# PV Park + BESS

## Project: Medgidia , CT
## Land Surface: 8.34 Ha
## Installed PV Power: 7.5 MWp
## BESS - Storage Capacity: 30 MWh


Emas Business Consulting
Bucuresti, Sector 1, Piata Presei Libere, Nr. 3-5, Tel: 0759.046.530
office@emasconsulting.com
www.emasconsulting.com

# Curves Level

# Photovoltaic Park + Storage Capacity Layout

| LEGENDA: | |
|---|---|
| Imprejmuire parc fotovoltaic | |
| Suport panouri - 12 PV 720 W<br>Azimut 0, Inclinare 35<br>Distanta randuri 5.5 m | |
| Post de conexiune si transformare | |
| Container stocare | |
| Alee | |
| Limita de proprietate | |

Emas Business Consulting
Bucuresti, Sector 1, Piata Presei Libere, Nr. 3-5, Tel: 0759.046.530
office@emasconsulting.com
www.emasconsulting.com

# PV Productions

**Peak power: 7.5 MWp**

**Module surface: 30,696.3 m²**

**Total number of modules: 11 364**

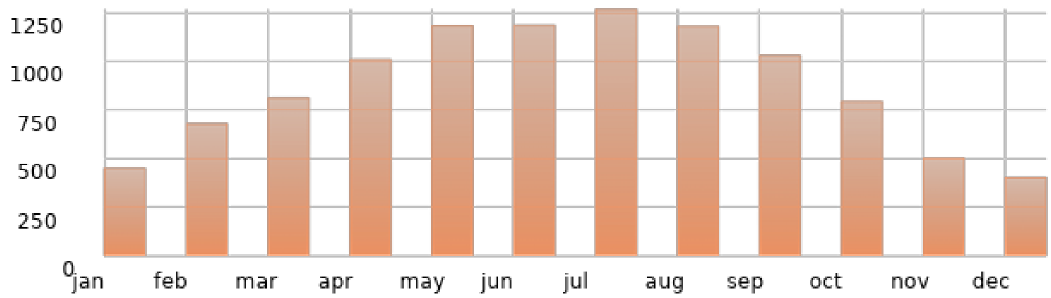
**Total number of inverters: 72**

**Average values:**

Annual production (DC) : 11,140 MWh

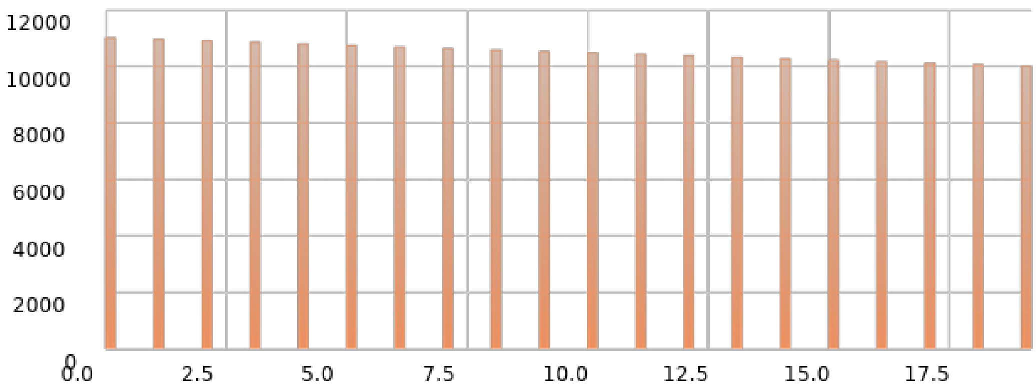
Annual production (AC) : 10,504 MWh

**Monthly AC production (MWh/month):**




| Months | Jan | Feb | Mar | Apr | May | June | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MWh | 451 | 679 | 812 | 1 010 | 1 183 | 1 186 | 1 269 | 1 181 | 1 031 | 795 | 503 | 403 |

AC production year by year (MWh):




| Years | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| MWh | 11 010 | 10 955 | 10 901 | 10 847 | 10 792 | 10 739 | 10 685 | 10 632 | 10 579 | 10 526 |

| Years | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|
| MWh | 10 474 | 10 421 | 10 369 | 10 317 | 10 266 | 10 215 | 10 164 | 10 113 | 10 062 | 10 012 |

EMISSIONS AVOIDED: 4 202 $CO_2$ equivalent (ton) *

* Quantity of greenhouse gases that would have been emitted during the observation period if this electricity had been generated through conventional means (20 g eq $CO_2$/kWh)

* Important: this does not mean that all the emissions would be avoided, since the process of manufacturing and transporting PV modules also generates greenhouse gas emissions.

# Economics PV + BESS

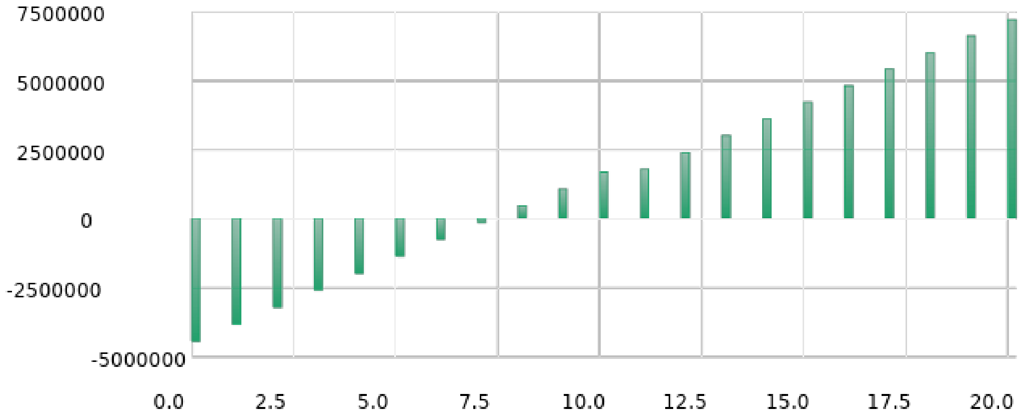
| Project assumptions | | |
|---|---|---|
| Project name | Medgidia, Constanta | |
| PV Installed Capacity | 7,5 | MWp |
| Annual energy production AC/MWp | 1.398 | MWh/Mwp/year |
| Annual PV pannel degradation | 0,5% | p.a. |
| Installed Storage Capacity | 30 | MWh |
| Charge-Discharge Battery cycles/days | 4 | hours |
| Annual BESS degradation | 3% | a |
| Energy produced base price | 60 | €/MWh |
| Balancing Market energy price | 900 | €/MWh |
| DAM energy price | 100 | €/MWh |
| IDM energy price | 200 | €/MWh |
| Inflation rate | 3% | p.a. |
| **Project cost** | | |
| Storage equipment cost | 150.000 | €/MWh |
| Other cost related to storage (connection et | 50.000 | €/MWh |
| Cost PV park per MWp | 595.000 | €/MWp |
| Cost Storage Batteries (BESS) | 6.000.000 | € |
| Cost PV park | 4.462.500 | € |
| Customer-Side Works $T_u$ | 741 | € |
| Grid Connection Installations $T_r$ | 157.791 | € |
| Grid Reinforcement $T_i$ specific | 177.515 | € |
| Grid Connection Route | 16.000 | € |
| TOTAL COST PV park + Storage | 10.814.546 | € |
| **Operational cost** | | |
| Land lease | 3.000 | €/MWp/year |
| Insurance/ MW/year | 3.000 | €/MWp/year |
| Operation& Maintenance/ MW/year | 3.000 | €/MWp/year |
| Balancing & forecasting services | 1.000 | €/MWp/year |
| Accounting, bank, legal, Opcom fees etc | 6.000 | €/year |
| Utlities (energy and water) | 2.000 | €/MWp/year |
| Contingencies/year | 5% | p.a. |
| Security services | 1.000 | €/MWp/year |
| Tax on land and construction | 2.500 | €/year |
| **Financial assumptions** | | |
| Equity | 3.244.364 | € |
| Loan Amount | 7.570.182 | € |
| Leverage | 70% | % |
| VAT credit line (21% of CAPEX hard cost) | 2.271.055 | € |
| Interest rate loan - Euribor 1 M | 2,68 | % |
| Interest Margin | 4,00 | % |
| Loan Maturity | 10 | years |
| Grace period | 12 | months |
| Monthly Instalments | 108 | months |
| Nominal cost of equity | 15% | % p.a. |
| Cost of debt | 6,4% | % p.a. |
| Tax rate | 16% | % p.a. |
| WACC | 8,3% | % p.a. |
| **Financial ratios project** | | |
| IRR project | 22% | % |
| IRR equity | 65% | % |
| NPV project | 5.270.589 | € |
| Payback period | 4 | years |

# Estimated results

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Production (kWh) | 11 009 967 | 10 955 260 | 10 900 818 | 10 846 554 | 10 792 479 | 10 738 669 | 10 685 127 | 10 631 853 | 10 578 844 | 10 526 076 |
| **Selling** | | | | | | | | | | |
| Prices (EUR/kWh) | 0.0603 | 0.0606 | 0.0609 | 0.0612 | 0.0615 | 0.0618 | 0.0621 | 0.0624 | 0.0628 | 0.0631 |
| Sales revenue (EUR) | 663 901.0 | 663 905.2 | 663 909.0 | 663 907.1 | 663 900.2 | 663 893.0 | 663 885.8 | 663 878.6 | 663 871.5 | 663 862.8 |
| **Total (EUR)** | | | | | | | | | | |
| **Revenues** | **663 901.0** | **663 905.2** | **663 909.0** | **663 907.1** | **663 900.2** | **663 893.0** | **663 885.8** | **663 878.6** | **663 871.5** | **663 862.8** |
| Maintenance | 45 517.5 | 46 427.9 | 47 356.4 | 48 303.5 | 49 269.6 | 50 255.0 | 51 260.1 | 52 285.3 | 53 331.0 | 54 397.6 |
| Inverter renewal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Results** | **618 383.5** | **617 477.3** | **616 552.6** | **615 603.5** | **614 630.6** | **613 638.0** | **612 625.7** | **611 593.3** | **610 540.5** | **609 465.2** |

| Year | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|
| Production (kWh) | 10 473 558 | 10 421 303 | 10 369 283 | 10 317 491 | 10 265 941 | 10 214 649 | 10 163 588 | 10 112 770 | 10 062 207 | 10 011 896 |
| **Selling** | | | | | | | | | | |
| Prices (EUR/kWh) | 0.0634 | 0.0637 | 0.0640 | 0.0643 | 0.0647 | 0.0650 | 0.0653 | 0.0656 | 0.0660 | 0.0663 |
| Sales revenue (EUR) | 663 853.4 | 663 844.0 | 663 832.9 | 663 819.8 | 663 805.6 | 663 791.5 | 663 775.7 | 663 759.1 | 663 742.5 | 663 725.9 |
| **Total (EUR)** | | | | | | | | | | |
| **Revenues** | **663 853.4** | **663 844.0** | **663 832.9** | **663 819.8** | **663 805.6** | **663 791.5** | **663 775.7** | **663 759.1** | **663 742.5** | **663 725.9** |
| Maintenance | 55 485.6 | 56 595.3 | 57 727.2 | 58 881.7 | 60 059.4 | 61 260.6 | 62 485.8 | 63 735.5 | 65 010.2 | 66 310.4 |
| Inverter renewal | 502 912.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Results** | **105 455.0** | **607 248.7** | **606 105.7** | **604 938.1** | **603 746.3** | **602 530.9** | **601 290.0** | **600 023.6** | **598 732.3** | **597 415.5** |

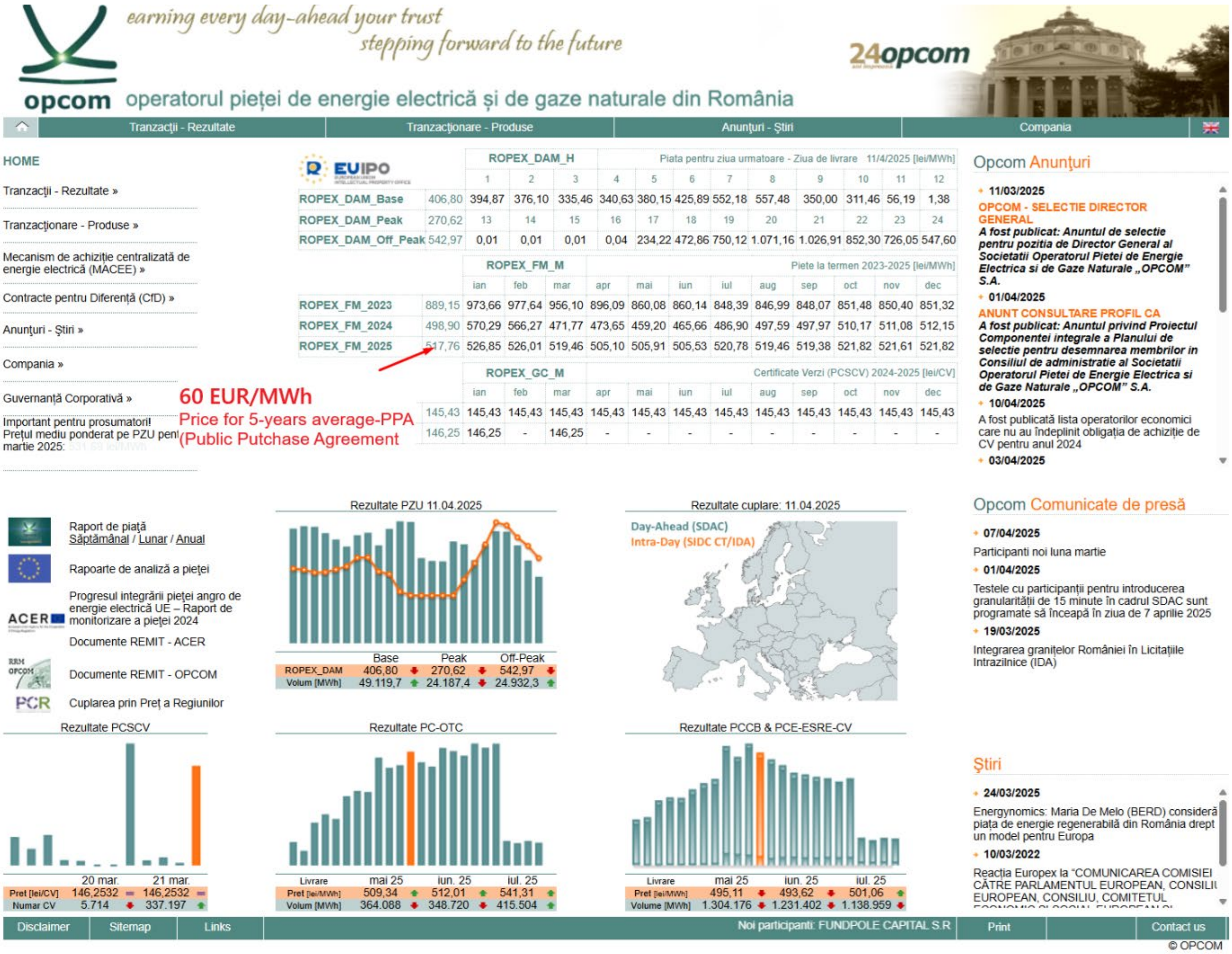
**Cash flow illustration (EUR):**




| Years | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| EUR | -3 844 116 | -3 226 639 | -2 610 086 | -1 994 482 | -1 379 851 | -766 213 | -153 587 | 458 006 | 1 068 547 | 1 678 012 |

| Years | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|
| EUR | 1 783 467 | 2 390 716 | 2 996 822 | 3 601 760 | 4 205 506 | 4 808 037 | 5 409 327 | 6 009 351 | 6 608 083 | 7 205 499 |

**According to www.opcom.ro



opcom — operatorul pieței de energie electrică și de gaze naturale din România

earning every day-ahead your trust / stepping forward to the future — 24opcom

Tranzacții - Rezultate | Tranzacționare - Produse | Anunțuri - Știri | Compania

| ROPEX_DAM_H | | Piata pentru ziua urmatoare - Ziua de livrare 11/4/2025 [lei/MWh] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| ROPEX_DAM_Base | 406,80 | 394,87 | 376,10 | 335,46 | 340,63 | 380,15 | 425,89 | 552,18 | 557,48 | 350,00 | 311,46 | 56,19 | 1,38 |
| ROPEX_DAM_Peak | 270,62 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| ROPEX_DAM_Off_Peak | 542,97 | 0,01 | 0,01 | 0,01 | 0,04 | 234,22 | 472,86 | 750,12 | 1.071,16 | 1.026,91 | 852,30 | 726,05 | 547,60 |

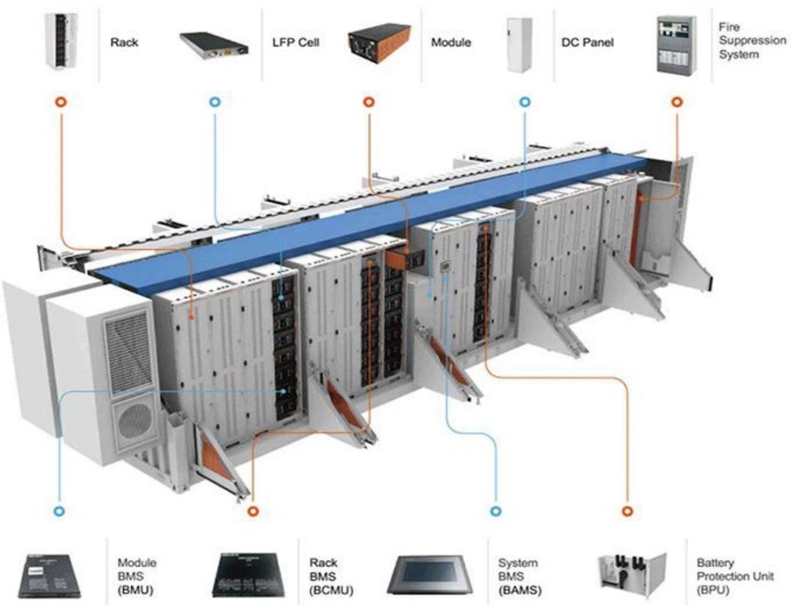
| ROPEX_FM_M | | Piete la termen 2023-2025 [lei/MWh] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ian | feb | mar | apr | mai | iun | iul | aug | sep | oct | nov | dec |
| ROPEX_FM_2023 | 889,15 | 973,66 | 977,64 | 956,10 | 896,09 | 860,08 | 860,14 | 848,39 | 846,99 | 848,07 | 851,48 | 850,40 | 851,32 |
| ROPEX_FM_2024 | 498,90 | 570,29 | 566,27 | 471,77 | 473,65 | 459,20 | 465,66 | 486,90 | 497,59 | 497,97 | 510,17 | 511,08 | 512,15 |
| ROPEX_FM_2025 | 517,76 | 526,85 | 526,01 | 519,46 | 505,10 | 505,91 | 505,53 | 520,78 | 519,46 | 519,38 | 521,82 | 521,61 | 521,82 |

| ROPEX_GC_M | | Certificate Verzi (PCSCV) 2024-2025 [lei/CV] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ian | feb | mar | apr | mai | iun | iul | aug | sep | oct | nov | dec |
| | 145,43 | 145,43 | 145,43 | 145,43 | 145,43 | 145,43 | 145,43 | 145,43 | 145,43 | 145,43 | 145,43 | 145,43 | 145,43 |
| | 146,25 | 146,25 | - | 146,25 | - | - | - | - | - | - | - | - | - |

60 EUR/MWh
Price for 5-years average-PPA
(Public Putchase Agreement

# Technical description of the storage facility

- **(Battery container)**




- **Transformation unit - (MV SKID)**

# Economic Data Storage Facility

## 1. Investment cost

| | Storage Capacity 30 MWh | |
|---|---|---|
| Investment | EUR | **6.000.000,00** |

## 2. Income

For a storage facility, there are several opportunities through which the electricity storage capacity can be used, including:
- Balancing market:
 Revenues: 800-1000 €/MWh;
 Charge/discharge cycles per day: ~ 0.2;
- DAM Arbitrage (Day-After Market):
 Revenues: ~€100/MWh;
 Charge/discharge cycles per day: ~ 1;
- IDM Arbitrage (Intra-Day Market):
 Revenues: ~ 200 €/MWh;
 Charge/discharge cycles per day: ~ 0.5-1;

For a combined scenario of using the storage facility, the following calculation will result, per MWh:

| Combined scenario usage per MWh of storage | | | |
|---|---|---|---|
| | Cycles per day | Price [€/MWh] | Daily income [€] |
| Balancing market arbitrage | 0,2 | 850 | 170 |
| DAM arbitrage | 0,7 | 100 | 70 |
| IDM Arbitrage | 0,75 | 166 | 124,5 |
| **Total** | | | **364,5** |

Emas Business Consulting
Bucuresti, Sector 1, Piata Presei Libere, Nr. 3-5, Tel: 0759.046.530
office@emasconsulting.com
www.emasconsulting.com

# Revenues produced by the storage facility

| Year | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30MWh 2.75 Cycles Charge/Discharge | Income | EUR 3.933.360,00 | EUR 3.854.692,80 | EUR 3.776.025,60 | EUR 3.697.358,40 | EUR 3.618.691,20 | EUR 3.540.024,00 | EUR 3.392.129,66 | EUR 3.382.689,60 | EUR 3.304.022,40 | EUR 3.225.355,20 |
| | Operational costs | EUR 275.335,20 | EUR 269.828,50 | EUR 264.321,79 | EUR 258.815,09 | EUR 253.308,38 | EUR 247.801,68 | EUR 237.449,08 | EUR 236.788,27 | EUR 231.281,57 | EUR 225.774,86 |
| | Profits | **EUR 3.658.024,80** | **EUR 3.584.864,30** | **EUR 3.511.703,81** | **EUR 3.438.543,31** | **EUR 3.365.382,82** | **EUR 3.292.222,32** | **EUR 3.154.680,59** | **EUR 3.145.901,33** | **EUR 3.072.740,83** | **EUR 2.999.580,34** |

# Cashflow

| An | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 30 MWh 2.75 Cycles Charging/Discharging | -2.341.975,20 € | 1.242.889,10 € | 4.754.592,91 € | 8.193.136,22 € | 11.558.519,04 € | 14.850.741,36 € | 18.005.421,95 € | 21.151.323,28 € | 24.224.064,11 € | 27.223.644,44 € |