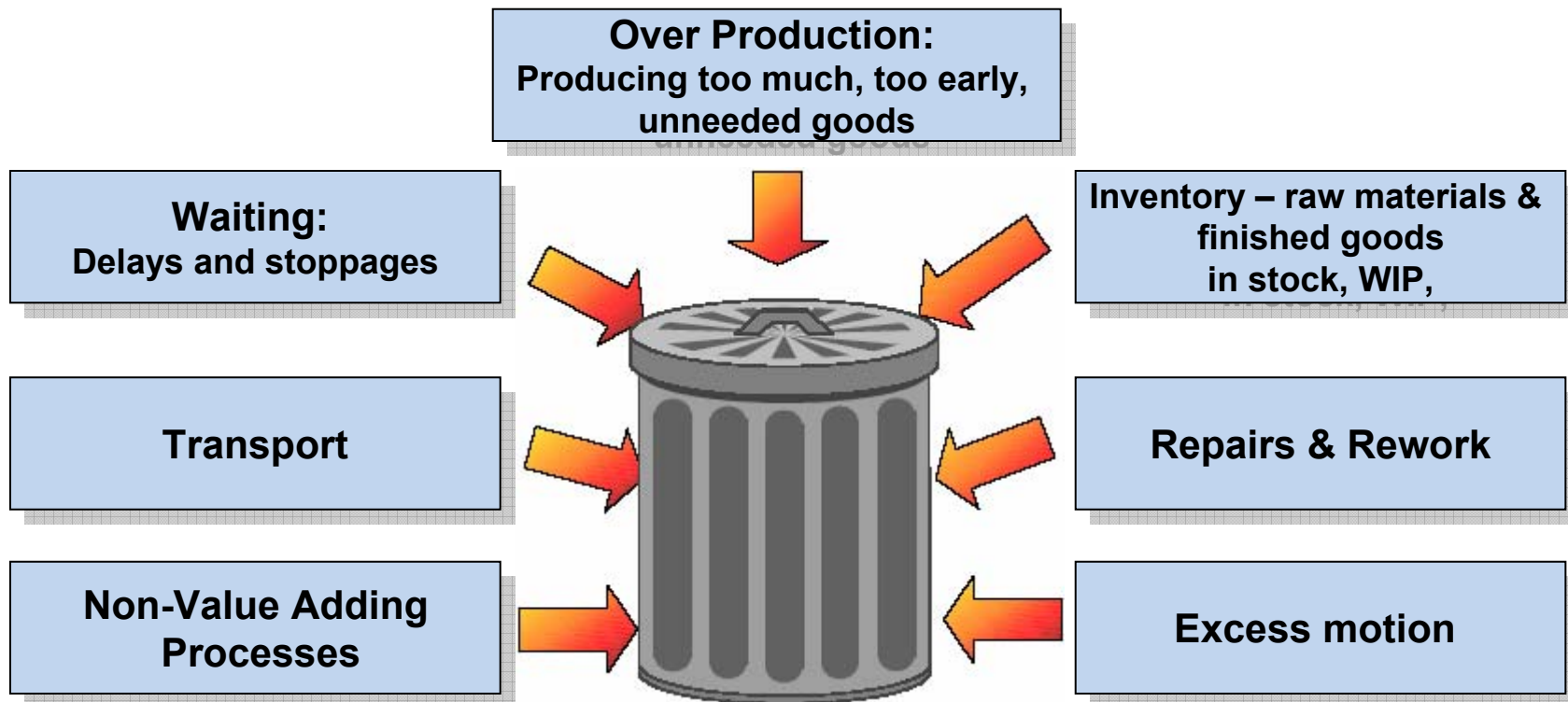
Results of using AviX?

- Improved communications (horizontal & vertical)
- Continuous improvement with immediate results
- AviX breaks boundaries, everyone speaks the “same” language
- Improved manufacturing cycle times
- Shorter training and “start up”
- Less time consuming analysis
- Total understanding of all processes and relations
- All data in ONE system with a widespread knowledge

AviX in ABB Poland (Łódź) & Brazil (Blumenau)

- ❑ **11.2003 – 02.2004** – checking the workstation as regards to ergonomic, work organization, reviewing the process times – MDT & Tank Fabrication Line
- ❑ **07.2004 – 09.2004** – checking the workstation as regards to ergonomic, work organization, reviewing the process times – SDT Line
- ❑ **11.2005 – 02.2006** – SMED analysis
- ❑ **04. 2006 – 09.2006** – reviewing process times for some designs. Updating times in SAP
- ❑ **2005** – LV & HV coil winding process time improvement (Brazil)
- ❑ **2006** – active part assembly – analyze of movements (Brazil)

AviX & 7 Wastes of Lean Manufacturing



Value Analysis Activities

- **Value Adding Activity**

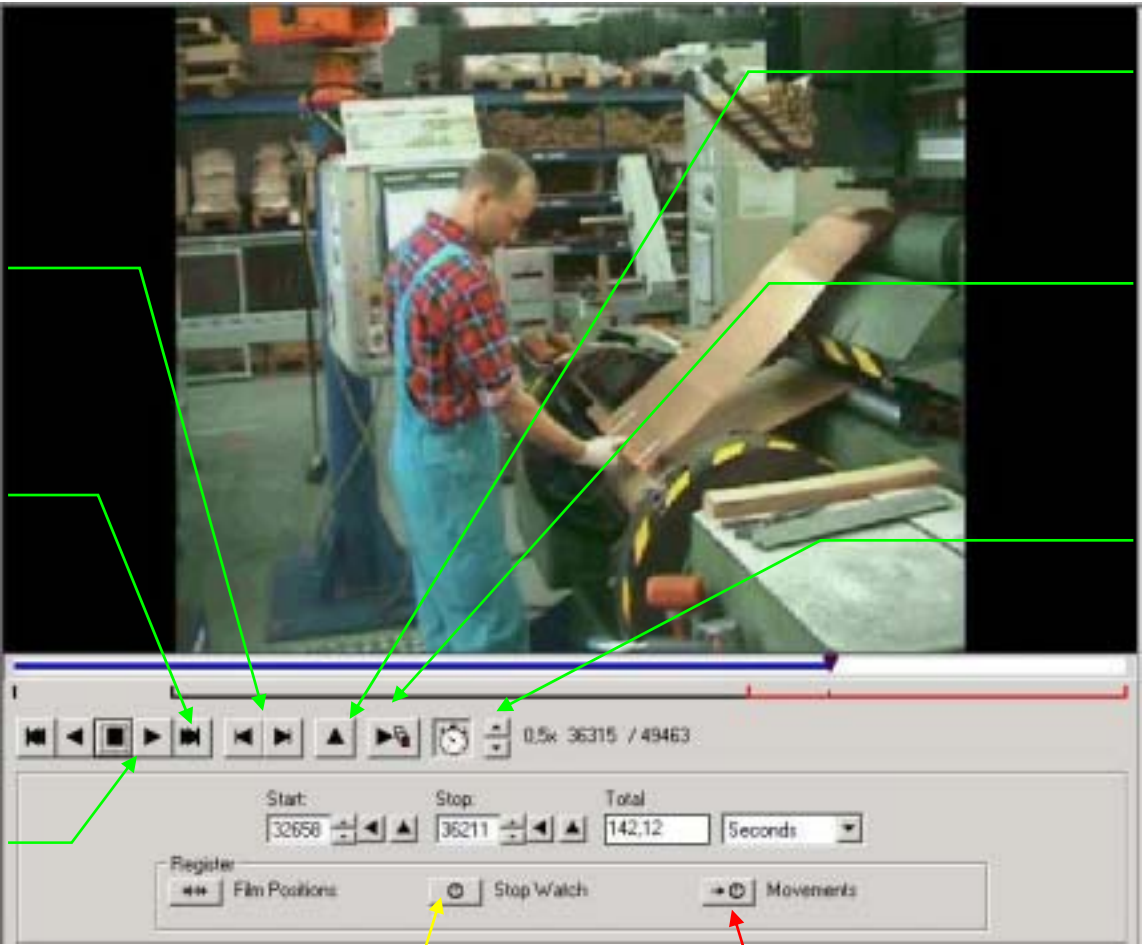
- An activity that transforms or shapes raw material or information to meet customer requirements

- **Non-Value Adding Activity**

- Those activities that take time, resources or space, but do not add to the value of the product itself



AviX introduction - the media player



Step forward or backward

Jump forward or backward 2,5 seconds

Play the movie forward or backward

Jump to the beginning of the task or operation

Play operations one after another

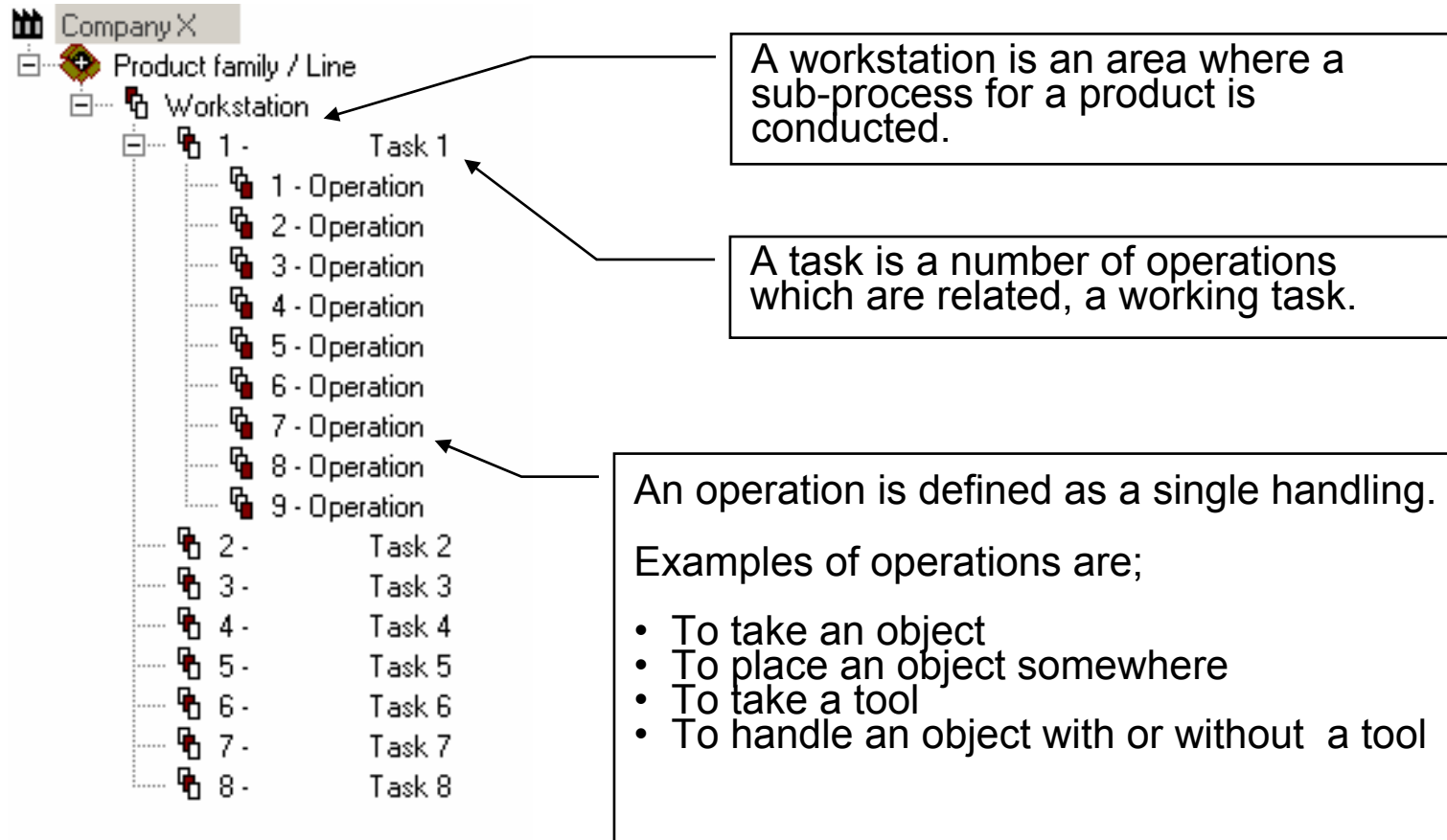
Increase/Decrease movie speed

Stop watch - use the watch when it is not possible to analyse the work or when you want to clock something - yellow

Movements - red



AviX introduction – Structure tree



AviX introduction – theory- Activities

Activity	Explanation
Take	grab things
Place	prepare things (for later)
Handle	prepare things (before assembly)
Fix	tightening, gluing
Adjust	correcting
Assembly	assemble in right position
Control	check an assembly
Replace	When you return things
Read Instruction	
Admin	When you document information
Wait	wait for something before you can assemble.
Stop Watch	analysis is impossible
Movement Stop Watch	analysis of movements is impossible

Operation

Basic | Extended

Number: 1 Start: 32658 Stop: 49463

VO

Object: Winding_foil Art. No.: 1 OUP

Production Aid: [NONE] Art. No.: [NONE] PUP

Activity: Assemble

A: 1 B: 1 C: 0 D: 1

UOF: 0 Stop Watch: 0 Seconds

Stop Watch for Movements: 0

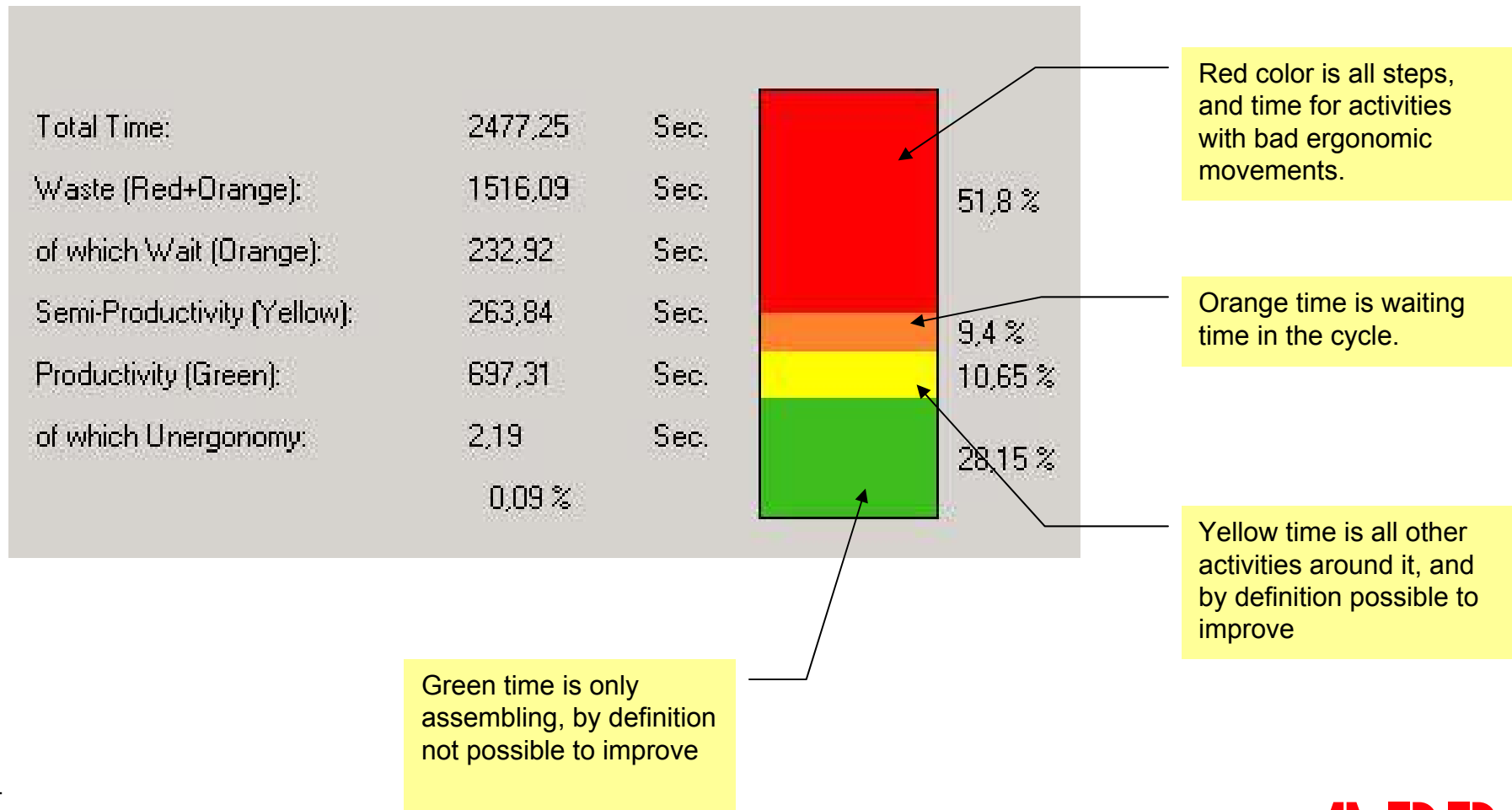
Step: 1 Bending: 1

Stretching: 1 Twist: 0

Instructions: Cut the foil only above the shelf

Comments:

AviX introduction - Results & color system



SMED

- SMED Single Minute Exchange of Dies in less than 10 minutes

The process was developed by Shigeo Shingo at Mazda, Mitsubishi and Toyota in the 1950's and 1960's.

Why SMED?

- ❑ Reduced inventories
- ❑ Improved productivity
- ❑ Higher quality levels
- ❑ Increased safety
- ❑ Improved flexibility
- ❑ Reduction in throughput time
- ❑ Improve operator capabilities
- ❑ Lower manufacturing costs

SMED Methodology

- ❑ Identify internal and external steps
 - ❑ Internal set-up activities - Elements in the changeover which can only be done when the machine is stopped
 - ❑ External set-up activities - Elements that can be performed when the machine is running
- ❑ Convert internal steps to external
- ❑ Improve all aspects of the setup operation
- ❑ Implement, Document

The SMED – Process

- ❑ Preliminary Stage – Observe and record - AviX
- ❑ Stage 1 – Separate internal and external activities - AviX
- ❑ Stage 2 – Convert internal activities to external activities - AviX
- ❑ Stage 3 – Improve all activities – Kaizen, Brainstorming, Ishikava chart, 6 thinking hats, etc.
- ❑ Stage 4 – Document internal and external procedures - AviX

Practical usage – SMED project with AviX

Tuboly LV winding machine



Step 0 - Observe and record

The screenshot displays the ABB Method Editor software interface. The top-left window shows a video of a worker in a red plaid shirt and blue overalls performing a task. The main interface is divided into several sections:

- Operation Basic/Extended:** Fields for Number (1), Start (0), Stop (1309), Object (Measure), Production Aid (Measure tool), Activity (Inspect), and various adjustment fields (A, B, C, D, UOF, Step, Stretching, Instructions, Comments).
- Time Summary:** Start: 0, Stop: 1309, Total: 52.4 Seconds.
- Operation - Total Time:** A table showing time breakdown for step 1: Measure and save data in PC (Measure).
- Task List:** A tree view showing the sequence of tasks for 'LV coil_winding'.

Category	Time (Sec)	Percentage
Total Time	52.5	
Waste (Red+Orange)	23	43.8%
of which Wait (Orange)	0	
Semi-Productivity (Yellow)	29.5	
Productivity (Green)	0	
of which Unergonomy	7.3	
Total Productivity	13.9	56.2%



Step 0 - Observe and record

The screenshot displays the ABB Method Editor software interface. The top-left window shows a video of a worker in a factory setting. The main interface is divided into several sections:

- Operation Details:**
 - Number: 1, Start: 1309, Stop: 1622
 - Object: Relieve (tie) the bolt, Art. No.: 5, DUP checkbox
 - Production Act: Pneumatic wrench (blue), Art. No.: 3, PUP checkbox
 - Activity: Return
 - Parameters: A: 2, B: 3, C: 1, D: 0
 - UOF: 0, Stop Watch: 0 Seconds
 - Step: 5, Bending: 0
 - Stretching: 0, Twist: 0
 - Instructions: Relieve the bolts (core clamp tooling)
 - Comments: Use the pneumatic wrench
- Operation - Total Time:**
 - + 2 - Relieve the bolts (core clamp tooling) [Relieve (tie) the bolt]
 - Total Time: 12.6 Sec.
 - Waste (Red+Orange): 4.3 Sec. (33.9%)
 - of which Wait (Orange): 0 Sec.
 - Semi-Productivity (Yellow): 8.3 Sec.
 - Productivity (Green): 0 Sec. (66.1%)
 - of which Uneconomy: 0 Sec.
 - 0%
- Register:**
 - Start: 1309, Stop: 1622, Total: 12.5 Seconds
 - Buttons: Film Positions, Stop Watch, Movements
- Task List:**
 - LV coil_winding
 - LV winding machine
 - 1 - Setup - part 1
 - 1 - Measure and save data in PC [Measure]
 - 2 - Relieve the bolts (core clamp tooling) [Relieve (tie) the bolt]
 - 3 - Bring the manipulator & unload LV coil [Transportation]
 - 4 - Bring a new core leg [Transportation]
 - 5 - Change the settings of the core clamp to [Relieve (tie) the bolt]
 - 6 - Adjust the size of the clamp tooling [Relieve (tie) the bolt]
 - 7 - Load the new core leg [Transportation]
 - 8 - Clamp the core [Relieve (tie) the bolt]
 - 9 - Free leg manipulation

Step 0 - Observe and record

The screenshot displays the ABB Method Editor interface. On the left, a video window shows a worker in a factory setting. The main area is divided into several panels:

- Operation Panel:** Shows details for operation number 1, starting at time 1622 and ending at 2309. The object is 'Transportation' and the activity is 'Take'. It includes fields for A, B, C, D, UOF, and various watch settings.
- Time Analysis Panel:** Titled 'Operation - Total Time', it shows a bar chart for step 3. The total time is 27.5 seconds. The chart is divided into 'Waste (Red-Orange)' at 9.3 seconds (33.7%) and 'Semi-Productivity (Yellow)' at 18.2 seconds (66.3%).
- Task List Panel:** A tree view showing the sequence of tasks for 'LV coil_winding', with step 3 highlighted.



Step 0 - Observe and record

The screenshot displays the ABB Method Editor software interface. The top-left window shows a video feed of a worker in a factory setting. The main interface is divided into several sections:

- Operation Details:**
 - Basic | Extended
 - Number: 1 | Start: 2308 | Stop: 2519
 - Object: Transportation | Art. No.: 3 | OUP:
 - Production Aid: Conveyor | Art. No.: 6 | PUP:
 - Activity: Take
 - A: 6 | B: 1 | C: 2 | D: 0
 - UOF: 3 | Stop Watch: 0 Seconds
 - Stop Watch for Movements: 0
 - Step: 14 | Bending: 0
 - Stretching: 0 | Twist: 0
 - Instructions: Bring a new core leg
 - Comments:
- Operation - Total Time:**
 - + 4 - Bring a new core leg [Transportation]

Total Time:	27.7	Sec.	36%
Waste (Red+Orange)	10	Sec.	
of which Wait (Orange)	0	Sec.	64%
Semi-Productivity (Yellow)	17.7	Sec.	
Productivity (Green)	0	Sec.	0%
of which Unergonomy	0	Sec.	
- Task Tree:**
 - LV coil_winding
 - LV winding machine
 - 1 - Setup - part 1
 - 1 - Measure and save data in PC [Measure]
 - 2 - Relieve the bolts (core clamp tooling) [Relieve (tie) the bolt]
 - 3 - Bring the manipulator & unload LV coil [Transportation]
 - 4 - Bring a new core leg [Transportation]
 - 5 - Change the settings of the core clamp to [Relieve (tie) the bolt]
 - 6 - Adjust the size of the clamp tooling [Relieve (tie) the bolt]
 - 7 - Load the new core leg [Transportation]
 - 8 - Clamp the core [Relieve (tie) the bolt]
 - 2 - Core leg preparation
 - 1 - Clean the core leg [Clean]
 - 2 - Core leg preparation [Core leg preparation]
 - 3 - Cut tape [Prepare]
 - 3 - Setup - part 2
 - 4 - Winding

Step 0 - Observe and record

The screenshot displays the ABB RobotStudio interface. On the left, a video window shows a worker in a blue uniform and white hard hat operating a machine. The main interface is divided into several sections:

- Operation Panel:**
 - Basic | Extended
 - Number: 1 | Start: 4761 | Stop: 5883
 - Object: Transportation | Art. No.: 3 | QUP
 - Production Aid: Manipulator | Art. No.: 1 | PUP
 - Activity: Place
 - A: 4 | B: 7 | C: 11 | D: 3
 - UOF: 1 | Stop Watch: 0 Seconds
 - Step: 19 | Bending: 3
 - Stretching: 0 | Twist: 1
 - Instructions: Load the new core leg
 - Comments: Load the new core leg into the clamping jaws; always wear a helmet using manipulator
- Operation - Total Time:**
 - + 7 - Load the new core leg [Transportation]
 - Total Time: 45.2 Sec.
 - Waste (Red+Orange): 20.8 Sec. (46.1%)
 - of which Wait (Orange): 0 Sec.
 - Semi-Productivity (Yellow): 24.4 Sec.
 - Productivity (Green): 0 Sec.
 - of which Unergonomy: 7.3 Sec. (16.1%)
- Register:**
 - Start: 4761 | Stop: 5883 | Total: 45.1 Seconds
 - File Positions | Stop Watch | Movements
- Task List:**
 - LV coil_winding
 - LV winding machine
 - 1 - Setup - part 1
 - 1 - Measure and save data in PC [Measure]
 - 2 - Relieve the bolts (core clamp tooling) [Relieve (tie) the bolt]
 - 3 - Bring the manipulator & unload LV coil [Transportation]
 - 4 - Bring a new core leg [Transportation]
 - 5 - Change the settings of the core clamp to [Relieve (tie) the bolt]
 - 5 - Adjust the size of the clamp tooling [Relieve (tie) the bolt]
 - 7 - Load the new core leg [Transportation]
 - 8 - Clamp the core [Relieve (tie) the bolt]



Step 0 - Observe and record

The screenshot displays the ABB Method Editor software interface. On the left, a video window shows a worker in a red plaid shirt and blue overalls performing a task. The main interface is divided into several sections:

- Operation Basic/Extended:** Fields for Number (25), Start (7417), Stop (9027), Object (Core leg preparation), Art. No. (7), Production Art. (NONE), Activity (Assemble), and various time parameters (A: 11, B: 13, C: 7, D: 0, UOF: 3, Step: 3, Stretching: 6, Instructions: Core leg preparation, Comments: Place the edge insulation, protect the edges with the metal bracket).
- Operation - Total Time:** A table showing time breakdown for '+ 2 - Core leg preparation'.
- Activity List:** A tree view of tasks including 'Measure and save data in PC', 'Relieve the bolts', 'Bring the manipulator & unload LV coil', 'Bring a new core leg', 'Change the settings of the core clamp to', 'Adjust the size of the clamp tooling', 'Load the new core leg', 'Clamp the core', 'Clean the core leg', 'Core leg preparation', and 'Cut tape'.
- Summary Table:** A table summarizing the total time and productivity.

Category	Time (Sec)	Percentage
Total Time	64,2	
Waste (Red+Orange)	19,2	29,9 %
of which Wait (Orange)	0	
Semi-Productivity (Yellow)	0	
Productivity (Green)	45	70,1 %
of which Unergonomy	17	
Total Productivity	26,5 %	

Step 0 - Observe and record

The screenshot displays the ABB Avik software interface. On the left, a video window shows a worker in a blue uniform and white helmet in a factory setting. Below the video is a playback control bar with a progress indicator at 1x 14501 / 49463. The main area is divided into two panels: 'Operation' and 'Operation - Total Time'.

Operation Panel:

- Basic | Extended
- Number: 1 Start: 14476 Stop: 16333
- Object: [NONE] Alt. No.: [NONE] DUP
- Production Aid: [NONE] Alt. No.: [NONE] PUP
- Activity: [NONE]
- A: 0 B: 0 C: 0 D: 0
- UOF: 0 Stop Watch: 0 Seconds
- Stop Watch for Movements: 74.3
- Step: 0 Bending: 0
- Stretching: 0 Twist: 0
- Instructions: Bring the over head crane
- Comments: always wear a helmet using the overhead crane

Operation - Total Time Panel:

- + 12 - Bring the over head crane

Category	Value	Unit	Percentage
Total Time	74.3	Sec	100%
Waste (Red+Orange)	74.3	Sec	
of which Wait (Orange)	0	Sec	
Semi-Productivity (Yellow)	0	Sec	
Productivity (Green)	0	Sec	
of which Unresponsivity	0	Sec	
Total Productivity	0%		

Task List (Left Panel):

- 1 - Walking
- 2 - Roll up the old foil [Prepare]
- 3 - Secure the material - foil [Prepare]
- 4 - Secure and unload the insulation [Prepare]
- 5 - Walk with the insulation [Transportation]
- 6 - Insert the new insulation on the shaft
- 7 - Place the insulation in the decoler. ad [Transportation]
- 8 - Walk to the machine cold welding unit
- 9 - Changing the batten (strip) [Prepare]
- 10 - Going back to the PC
- 11 - Look for the right drawing [Prepare]
- 12 - Bring the over head crane
- 13 - Unload the material [Prepare]
- 14 - Look for material in the storage [Prepare]
- 15 - Bring the new foil from the storage [Transportation]
- 16 - Change back the belt [Prepare]
- 17 - Bring the material to the machine [Transportation]
- 18 - Place the material on the decoler [Prepare]
- 19 - Move the crane [Transportation]

2007-02-15

Step 0 - Observe and record

The screenshot displays the ABB AvDK software interface. On the left, a video window shows a worker in a blue uniform and white hard hat operating a large industrial machine. Below the video is a playback control bar with a progress indicator at 1x 17574 / 49463. The main right-hand panel is titled 'Operation' and contains the following fields:

- Basic | Extended** (tabbed)
- Number: 1 | Start: 16333 | Stop: 19193
- FD (Function Definition) section:
 - Object: Prepare | Art No.: 0 | OUP
 - Production Aid: [NONE] | Art No.: [NONE] | PUP
 - Activity: Handle
- Time parameters: A: 21 | B: 25 | C: 15 | D: 9
- UQP: 6 | Stop Watch: 0 | Seconds
- Stop Watch for Movements: 0
- Step: 33 | Bending: 0
- Stretching: 2 | Twist: 0
- Instructions: Unload the material
- Comments: Weight the material. Leave the material on a rack.

At the bottom left, a task list is visible:

- 2- Core leg preparation
- 3- Setup - part 2
 - 1 - Walking [Prepare]
 - 2 - Roll up the old foil [Prepare]
 - 3 - Secure the material - foil [Prepare]
 - 4 - Secure and unload the insulation [Prepare]
 - 5 - Walk with the insulation [Transportation]
 - 6 - Insert the new insulation on the shaft [Prepare]
 - 7 - Place the insulation in the decoiler, ad [Transportation]
 - 8 - Walk to the machine cold welding unit [Prepare]
 - 9 - Changing the batten (istwa) [Prepare]
 - 10 - Going back to the PC [Prepare]
 - 11 - Look for the right drawing [Prepare]
 - 12 - Bring the over head crane [Prepare]
 - 13 - Unload the material [Prepare]
 - 14 - Look for material in the storage [Prepare]
 - 15 - Bring the new foil from the storage [Transportation]
 - 16 - Change back the belt [Prepare]
 - 17 - Bring the material to the machine [Transportation]
 - 18 - Place the material on the decoiler [Prepare]

At the bottom right, the 'Operation - Total Time' section shows a bar chart and a table:

Category	Time (Sec)	Percentage
Total Time	114,6	21,7 %
Waste (Red+Orange)	24,8	
of which Wait (Orange)	0	
Semi-Productivity (Yellow)	89,7	78,3 %
Productivity (Green)	0	
of which Unergonomy	1,3	
	1,2 %	

The date 2007-02-15 is displayed at the bottom right of the interface.



Step 0 - Observe and record

The screenshot displays the ABB Avik software interface. On the left, a video feed shows a worker in a blue uniform in a factory setting. Below the video is a playback control bar with a progress indicator at 1x 19502 / 49403. The main area is divided into several sections:

- Operation:** Includes fields for Number (1), Start (19231), Stop (19549), Object, Production Aid, Activity (Handle), and various time-related parameters like A, B, C, D, UDF, Stop Watch, Step, Bending, Stretching, and Twist. The instruction is "Change the belt".
- Operation - Total Time:** A table showing the breakdown of time for the operation.

Category	Time (Sec)	Percentage
Total Time	13.3	
Waste (Red+Orange)	5.8	43.6%
of which Wait (Orange)	0	
Semi-Productivity (Yellow)	7.5	
Productivity (Green)	0	
of which Unergonomy	4.4	32.9%
- Register:** A list of tasks with their durations and categories.

Task	Category
5 - Walk with the insulation	[Transportation]
6 - Insert the new insulation on the shaft	
7 - Place the insulation in the decoller, ad	[Transportation]
8 - Walk to the machine cold welding unit	
9 - Changing the balten (stiva)	[Prepare]
10 - Going back to the PC	
11 - Look for the right drawing	[Prepare]
12 - Bring the over head crane	
13 - Unload the material	[Prepare]
14 - Change the belt	
15 - Look for material in the storage	[Prepare]
16 - Bring the new foil from the storage	[Transportation]
17 - Change back the belt	[Prepare]

Step 0 - Observe and record

Operation Configuration:

- Basic | Extended
- Number: 1 Start: 19193 Stop: 21290
- Object: Prepare Art. No.: 8 OUP
- Production Aid: Over head crane Art. No.: 2 PUP
- Activity: [NONE]
- A: 0 B: 0 C: 0 D: 0
- UOF: 0 Stop Watch: 0 Seconds
- Stop Watch for Movements: 83.9
- Step: 0 Bending: 0
- Stretching: 0 Treat: 0
- Instructions: Look for material in the storage
- Comments: Change the belt, secure the belt around the material

Operation - Total Time

- + 14 - Look for material in the storage [Prepare]

Total Time:	83.9	Sec.	100%
Waste (Red+Orange):	83.9	Sec.	
of which Wait (Orange):	0	Sec.	
Semi-Productivity (Yellow):	0	Sec.	
Productivity (Green):	0	Sec.	
of which Unergonomy:	0	Sec.	
	0%		

2007-02-15

Step 0 - Observe and record

The screenshot displays the AVIX software interface. On the left, a video window shows a worker in a factory setting. Below the video is a playback control bar with a progress indicator at 2x 21419 / 45463. The main area is divided into a task list on the left and operation details on the right.

Task List (Left Panel):

- 3 - Setup - part 2
 - 1 - Walking [Prepare]
 - 2 - Roll up the old foil [Prepare]
 - 3 - Secure the material - foil [Prepare]
 - 4 - Secure and unload the insulation [Prepare]
 - 5 - Walk with the insulation [Transportation]
 - 6 - Insert the new insulation on the shaft [Prepare]
 - 7 - Place the insulation in the decoler. ad [Transportation]
 - 8 - Walk to the machine cold welding unit [Prepare]
 - 9 - Changing the batten (listwa) [Prepare]
 - 10 - Going back to the PC [Prepare]
 - 11 - Look for the right drawing [Prepare]
 - 12 - Bring the over head crane [Transportation]
 - 13 - Unload the material [Prepare]
 - 14 - Look for material in the storage [Prepare]
 - 15 - Bring the new foil from the storage [Transportation]
 - 16 - Change back the belt [Prepare]
 - 17 - Bring the material to the machine [Transportation]
 - 18 - Place the material on the decoler [Prepare]
 - 19 - Move the crane [Transportation]

Operation Details (Right Panel):

Operation
 Basic | Extended
 Number: 1 Start: 21290 Stop: 23183
 Object: Transportation Art. No.: 3 OUP
 Production Aid: Over head crane Art. No.: 2 PUP
 Activity: Take
 A: 14 B: 6 C: 26 D: 6
 UOF: 4 Stop Watch: 0 Seconds
 Stop Watch for Movements: 0
 Step: 15 Bending: 3
 Stretching: 0 Twist: 0
 Instructions: Bring the new foil from the storage
 Comments: place the new material on rack

Operation - Total Time

Category	Time (Sec)	Percentage
Total Time	74.8	
Waste (Red+Orange)	18	24 %
of which Wait (Orange)	0	
Semi-Productivity (Yellow)	56.8	76 %
Productivity (Green)	0	
of which Unresponsivity	6.6	8.8 %

Step 0 - Observe and record

Operation

Basic | Extended

Number: 1 Start: 21290 Stop: 23183

Object: Transportation Art. No.: 3

Production Aid: Over head crane Art. No.: 2

Activity: Take

A: 14 B: 6 C: 26 D: 6

UOF: 4 Stop Watch: 0 Seconds

Stop Watch for Movements: 0

Step: 16 Bending: 3

Stretching: 0 Twist: 0

Instructions: Bring the new foil from the storage

Comments: place the new material on rack

Operation - Total Time

+ 15 - Bring the new foil from the storage [Transportation]

Total Time:	74.8	Sec.	24%
Waste (Red+Orange):	18	Sec.	
of which Wait (Orange):	0	Sec.	
Semi-Productivity (Yellow):	56.0	Sec.	75%
Productivity (Green):	0	Sec.	
of which Unnecessary:	6.6	Sec.	
	8.8%		

2007-02-15

Step 0 - Observe and record

Operation

Basic | Extended

Number: 1 Start: 23183 Stop: 23885

Object: Prepare Art. No.: 8 OUP

Production Aid: Over head crane Art. No.: 2 PUP

Activity: Handle

A: 6 B: 2 C: 1 D: 4

UOF: 0 Stop Watch: 0 Seconds

Stop Watch for Movements: 0

Step: 8 Bending: 2

Stretching: 1 Twist: 0

Instructions: Change back the bell

Comments:

Operation - Total Time

+ 15 - Change back the bell [Prepare]

Total Time:	20	Sec.	
Waste (Red+Orange)	10.7	Sec.	38.4 %
of which Wait (Orange)	0	Sec.	
Semi-Productivity (Yellow)	17.3	Sec.	61.6 %
Productivity (Green)	0	Sec.	
of which Unergonomy	5	Sec.	
	18 %		

2007-02-15

Step 0 - Observe and record

The screenshot displays the AVIX software interface. On the left, a video window shows a worker in a red shirt and blue overalls handling a large roll of material in a factory setting. Below the video is a playback control bar with a progress indicator at 1x, 20023 / 49403. To the right of the video is a task list for 'Setup - part 2' with 19 numbered steps, each with a status in brackets (e.g., [Prepare], [Transportation]). The main right-hand panel is titled 'Operation' and contains various input fields for 'Number', 'Start', 'Stop', 'Object', 'Production Aid', 'Activity', and time-related parameters like 'A', 'B', 'C', 'D', 'UDF', 'Stop Watch', 'Step', 'Stretching', 'Bending', and 'Twist'. Below these fields is a text area for 'Instructions' and 'Comments'. At the bottom right of the 'Operation' panel is a section titled 'Operation - Total Time' which includes a table and a stacked bar chart.

Task	Time (Sec)	Percentage
Total Time	30.8	
Waste (Red+Orange)	7.9	25.4 %
of which Wait (Orange)	0	
Semi-Productivity (Yellow)	23	74.6 %
Productivity (Green)	0	
of which Unergonomy	0	
	0 %	

Step 0 - Observe and record

Operation Configuration:

- Basic: Extended
- Number: 1 | Start: 28460 | Stop: 28934
- Object: [NONE] | Art. No.: [NONE] | DUP
- Production Art: [NONE] | Art. No.: [NONE] | PUP
- Activity: [NONE]
- A: 0 | B: 0 | C: 0 | D: 0
- UDF: 0 | Stop Watch: 0 Seconds
- Stop Watch for Movements: 19
- Step: 0 | Bending: 0
- Stretching: 0 | Twist: 0
- Instructions: Bring the caliper gage (summiarka)
- Comments: [Empty]

Operation - Total Time

Category	Time (Sec)	Percentage
Total Time	19	100%
Waste (Red+Orange)	19	
of which Wait (Orange)	0	
Semi-Productivity (Yellow)	0	
Productivity (Green)	0	
of which Unergonomy	0	
Total Productivity	0%	

Task List:

- 7 - Place the insulation in the decoller, ad [Transportation]
- 8 - Walk to the machine cold welding unit
- 9 - Changing the battery (istwa) [Prepare]
- 10 - Going back to the PC
- 11 - Look for the right drawing [Prepare]
- 12 - Bring the over head crane
- 13 - Unload the material [Prepare]
- 14 - Look for material in the storage [Prepare]
- 15 - Bring the new foil from the storage [Transportation]
- 16 - Change back the belt [Prepare]
- 17 - Bring the material to the machine [Transportation]
- 18 - Place the material on the decoller [Prepare]
- 19 - Move the crane [Transportation]
- 20 - Walking
- 21 - Bring the caliper gage (summiarka)
- 22 - Measure the material thickness [Prepare]
- 23 - Bring back the caliper gage
- 24 - Roll out the foil, grind the foil [Prepare]
- 25 - Place the lead...

Step 0 - Observe and record

The screenshot displays the ABB Avik software interface. On the left, a video window shows a worker in a red plaid shirt and blue overalls measuring a large roll of material. Below the video is a playback control bar with a progress indicator at 0.5x, 29004 / 49403. The main area is divided into two panels. The top panel, titled 'Operation', contains configuration fields for 'Basic' and 'Extended' views. The 'Basic' view shows 'Number: 1', 'Start: 29334', and 'Stop: 29160'. The 'Extended' view shows 'Object: Prepare', 'Production Aid: [NONE]', 'Activity: Inspect', and various time-related fields like 'A: 0', 'B: 0', 'C: 0', 'D: 0', 'UOF: 0', 'Stop Watch: 2.9 Seconds', and 'Step: 0'. The bottom panel, titled 'Operation - Total Time', shows a list of tasks with their durations and a bar chart. The task '22 - Measure the material thickness' is highlighted in yellow, indicating it is the current step. The bar chart shows a total time of 2.9 seconds, with 100% of the time spent on this task.

Operation - Total Time

Task	Duration	Unit	Percentage
22 - Measure the material thickness	2.9	Sec	100%
Waste (Red+Orange)	0	Sec	
of which Wait (Orange)	0	Sec	
Semi-Productivity (Yellow)	2.9	Sec	
Productivity (Green)	0	Sec	
of which Unrecognized	0	Sec	
Total	2.9	Sec	100%

Step 0 - Observe and record

The screenshot displays the ABB Method Editor software. The top window shows a video of a worker in a red plaid shirt and blue overalls operating a machine. The main interface is split into several sections:

- Operation Panel:** Contains fields for 'Number' (1), 'Start' (30671), and 'Stop' (31132). It also includes dropdowns for 'Object' (Prepare), 'Production Act' (NONE), and 'Activity' (Handle). There are also input fields for 'A' (4), 'B' (3), 'C' (0), 'D' (0), 'UOF' (0), 'Step' (5), 'Stretching' (3), 'Instructions' (Place the leadout), and 'Comments' (gear the foil with some trafa oil).
- Task List:** A list of tasks with icons and status indicators. The current task is '25 - Place the leadout' with a status of '[Prepare]'. Other tasks include '9 - Changing the batten (silva)', '10 - Going back to the PC', '11 - Look for the right drawing', '12 - Bring the over head crane', '13 - Unload the material', '14 - Look for material in the storage', '15 - Bring the new foil from the storage', '16 - Change back the belt', '17 - Bring the material to the machine', '18 - Place the material on the decoiler', '19 - Move the crane', '20 - Walking', '21 - Bring the caliper gage (szumiska)', '22 - Measure the material thickness', '23 - Bring back the caliper gage', '24 - Roll out the foil, grind the foil', and '26 - Load the right program'.
- Operation - Total Time:** A table showing time analysis for the current task.

Category	Time (Sec)	Percentage
Total Time	18,5	
Waste (Red+Orange)	6,3	33,8 %
of which Wait (Orange)	0	
Semi-Productivity (Yellow)	12,2	
Productivity (Green)	0	66,2 %
of which Inergonomy	2	
Total Productivity	10,7 %	

Step 0 - Observe and record

The screenshot displays the ABB AvD software interface. On the left, a video window shows a worker in a red plaid shirt and blue overalls operating a machine. The main interface is divided into several sections:

- Operation Panel:**
 - Number: 296, Start: 32658, Stop: 49463
 - Object: Winding_foil, Art. No.: 1, DUP:
 - Production Art: [NONE], Art. No.: [NONE], DUP:
 - Activity: Assemble
 - Parameters: A: 0, B: 0, C: 0, D: 0
 - UOF: 0, Step Watch: 672.2 Seconds, Stop Watch for Movements: 0
 - Step: 0, Bending: 1, Stretching: 0, Twist: 0
 - Instructions: Start winding
 - Comments: Follow the comments on the screen.
- Operation - Total Time:**

Category	Value	Unit	Percentage
Total Time	674.4	Sec.	1.9%
Waste (Red+Orange)	2.2	Sec.	
of which Wait (Orange)	0	Sec.	
Semi-Productivity (Yellow)	13.1	Sec.	97.7%
Productivity (Green)	659.1	Sec.	
of which Inergonomy	2.2	Sec.	
Total	674.4	Sec.	100%
- Task List:**
 - 9 - Changing the batten [istwa] [Prepare]
 - 10 - Going back to the PC
 - 11 - Look for the right drawing [Prepare]
 - 12 - Bring the over head crane
 - 13 - Unload the material [Prepare]
 - 14 - Look for material in the storage [Prepare]
 - 15 - Bring the new lol from the storage [Transportation]
 - 16 - Change back the belt [Prepare]
 - 17 - Bring the material to the machine [Transportation]
 - 18 - Place the material on the decoler [Prepare]
 - 19 - Move the crane [Transportation]
 - 20 - Walking
 - 21 - Bring the caliper gage (suwmiaska)
 - 22 - Measure the material thickness [Prepare]
 - 23 - Bring back the caliper gage
 - 24 - Roll out the lol, gain the foil [Prepare]
 - 25 - Place the leadout [Prepare]
 - 26 - Load the right program [Prepare]
 - 4 - Winding
 - 1 - Start winding [Winding_foil]

Stage 0 - report

ABB
 Issued by:
 Issue:



Workstation:	LV winding machine 132
Product:	LV coil_winding
Version	
Analyst	
Total Time:	1 950,8
Description	This machine is used to wind the LV coil direct on a core leg

	<u>Total tid</u>	<u>Total tid (%)</u>	
Waste (Red+Orange):	576,7	29,6 %	
of which Wait (Orange):	6,7	0,3 %	
of which Unergonomy:	109,8	5,6 %	
Semi-Productivity (Yellow):	670,0	34,3 %	
Productivity (Green):	704,1	36,1 %	

<u>Time for Activities</u>		
Take	166,9	8,6 %
Place	158,5	8,1 %
Affix	61,0	3,1 %
Handle	357,5	18,3 %
Adjust	73,7	3,8 %
Assemble	738,5	37,9 %
Inspect	55,4	2,8 %
Return	41,6	2,1 %
Read instructions	0,0	0,0 %
Admin	61,0	3,1 %
Wait	6,7	0,3 %



Stage 1 – Separate internal and external activities

The screenshot displays the ABB Avx software interface for configuring tasks. The main window is titled "Avx - [Method file (C:\... Avx training in China\LV SMED.avx)]". The interface includes a menu bar (File, Edit, Method, Tools, Reports, Window, Help), a toolbar, and a video player showing a worker at a machine. The "Task" configuration panel on the right includes fields for Name, Number, Frequency (%), Description, Comments, and File path. Below these are Start, Stop, and Total time input fields, and a Documents field. The "Task - Total Time" section at the bottom right provides a breakdown of time components and a stacked bar chart.

Category	Value	Unit	Percentage
Total Time	1315.5	Sec	14.3%
Waste (Red+Orange)	187.8	Sec	34.6%
of which Wait (Orange)	0	Sec	-
Semi-Productivity (Yellow)	455.5	Sec	-
Productivity (Green)	672.2	Sec	51.1%
of which Unergonomy	54.5	Sec	4.1%



Stage 2 & 3 - Convert internal activities to external & improve

Core leg preparation

Before



After



Stage 2 & 3 - Convert internal activities to external & improve



- installed flash lights on machine cabinets
- flashing light - signal for the helper – operator will need sth. (example: will do the change over in 30 min)



Stage 2 & 3 - Convert internal activities to external & improve

Example: Unpack the material

Before

Machine operator



After

Helper



Stage 2 & 3 - Convert internal activities to external & improve

Example: Bring the material from the storage (leave on rack)

Before

Machine operator



After

Helper



Stage 2 & 3 - Convert internal activities to external & improve

Example: Bring the core leg

Before

Machine operator



After

Helper



Stage 2 & 3 - Convert internal activities to external & improve

Example: Bring the metal brackets



Stage 2 & 3 - Convert internal activities to external & improve

Prepare/bring the right cooling duct



Prepare/bring the right lead outs



Stage 2 & 3 - Convert internal activities to external & improve

Forward the LV coil to the HV machines



Take care of scrap



Stage 4 – Document internal and external procedures

- Prepare the presentation/ procedure for machines operators & helpers
- Training



SMED Results

- LV winding machine
 - Change over time – 10 min. (was 21 min.)
 - Winding time of one LV coil on the machine – 10 min. (was 12 min.)
 - Total time: 20 min (was 33 min)

- Time savings: 33min – 20 min = 13 min (≈40%)

Thank You

Questions?

