

Burner

- [Source Code](#)
- [Deployed Contract](#)

The contract provides a way for Lido protocol to burn stETH token shares as a means to finalize withdrawals, penalize untimely exiting node operators, and, possibly, cover losses in staking.

It relies on the [rebasing](#) nature of stETH. The Lido contract calculates user balance using the following equation: $\text{balanceOf}(\text{account}) = \text{shares}[\text{account}] * \text{totalPooledEther} / \text{totalShares}$. Therefore, burning shares (e.g. decreasing the totalShares amount) increases stETH holders' balances.

It's presumed that actual shares burning happens inside the [Lido](#) contract as a part of the [AccountingOracle](#) report. Burner provides a safe and deterministic way to incur a positive stETH token rebase by gradually decreasing totalShares that can be correctly handled by 3rd party protocols integrated with stETH.

Burner accepts burning requests in the following two ways:

- Locking someone's pre-approved
- stETH by the caller with the assigned REQUEST_BURN_SHARES_ROLE
- ;
- Locking caller-provided
- stETH with the REQUEST_BURN_MY_STETH_ROLE
- assigned role.

Those burn requests are initially set by the contract to a pending state. Actual burning happens as part of an oracle ([AccountingOracle](#)) report handling by [Lido](#) to prevent additional fluctuations of the existing stETH token rebase period (~24h).

We also distinguish two types of shares burn requests:

- request to cover
- a slashing event (e.g. decreasing of the total pooled ETH amount
- between the two consecutive oracle reports);
- request to burn shares for any other cases (non-cover
-).

The contract has two separate counters for the burnt shares: cover and non-cover ones. The contract is exclusively responsible for the stETH shares burning by [Lido](#) and burning allowed only from the contract's own balance only.

Shares burnt counters

The contract keeps count of all shares ever burned by way of maintaining two internal counters: totalCoverSharesBurnt and totalNonCoverSharesBurnt for cover and non-cover burns, respectively. These counters are increased when actual stETH burn is performed as part of the Lido Oracle report.

This makes it possible to split any stETH rebase into two sub-components: the rewards-induced rebase and cover application-induced rebase, which can be done as follows:

1. Before the rebase, store the previous values of both counters, as well as the value of stETH share price:
2. prevCoverSharesBurnt
3. =
4. Burner
5. .
6. totalCoverSharesBurnt
7. (
8.)
9. prevSharePrice
10. =
11. stETH
12. .
13. totalSupply
14. (
15.)
16. /
17. stETH
18. .
19. getTotalShares
20. (

```

21. )
22. After the rebase, perform the following calculations:
23. sharesBurntFromOldToNew
24. =
25. Burner
26. .
27. totalCoverSharesBurnt
28. (
29. )
30. -
31. prevCoverSharesBurnt
32. ;
33. newSharePriceAfterCov
34. =
35. stETH
36. .
37. totalSupply
38. (
39. )
40. /
41. (
42. stETH
43. .
44. getTotalShares
45. (
46. )
47. +
48. sharesBurntFromOldToNew
49. )
50. ;
51. newSharePrice
52. =
53. stETH
54. .
55. totalSupply
56. (
57. )
58. /
59. stETH
60. .
61. getTotalShares
62. (
63. )
64. ;
65. // rewards-induced share price increase
66. rewardPerShare
67. =
68. newSharePriceAfterCov
69. -
70. prevSharePrice
71. ;
72. // cover-induced share price increase
73. nonRewardSharePriceIncrease
74. =
75. newSharePrice
76. -
77. prevSharePrice
78. -
79. rewardPerShare
80. ;

```

View methods

getCoverSharesBurnt()

Returns the total cover shares ever burnt.

function

getCoverSharesBurnt ()

external

view

returns

(uint256)

getNonCoverSharesBurnt()

Returns the total non-cover shares ever burnt.

function

getNonCoverSharesBurnt ()

external

view

returns

(uint256)

getExcessStETH()

Returns the stETH amount belonging to the burner contract address but not marked for burning.

function

getExcessStETH ()

external

view

returns

(uint256)

getSharesRequestedToBurn()

Returns numbers of cover and non-cover shares requested to burn.

function

getSharesRequestedToBurn ()

external

view

returns

(uint256 coverShares ,

uint256 nonCoverShares)

Methods

requestBurnMyStETHForCover()

Transfers stETH tokens from the message sender and irreversibly locks these on the burner contract address. Internally converts tokens amount into underlying shares amount and marks the converted shares amount for cover-backed burning by increasing the internalcoverSharesBurnRequested counter.

function

requestBurnMyStETHForCover (uint256 _stETHAmountToBurn)

external note Reverts if any of the following is true:

- msg.sender
- is not a holder of theREQUEST_BURN_MY_STETH_ROLE
- role;
- no stETH provided (_stETHAmountToBurn == 0
-);
- no stETH transferred (allowance exceeded).

Parameters

Name	Type	Description
_stETHAmountToBurn	uint256	stETH tokens amount (not shares amount) to burn

requestBurnSharesForCover()

Transfers stETH shares from _from and irreversibly locks these on the burner contract address. Internally marks the shares amount for cover-backed burning by increasing the internalcoverSharesBurnRequested counter.

Can be called only by a holder ofREQUEST_BURN_SHARES_ROLE . After Lido V2 upgrade not actually called by any contract and supposed to be called by Lido DAO Agent in case of a need for cover.

function

requestBurnSharesForCover (address _from ,

uint256 _sharesAmountToBurn) note Reverts if any of the following is true:

- msg.sender
- is not a holder of theREQUEST_BURN_SHARES_ROLE
- role;
- no stETH shares provided (_sharesAmountToBurn == 0
-);
- no stETH shares transferred (allowance exceeded).

Parameters

Name	Type	Description
_from	address	address to transfer shares from
_sharesAmountToBurn	uint256	shares amount (not stETH tokens amount) to burn

requestBurnMyStETH()

Transfers stETH tokens from the message sender and irreversibly locks these on the burner contract address. Internally converts tokens amount into underlying shares amount and marks the converted amount for non-cover backed burning by increasing the internalnonCoverSharesBurnRequested counter.

function

requestBurnMyStETH (uint256 _stETHAmountToBurn)

external note Reverts if any of the following is true:

- msg.sender
- is not a holder of theREQUEST_BURN_MY_STETH_ROLE
- role;
- no stETH provided (_stETHAmountToBurn == 0
-);
- no stETH transferred (allowance exceeded).

Parameters

Name	Type	Description
_stETHAmountToBurn	uint256	stETH tokens amount (not shares amount) to burn

requestBurnShares()

Transfers stETH shares from _from and irreversibly locks these on the burner contract address. Internally marks the shares amount for non-cover backed burning by increasing the internalnonCoverSharesBurnRequested counter.

Can be called only by a holder of theREQUEST_BURN_SHARES_ROLE role which after Lido V2 upgrade is either [Lido](#) or [NodeOperatorsRegistry](#) . [Lido](#) needs this to request shares locked on the [WithdrawalQueueERC721](#)

and [NodeOperatorsRegistry](#) needs it to request burning shares to penalize the rewards of misbehaving node operators.

function

requestBurnShares (address _from ,

uint256 _sharesAmountToBurn) note Reverts if any of the following is true:

- msg.sender
- is not a holder of REQUEST_BURN_SHARES_ROLE
- role;
- no stETH shares provided (_sharesAmountToBurn == 0
-);
- no stETH shares transferred (allowance exceeded).

Parameters

Name	Type	Description
_from	address	address to transfer shares from
_sharesAmountToBurn	uint256	shares amount (not stETH tokens amount) to burn

recoverExcessStETH()

Transfers the excess stETH amount (e.g. belonging to the burner contract address but not marked for burning) to the Lido treasury address (theDAO Agent contract) set upon the contract construction.

Does nothing if thegetExcessStETH view func returns 0 (zero), i.e. there is no excess stETH on the contract's balance.

function

recoverExcessStETH ()

external

recoverERC20()

Transfers a given amount of an ERC20-token (defined by the provided contract address) belonging to the burner contract address to the Lido treasury (theDAO Agent contract) address.

function

recoverERC20 (address _token ,

uint256 _amount)

external note Reverts if any of the following is true:

- _amount
- value is 0 (zero);
- _token
- address is 0 (zero);
- _token
- address equals to thestETH
- address (userecoverExcessStETH
- instead).

Parameters

Name	Type	Description
_token	address	ERC20-compatible token address to recover
_amount	uint256	Amount to recover

recoverERC721()

Transfers a given ERC721-compatible NFT (defined by the contract address) belonging to the burner contract address to the Lido treasury (theDAO Agent) address.

function

recoverERC721 (address _token ,

uint256 _tokenId)

external note Reverts if any of the following is true:

- `_token`
- address is 0 (zero);
- `_token`
- address equals to `theStETH`
- address (`userRecoverExcessStETH` instead).

Parameters

Name	Type	Description
<code>_token</code>	address	ERC721-compatible token address to recover
<code>_tokenId</code>	uint256	Token id to recover

commitSharesToBurn()

Marks previously requested to burn cover and non-cover share as burnt. Emits `StETHBurnt` event for the cover and non-cover shares marked as burnt.

This function is called by the `Lido` contract together with (i.e., the same tx) performing the actual shares burning.

If `_sharesToBurn` is 0 does nothing.

function

`commitSharesToBurn (uint256 _sharesToBurn)`

external note Reverts if any of the following is true:

- `msg.sender`
- address is NOT equal to `theStETH`
- address;
- `_sharesToBurn`
- is greater than the cover plus non-cover shares requested to burn.

Parameters

Name	Type	Description
<code>_sharesToBurn</code>	uint256	Amount of cover plus non-cover shares to mark as burnt

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