TECNOMATIC AT THE FOREFRONT OF PLASTIC PIPES PROCESS: ITALIAN INNOVATIVE SPIRIT FOR EXTRUSION

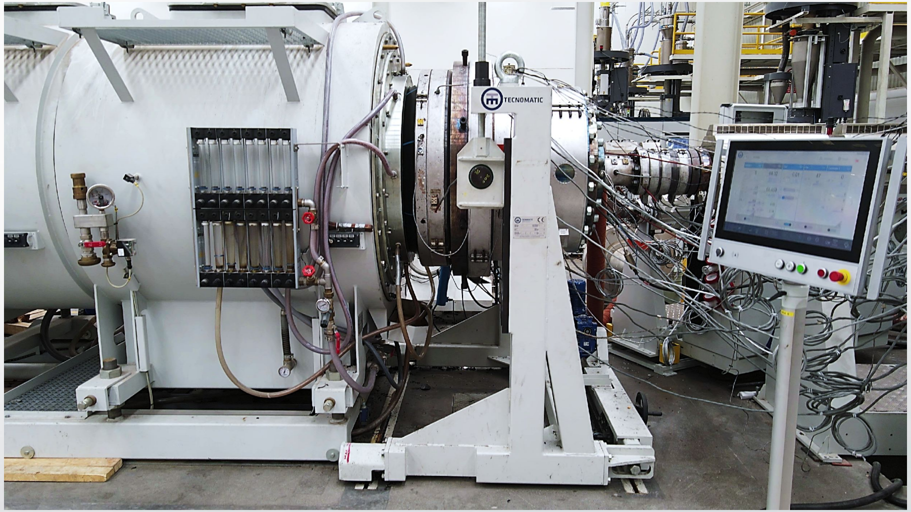
Performance, Material Savings, Comparative Advantages

“Technological innovation is at the heart of our projects”

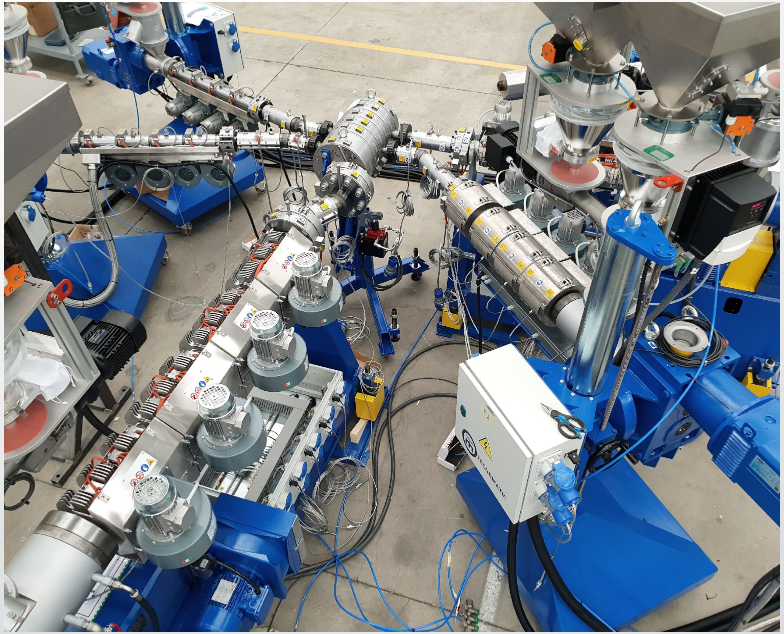
MADE IN ITALY

THE COMPANY

- Leading provider of advanced extrusion technology
- Specializes in innovative solutions for pipe production
- Renowned for reliability, precision, and performance



HDPE mono and multilayer lines



5 layers PE-RT and PEX-b line

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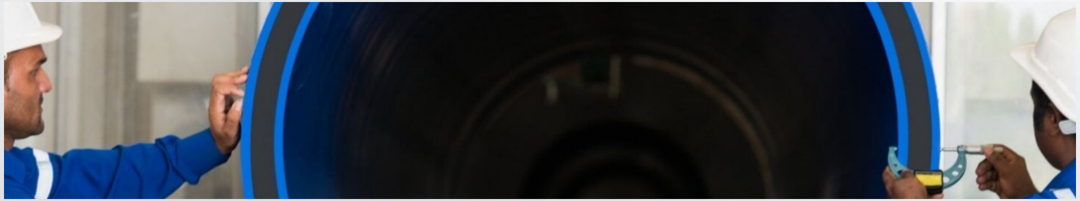
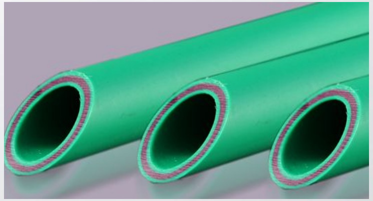
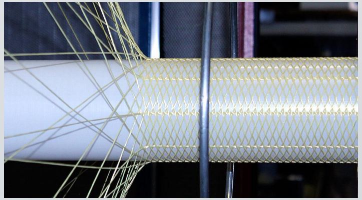
INNOVATIVE EXTRUSION TECHNOLOGY

- State-of-the-art machinery
- Customizable solutions for various pipe applications
- Integration of advanced control systems

INFRASTRUCTURE & CONSTRUCTION	Potable / storm water, Gas distribution, Sewage and drainage, Cable / Micro duct, Industrial application
IN-HOUSE, HEATING & PLUMBING	PE-x, PE-RT, PP-r, Floor heating, Hot, cold and waste water, Ventilation, Conduit & Insulation.
INDUSTRIAL	Chemical, Cooling & heating, Dredging & Mining, Slurry, Oil & Gas, Hydropower
AGRI & AQUACULTURE	Cages for fish farming, Drainage, Sewage, Irrigation pipes, with or without dripper
OEM SOLUTIONS	Extruders for SWC & DWC pipes, Extruders for special applications (Customized Lines and Machines)



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SUMMARY

How new technologies in polyolefin extrusion can help Indian manufacturers solve common challenges?

The Indian plastics industry is one of the largest and fastest-growing in the world and face a number of challenges

High costs of raw materials
How to improve the efficiency and reduce raw material consumption

High-quality products
New technologies applied in Extrusion

OEE IN PIPE MANUFACTURING

Environmental regulations
Sustainable plastics products and how to reduce waste;

Examples of how new technologies help manufacturers
Multilayer Extrusion
Raw material with enhanced properties
Biaxial extrusion technology;

PORTFOL IO

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PIPE SECTOR DEMAND

The Indian plastics PIPE industry is one of the largest and fastest-growing in the world

PIPE SECTOR DEMAND (2021-22) - INDIA

PLASTINDIA 2023
FEB 1-5 PRAGATI MAIDAN - NEW DELHI - INDIA

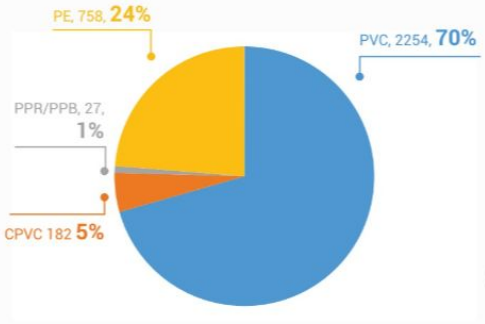
PIPE DEMAND (PVC/CPVC/PE/PP)

SEGMENT	2021-22 KT	2021-22 Growth %
PVC (SWR + Plumbing+ Fittings)	2254	7.0
**HDPE Water Distribution + Industrial Pipe	343	7.5
*MD/HDPE Gas Distribution Network	28	25.0
HDPE Optical Fibre Duct	87	-5.0
Sprinkler (HDPE)	74	10.0
CPVC plumbing pipe	182	6.0
HDPE Corrugated pipe (Sewage + Cable Duct)	61	15.0
LLDPE drip irrigation	165	5.0
Plumbing pipe PPB / PPR	27	10.0
Total Market (Virgin Polymer)	3221	

All Fig in KT

* compounded ** partly compounded

BREAK UP OF PLASTICS DEMAND IN PIPE SECTOR



2021-22 Demand 3221 KT 2022-23 (E) 3446 KT YoY Growth ~ 7%

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https://plastindia.org/plastic-industry-status-report/report-india/

PIPE SECTOR DRIVERS

The Indian plastics PIPE industry and Indian Government Initiatives

Skill India
Plastic Industry offers great potential to train people in Extrusion

Smart Cities Mission
Urban renewal: Pipe for Infrastructure (Potential 300 KTA of HDPE)
Optical Fiber Ducts (Potential 60 KTA of HDPE)

National Mission for Clean Ganga
Re-develop Ecological system Potential LLDPE + HDPE 30 KTA

Digital India
Increase connectivity Potential LDPE + HDPE 250 KTA

OTHERS
Large Diameter HDPE pipes
Desalinization plants - Gas Distribution
Double Wall Corrugated pipes for sewage
Conserve WATER – minimizing leakage and 24 x7 supply

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https://plastindia.org/plastic-industry-status-report/report-india/

OEE IN PIPE MANUFACTURING

OEE Performance Indicator: Pipe manufacturers can use Overall Equipment Effectiveness (OEE) to measure efficiency and effectiveness, focusing on availability, performance, and quality.

Availability (A)	Performance (P)	Quality (Q)
The ratio of actual operating time to planned production time.	The ratio of the actual production rate to the ideal production rate.	Quality is the ratio of good units produced to the total units produced.
Operating Time: Planned Production Time - Downtime (breakdowns, maintenance, etc.)	**Total Count:** Number of units produced. **Ideal Cycle Time:** The fastest possible time to produce one unit.	**Good Count:** Units that meet quality std **Total Count:** Number of units produced.

OEE = Availability × Performance × Quality

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IMPROVE OEE IN PIPE MANUFACTURING

OEE Performance Indicator: HOW TO IMPROVE

Improve Availability (A)	Improve Performance (P)	Improve Quality (Q)
Improve Operating time Less Breakdowns Less Maintenance Less time in settings	Improve Performance More output with same efforts	Better results in terms of More "good units" produced <u>OR</u> Less Total units produced for the same good units
(A1) Preventive maintenance with wide experienced technicians	**(P1)** High output and efficiency extruder (EVO)	**(Q1)** - Overweight control with optimized gravimetric PID
(IND 4.0) Advanced HMI for fast start	(**IND 4.0**) KPI monitored for further optimization	**(IND 4.0)** KPI monitored for further optimization
Remote assistance *High reliability components* *Wear resistance screw and barrels* *Advance design of components*	*High efficiency motors* *High efficiency inverters* *PID continuous development* *In house software developers*	*Process optimization support* *Listening for further developments* *Tailormade configurations*

A1) OEE APPROACH FROM THE BEGINNING

Reduce unplanned downtime with **preventative maintenance**.

Maintenance plans offered with the Extrusion line and openly scheduled with customers.

Implement a **remote monitoring** system to identify potential problems early.

Every EXTRUDER has the remote assistance program available, lifespan available, triage for free.

Optimize the **product changeover** process to reduce downtime.

From the beginning we develop the best configuration of tools for reduce the changeover time based on your production mix.

Train operators on start, produce and change type.

We offer a training on the field during start-up with wide experienced operators and tailormade programs.

Optimize start-up parameters to reduce material and energy waste.

During the start-up we optimize the parameters for your production and we support you for further optimization.

Implement standardized **start-up procedures** to ensure consistency.

We can develop and personalize the recipes according with your MES, ERP or management SOFTWARE.

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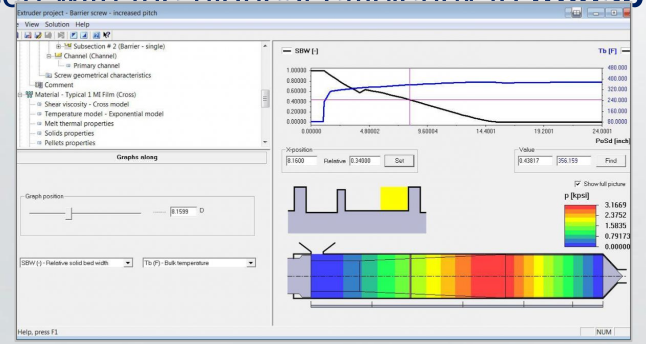
P1) OEE THROUGH COMPONENTS DESIGN

Implement **ADVANCED CONTROL SYSTEMS** to ensure a stable and precise process.
Adapt the extrusion line to produce a **VARIETY OF PRODUCTS** with different characteristics.
Offer **CUSTOMIZATION** options to meet their specific **NEEDS**.
Rapidly develop **NEW PRODUCTS** to respond to market trends.

Increase the production **OUTPUT** of the extrusion line without sacrificing quality.
Optimize the **FEEDBUSH** and **SCREW** design to improve material flow.

The crucial factor for reducing the energy consumption is the **SCREW GEOMETRY**. It's extremely important that
the energy input in the system is used with the highest efficiency to **transport and plasticize the material**.



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P1) OEE THROUGH EVOLUTION

A state of the art technology for all components: EVO for GEARBOX and GEARLESS Version

Vega 60.37

Zephyr
60.40

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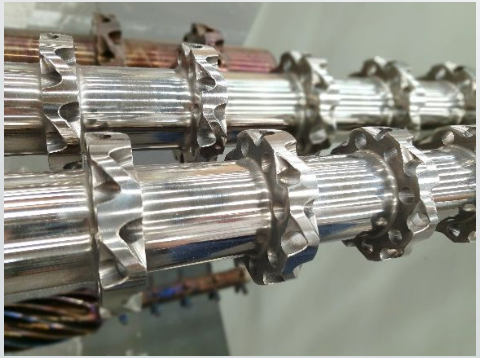
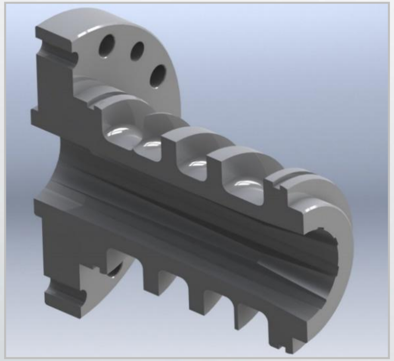
P1) OEE THROUGH EVOLUTION

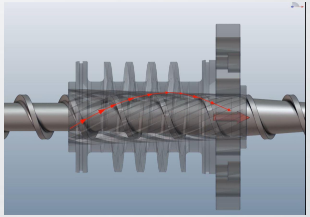
The new **EVO** version feature a completely revised geometry of the screw, as well as newly designed spiral feed-bush. The new version represents the strongest evolution of Tecnomatic extruders after several years, and aims to improve plasticization, homogeneity and energy saving.

Spiral grooved feed bush - optimized production values even with different pellets structures.

Mixing barrier **Single screws** with a developed geometry, which further reduces the passage gap with the barrel, for clear separation of melt and an higher homogenous extruded material.







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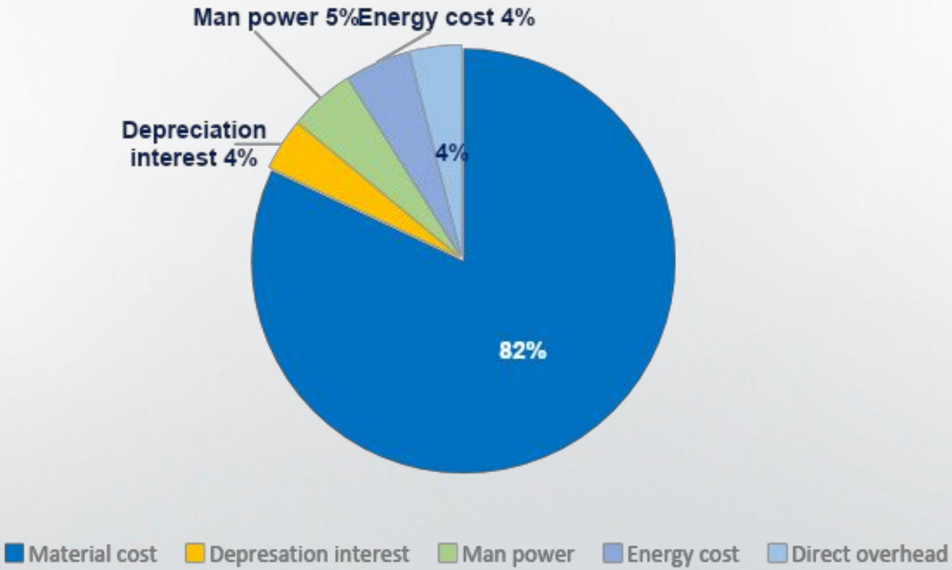
Q1) MATERIAL COST: SCRAP AND OVERWEIGHT

For Solid Wall Plastic pipe, the dominant factor in the cost price is beyond any doubt the material cost

COST BREAK DOWN OF PLASTIC PIPES



Three different flows of material loss:

- Start and stop scrap
- Reject pipe during production
- Overweight of the pipe

Key Distinction:

- **Scrap**: Most scrap can be reworked into the material flow. The direct costs of rework are ≈ 20% of the missed turnover.
- **Overweight**: This is a pure loss. Excess material is leaving the factory, and customers do not pay for this extra.

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Q1) DEFINING OVERWEIGHT

Theoretically, overweight in pipe production refers to the excess material used in producing pipes, calculated as the difference between the actual pipe weight and a reference pipe weight.

- **Accepting Overweight as Inevitable**

Acknowledge that achieving zero overweight may not be practical due to manufacturing realities (Even with precise control, variations in raw materials and production processes can result in slight weight differences)

- **Importance of Clear Measurement Definitions**

Define overweight measurement criteria clearly to facilitate accurate quality control and decision-making.

Real Actual Output Measurement:

Utilize a gravimetric loss-in-weight device for precise measurement.

Line Speed Measurement:

Apply a pulse wheel or a laser device.

Calculation: Output/line speed

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Q1) THE OVERWEIGHT COST or SAVING ?

- Include diameter, wall thickness, and material density in the system.
- Use actual pipe weight data to determine real overweight.
- Continuously register this value as a parameter for production performance.

Interpretation of Overweight Values: Optimal Range:2-3% overweight indicates excellent performance. Regularly check to maintain consistency.

Higher Overweight: Values like 8% are common; 12% is not unusual. High values suggest potential for significant cost savings.

MATERIAL COST FOR AN EXTRUSION LINE IS ABOUT 10 TIME THE LINE'S VALUE

By reducing the overweight from 8% to 4%, the company can save annually the cost of the line

Contact me for a B2B appointment, we can check calculations together with your production plan!

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IND 4.0) DATA AND OEE IN INDUSTRY 4.0

Advantages of the Industry 4.0

- **Approach Optimized Output:**

  Ensures that the maximum efficient output is achieved for each product type.
- **Proactive Management:**

  Allows for immediate adjustments based on real-time data to maintain optimal conditions.
- **Data Analysis:**

  Enhances understanding of various bottlenecks and how to address them effectively.

In brief

Implementing an Industry 4.0 approach to OEE and maximum output in pipe manufacturing involves dynamic calculation of optimal output based on real-time data and comprehensive analysis of all potential bottlenecks. This ensures efficient production, reduced waste, and improved overall equipment effectiveness.

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IND 4.0) DATA AND OEE ANALYSYS

Bottlenecks investigation

Extruder Output: In some cases, the extruder output is the bottleneck and should be maximized.

Cooling Length: For other pipe sizes, the cooling length may be the limiting factor.

Haul Off Speed and Pipe Roughness: These can also be bottlenecks depending on the product mix.

Proposed Solution

Industry 4.0 Approach Dynamic Calculation: The line control should calculate the optimal output for each pipe size, considering the line setup, plastic formulation, and product characteristics.

Real-time Measurement: The actual output should be measured, displayed, and reported in real-time to ensure efficiency - Industry 4.0

Integration: This approach aligns with Industry 4.0 principles, using advanced data analytics and automation for optimal performance.

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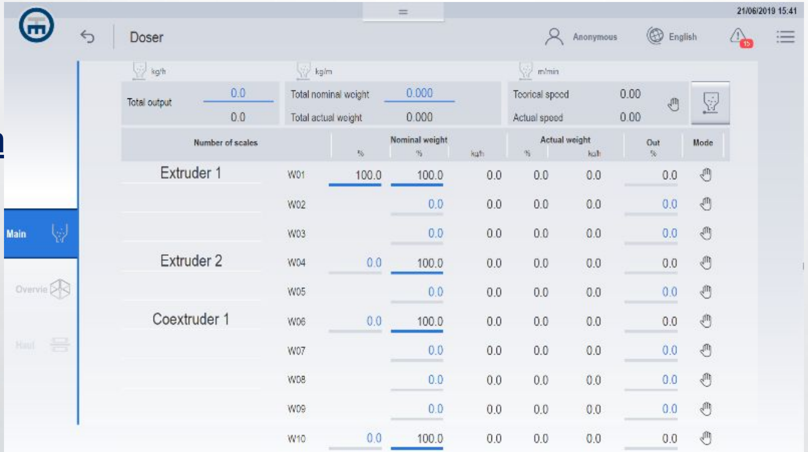
IND 4.0) INDUSTRY 4.0 FOR **AVAILABILITY**

Industry 4.0 with Easy HMI + Recipes Management + Process Reports (also for each batch):

Increasing the speed of setting up and fine-tuning the recipe of a specific tube becomes faster, both in the simulation and in recalling those parameters once identified.

These factors are even more important when you have MULTILAYER pipes and different raw materials.



<u>Benefits for Production and for Managemen</u>

Every batch is under control:

- Energy measurement;
- Material consumption;
- Components consumption;
- Cost drivers always available.

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IND 4.0) INDUSTRY 4.0 FOR **PERFORMANCE**

Industry 4.0 Integration Increased Sensors: A significant increase in sensors across the extrusion line is necessary, capturing data beyond the extruder and die head.

Include parameters like vacuum level, water temperatures, pressures in cooling units, factory water conditions, and ambient environment data for holistic analysis.

Benefits Proactive Management:

- Ensures early detection and resolution of issues.
- Maintains optimal operating conditions (Reducing also material waste and improving efficiency).
- Incorporates advanced data analysis and automation for smarter manufacturing processes.

These factors helps to maintain the line at the best performance as a brand new machine for the entire lifespan.

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IND 4.0) INDUSTRY 4.0 FOR **QUALITY**

Identifying causes through data

Correlations: Analyze data on wall thickness, motor load, melt temperature, die pressure, and output to find the root cause of fluctuations.

Understanding these correlations helps minimize overweight production, reducing waste and ensuring consistent quality.

Enhanced Monitoring and Control Real-time Warnings: Extrusion line control systems should generate warnings when processes deviate from optimal conditions.

Systems must assist operators in interpreting data and correcting issues promptly, maintaining process stability.

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A x P x Q - COMPARATIVE ADVANTAGES

Comparative Analysis for high tech investments

- **Availability:** Higher uptime and lower maintenance needs, improves reliability (and quality parameters.)
- **Performance:** Better performance metrics, ensuring faster and more consistent production.
- **Quality:** Higher quality outputs with fewer defects.

Despite higher initial investment, lower operational costs and higher productivity result in **better long-term value.**

Case Study: OEE Improvement with Tecnomatic

OEE with low-cost machine	OEE with Tecnomatic
Line Availability: 80% Performance: 75% Quality: 85%	Line Availability: 90% Performance: 85% Quality: 95%
OEE: 0.80 × 0.75 × 0.85 = 51%	**OEE:** 0.90 × 0.85 × 0.95 ≈ 73%

With 2’500 tons per year - HDPE pipes - he covered the price difference in less than 2 years

Contact me for a B2B appointment, we can adapt calculations to your capability!

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SOLUTIONS IMPLEMENTED WITH CUSTOMERS

MULTILAYER LINES FOR COMPLEX PIPES

WITH FUNCTIONAL LAYERS

Tecnomatic has well interpreted these customer needs and has developed, based on the VENUS die-head concept, complete lines, for the production of two, three or four layers pipes, even in large diameter size.

A project in 1.600 mm multi layers is the milestone of the multilayer production made by Tecnomatic.

1.200 mm, PE three layers line

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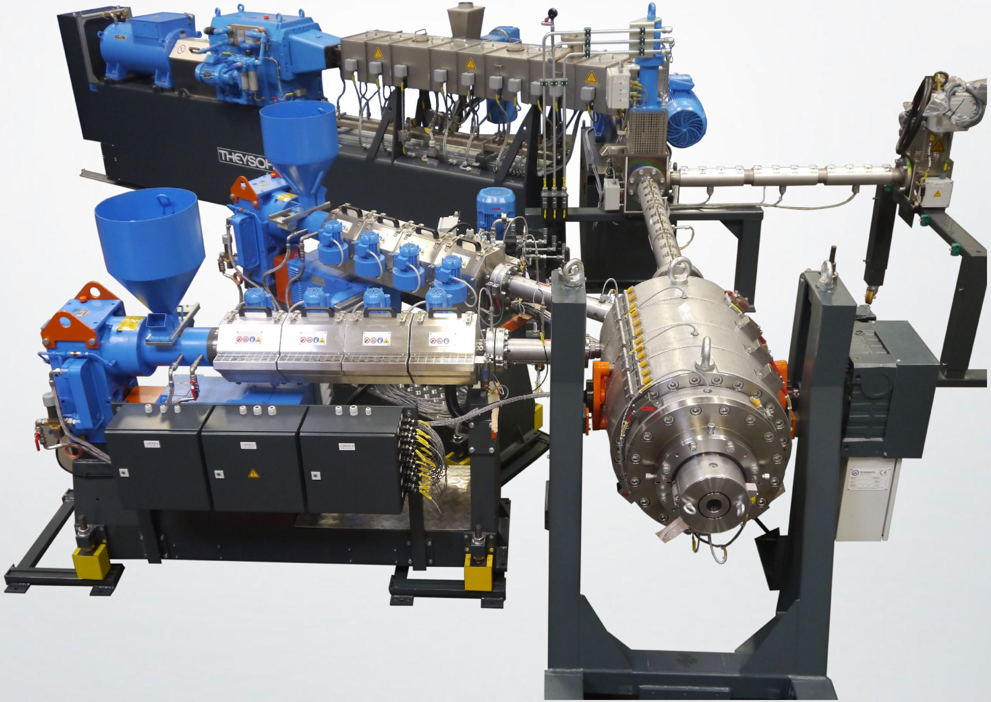
SOLUTIONS IMPLEMENTED WITH CUSTOMERS

MULTILAYER LINES FOR COMPLEX PIPES

WITH FUNCTIONAL LAYERS

The growing market of PP waste & soil pipes has also seen the company very active with the design of high output lines, especially as multilayer solution with mineral fillers. The top and bottom layers of these pipes are made of **polypropylene** and middle layer made of **mineral filler** polypropylene compounds which guarantees:

- High mechanical resistance
- Excellent acoustic performance
- Resistance to the agents.



160 mm, PP line in direct extrusion with Theysohn compounder exruder

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SOLUTIONS IMPLEMENTED WITH CUSTOMERS

THE BIAX PIPEPROJECT – BENEFITS IN PERFORMANCE & SUSTANIBILITY

22's | 23's | And…..

The largest public company in the Middle East, and the world's fourth largest chemical producer, Sabic, has entered into a cooperation and a contract with Tecnomatic to deliver an innovative line for testing of new pipe solutions.

SABIC has succeeded in optimizing the formulation of dedicated PE and PP resins for biaxial stretching that will allow manufacturers to boost the key properties of pressure pipes to unprecedented levels. The new resins in combination with the BiAx stretching technology will enable a new generation of lighter and stronger as well as energy- and cost-efficient pipe systems.

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TECNOMATIC

Thank You
Special thanks to

Indo-Italian Chamber of Commerce and Industry (IICCI)
Embassy of Italy in India
AMAPLAST
UCIMU
Mr. Nilesh Joshi (AMAPLAST-UCIMU - India)

Contact me for a Virtual B2B meeting
July 18th & 19th

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MADE IN ITALY