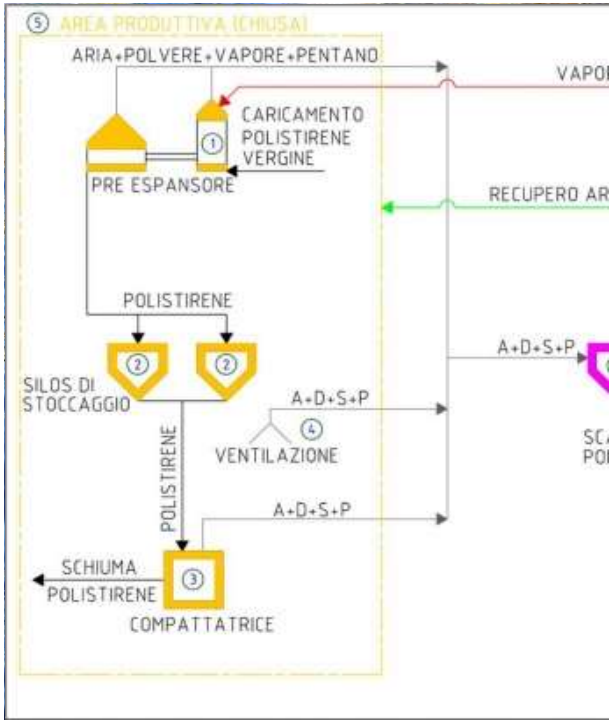
Pentane Recovery Unit

ULIX INNOVATION S.r.l.



Who we are

ULIX Innovation is an Italian company of young people with a **passion for innovation** and great attention to **environmental pollution issues**.

We specialize in **VOC abatement systems** and **solvent recovery**.

We invest every year in research and development to make technologies more efficient and innovative, and guarantee savings in the purchase of raw materials and energy consumption.

Pentane in the polystyrene (EPS) process

Pentane is a hydrocarbon widely used in the process of expanding **polystyrene (EPS)**. During this process, the polystyrene beads are **impregnated with pentane** and are exposed to a stream of water vapor that evaporates the **pentane** and expands the beads up to 20 times their volume.

Of the pentane used in the process, one sixth remains in the spheres, while the remaining **five sixth are released in the atmosphere**.

Pentane released into the air has a very high polluting impact on plants and ecosystems, especially when combined with other atmospheric pollutants.

EPS in Europe and Turkey

We are interested to know that ***about 5% of the weight of polystyrene consists of pentane emissions***. This means that if a company produces **10.000 tons** of polystyrene annually, it is releasing approximately **500 tons of pentane into the atmosphere**.

According to the Mordor Intelligence database, **in Europe**, the annual production volume of **EPS** is estimated to be around **2.71 million tons** per year.

According to the United Nations Development Program, **Turkey's** annual production volume of EPS is estimated in **210 thousand of tons**.

This mean approximately **135.000 tons** and **10.500 tons**, respectively, **of released pentane into the atmosphere**.

Post Combustor: a temporary non-solution

Unfortunately, the most common response to pollution is still the Regenerative **Post Combustor**, which is tasked with *burning **pentane***. However, **for two main reasons**, the Combustor is not a real solution. The first reason that concerns us closely is **environmental**, as the burner produces CO_2 and nitrogen oxides, further polluting the environment.

The second reason is of an **economic nature**; despite costing approximately 30% less than a ULIX plant, the Combustor is not an investment but rather a futile expense. T*o burn **pentane** vapors, it must be diluted with methane*. Many EPS producers who have purchased Combustors are now forced to keep them idle due to the excessive cost of keeping them operational.

Comparison (Post Combustor vs ULIX Plant) & Forecasts

Let's now consider the major EPS manufacturing companies in Turkey, "**RAVAGO Petrokimya**" & "**ASCHEM Petrochemical Ind.**" utilizing public data. We'll make investment forecasts, estimate the environmental impact reduction, and assess the potential earnings. *Here is "**RAVAGO**":*

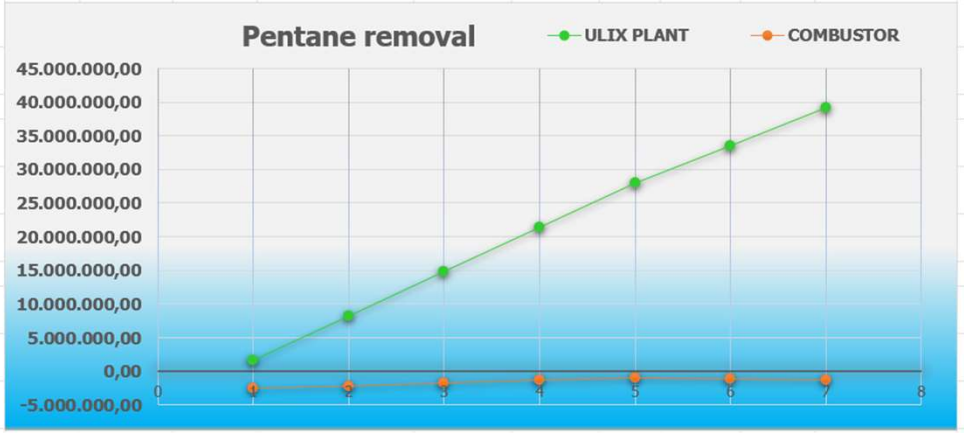
YEAR	ULIX PLANT	Recovered solvent	Plant running costs	Depreciation	White certificates (for Italy)	Carbon credits (globally)	Total
1	-5000000	5700000	115000	1000000	0	0	6585000
2	0	5700000	115000	1000000	0	0	6585000
3	0	5700000	115000	1000000	0	0	6585000
4	0	5700000	115000	1000000	0	0	6585000
5	0	5700000	115000	1000000	0	0	6585000
6	0	5700000	115000	0	0	0	5700000
7	0	5700000	115000	0	0	0	5700000

YEAR	Post combustor	Recovered solvent - plant running cost	Depreciation	White Cert.	Carbon credits	Total
1	-3000000	-180000	600000	0	0	420000
2	0	-180000	600000	0	0	420000
3	0	-180000	600000	0	0	420000
4	0	-180000	600000	0	0	420000
5	0	-180000	600000	0	0	420000
6	0	-180000	0	0	0	-180000
7	0	-180000	0	0	0	-180000

YEAR	ULIX PLANT	COMBUSTOR
1	1.585.000,00	-2.580.000,00
2	8.170.000,00	-2.160.000,00
3	14.755.000,00	-1.740.000,00
4	21.340.000,00	-1.320.000,00
5	27.925.000,00	-900.000,00
6	33.510.000,00	-1.080.000,00
7	39.095.000,00	-1.260.000,00

Yearly EPS production	150000	*tons*
Years of depreciation	5	
Heating power pentane	45	*MJ/kg*
White Certificates	5350	*kWh/year*
Daily recovered solvent	3000	*Kg/day*
Pentane effecively recovered	95%	
Yearly recovered solvent	7125000	*Kg/year*
Pentane price	0,8	*EURO al Kg*
White certificate value	0	*EURO*
Value of carbon credit	33,00	*EURO*
GWP power of pentane	4	

RAVAGO



Comparison (Post Combustor vs ULIX Plant) & Forecasts pt.2

With a 150.000(t) EPS year production, **ULIX Plant** can recover up to **7.125.000** kg of Pentane. Moreover, as can be seen from the forecasts, with our plant, **the companies return on the investment and begin to make a profit** from the end of the **first year** of operation of the plant.

*In the next graph we have "**ASCHEM**" as an example:*

YEAR	ULIX PLANT	Recovered solvent	Plant running costs	Depreciation	White certificates (for Italy)	Carbon credits (globally)	Total
1	-2000000	760000	16500	400000	0	0	1143500
2	0	760000	16500	400000	0	0	1143500
3	0	760000	16500	400000	0	0	1143500
4	0	760000	16500	400000	0	0	1143500
5	0	760000	16500	400000	0	0	1143500
6	0	760000	16500	0	0	0	760000
7	0	760000	16500	0	0	0	760000

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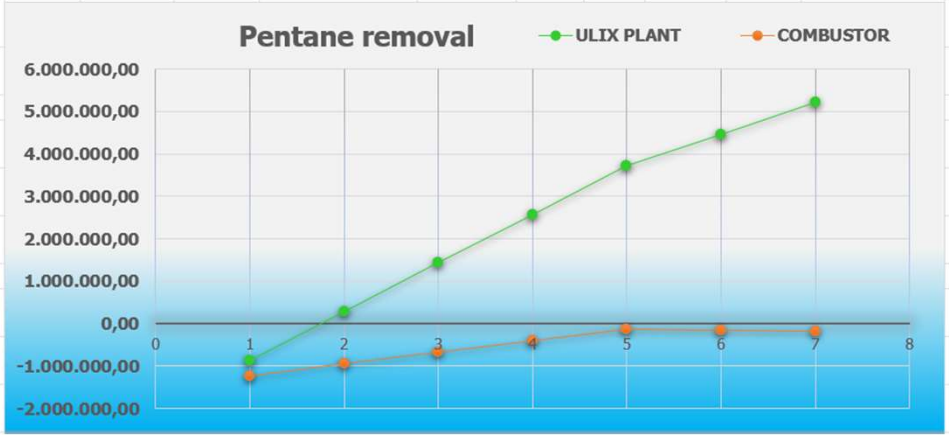
White certificate value	0	*EURO*
Value of carbon credit	33,00	*EURO*
GWP power of pentane	4	

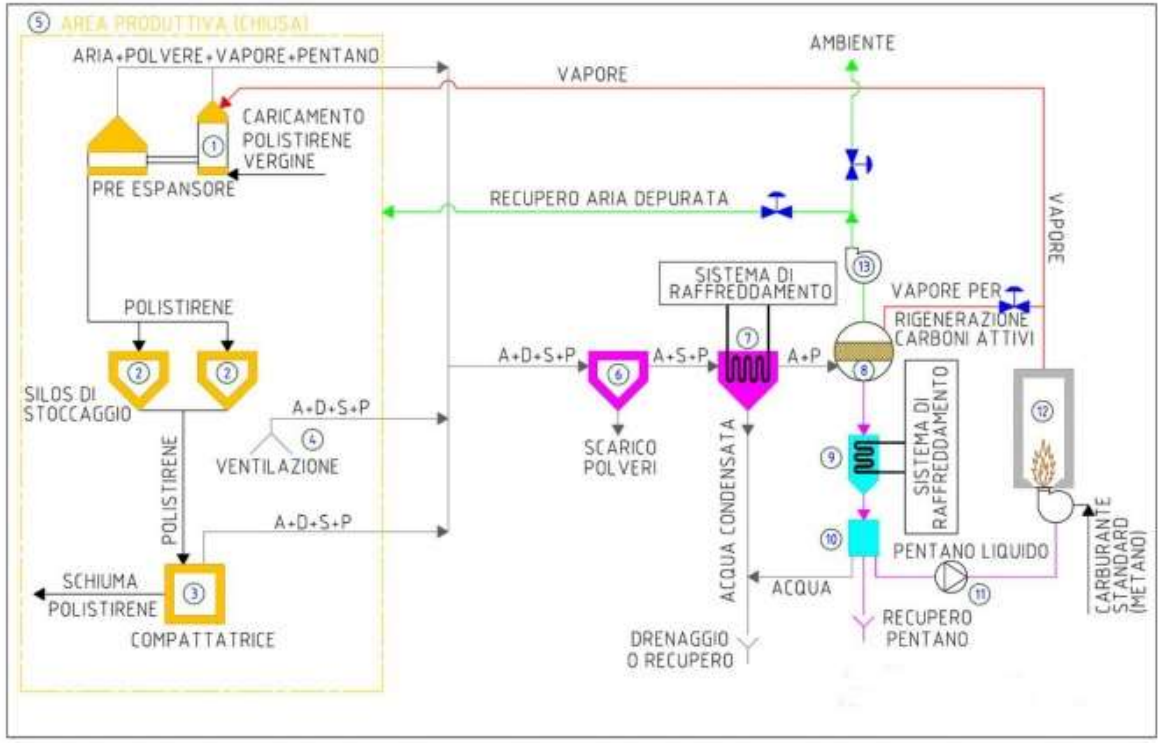
ASCHEM

Post combustor	Recovered solvent - plant running cost	Depreciation	White Cert.	Carbon credits	Total
-1500000	-25500	300000	0	0	274500
0	-25500	300000	0	0	274500
0	-25500	300000	0	0	274500
0	-25500	300000	0	0	274500
0	-25500	300000	0	0	274500
0	-25500	0	0	0	-25500
0	-25500	0	0	0	-25500

YEAR	ULIX PLANT	COMBUSTOR
1	-856.500,00	-1.225.500,00
2	287.000,00	-951.000,00
3	1.430.500,00	-676.500,00
4	2.574.000,00	-402.000,00
5	3.717.500,00	-127.500,00
6	4.461.000,00	-153.000,00
7	5.204.500,00	-178.500,00



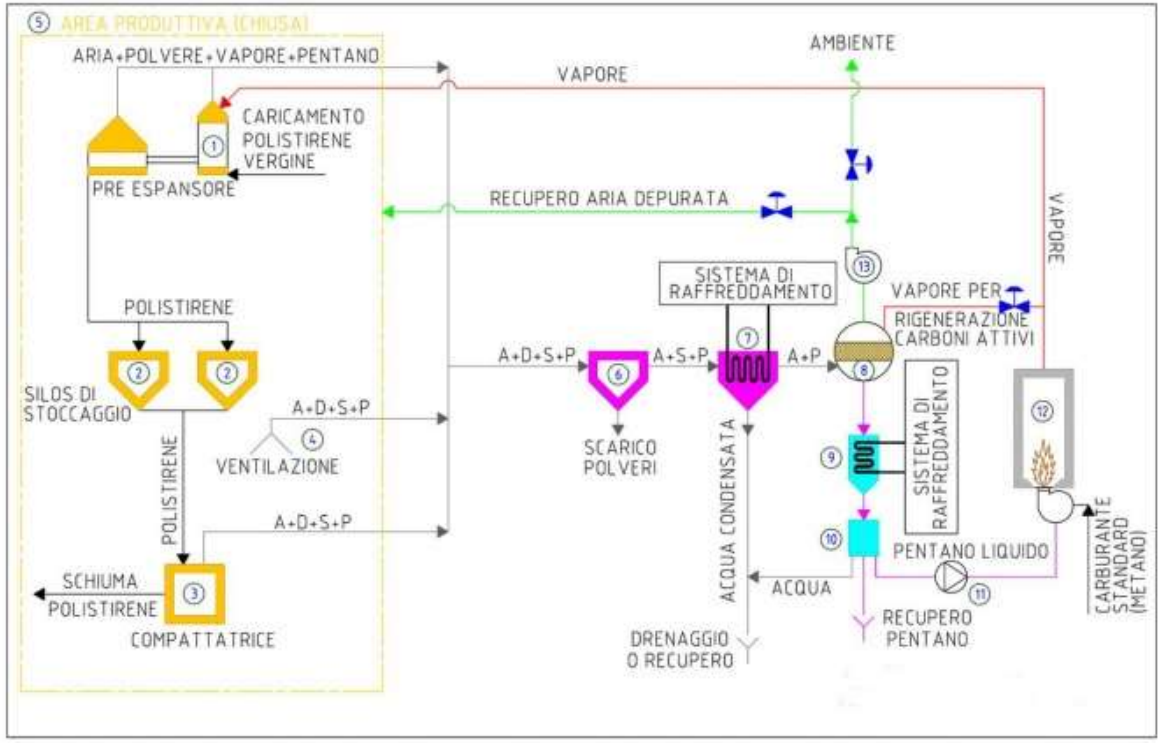
How does ULIX PLANT work? pt.1



Polluted air is contaminated with pentane, dust and water vapor [4]. After extracting dust with a special filter [6], and condensed the vapor with a cooling unit, the air is sent to one or the activated carbon beds where pentane is adsorbed [8]. Pentane is recovered through a water vapor stream and reduced into liquid phase via condensation [9]. Recovered pentane is stored in a tank ready to be used in the industrial process.

In alternative the solvent is sent to the boiler [12], which produces steam for the polystyrene production machines (not adviced).

How does ULIX PLANT work? pt.2

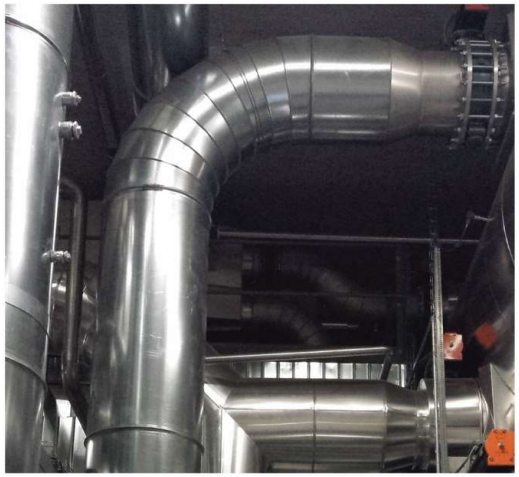


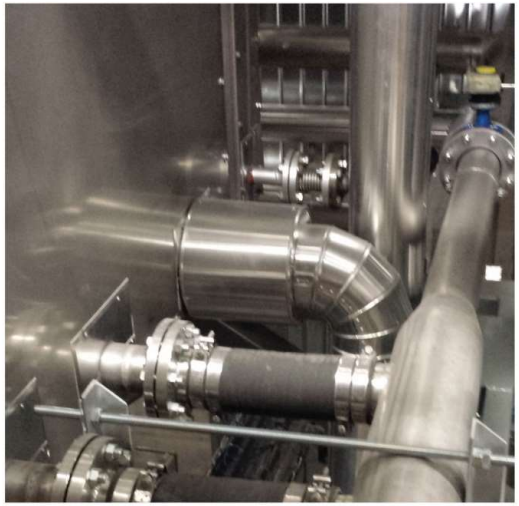
[..] In this way, a zero emission plant is employed, both in terms of pentane and emitted air.

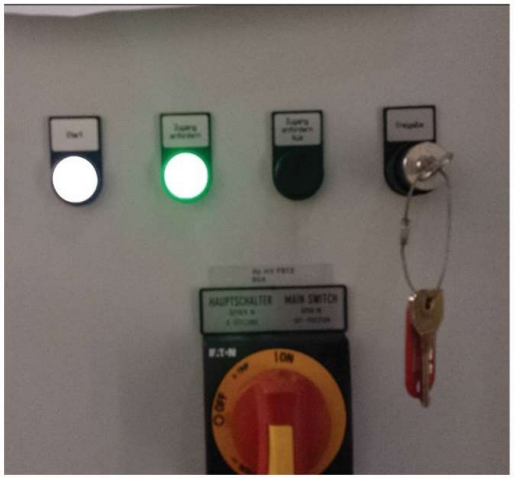
The plant is supplied turn-key, complete with electrical panel, electric system, PLC and operator interface terminal, assembled, calibrated and ready for production.

Additionally, the recovered pentane can be sold to companies that produce expandable polystyrene or for other applications.

some ULIX PLANT pictures







KEY BENEFITS OF THE **ULIX PLANT:**

- Complying to ecological principles and European regulations;
- Positive ROI from the first year of plant activation;
- Improved production capacities and development of new business relationships.

ULIX LATEST **PLANT**

Our latest and largest **Pentane Recovery PLANT** currently built is at a major Swiss company that manufactures EPS insulation, **'ISOPOR Schweiz AG,'** a partner very committed to adhering to modern ecological principles.

ISOPOR

www.isopor.ch

ULIX INNOVATION Team

Thanks You for your attention

We are available for any further clarification requests

Best Regards