Unleash the Power of Flexibility with Shapeshifter: A Universal Flex Trading Protocol

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Outline

- What problem are we trying to solve?
- What is Shapeshifter and how does it work?
- How to use it?
The Dutch grid is at its limits

Source: https://capaciteitskaart.netbeheernederland.nl/ (electricity consumption)
Trends in the Energy Transition

- Centralized to decentralized production
- Increasing electrification
- Increasing simultaneity
Flex optimizes grid utilization

Daily grid load

- Contracted capacity
- Grid capacity
- Expected use

MW

0:00 12:00 24:00
Flex optimizes grid utilization

Daily grid load

Contracted capacity
Grid capacity
Expected use

MW →

0:00 12:00 24:00
Flex optimizes grid utilization

Daily grid load

Contracted capacity
Expected use
Grid capacity

MW

0:00 12:00 24:00
Flex optimizes grid utilization
Congestion management

Create Insight
Identify Problems
Choose a Solution
Activate Solution
Evaluate and Settle
Introducing Shapeshifter

Shapeshifter implements the **Universal Smart Energy Framework** for flexibility forecasting, offering, ordering, and settlement processes.

USEF was founded in 2014 with the common goal of developing a smart energy system that benefits all participants. USEF has been put into practice by Dutch DSO’s. And in other European countries, USEF has also been used and/or implemented as a reference.

Update on framework in January 2020 based on learning experiences from implementations and in collaboration with DSO’s and aggregators.

In 2021 UFTP is part of the Linux Foundation Energy Flexibility Suite as Shapeshifter.

To increase community involvement, Shapeshifter will be present at the LFE Summit in June 2023.

USEF Flex Trading Protocol (UFTP) is a subset of USEF and specifically aimed at flexible trading between the Aggregator and DSO or TSO.
Typical Shapeshifter flex applications

- Solar parks
- Wind parks
- Freezer warehouses
- Farms with solar
- Steel mills
- Greenhouses
The Shapeshifter project

- Specification + XML schemas
- Technical Steering Committee
- Java library (Alliander, GOPACS, SP)
- Python library (Enexis)

- Apache 2.0 license
- OpenSSF best practices (change control, reporting, quality, security)
- LF Energy

Shapeshifter (github.com)
Flex trading options

Shapeshifter is designed and used for bilateral trade between DSO and AGR and for trade via a coordination platform.
### Implementations

<table>
<thead>
<tr>
<th>Fusion</th>
<th>GOPACS</th>
<th>Grid operators</th>
</tr>
</thead>
</table>
| ![Fusion Logo](image)  
**Shapeshifter is implemented in the UK for congestion management in a demonstration project** | ![GOPACS Logo](image)  
**Shapeshifter is also used to activate capacity limit contracts at GOPACS in the Netherlands** | ![Enexis Logo](image)  
DSOs in The Netherlands are using Shapeshifter to facilitate trade with AGRs. |
Example conversation

Validate

- FlexRequest
- determine offers
- [optional] D-prognosis
- FlexRequest
- determine offers
- FlexOffer
- FlexOrder
- [optional] (updated) D-prognosis

- non-aggregator forecast
- Grid safety analysis → NOK
- Evaluate offers
- Grid safety analysis → OK
Message format

REST/XML API: messages are validated against XML schemas

NaCl cryptography (“salt”, 2012)
Public-private key encryption (Ed25519) providing authentication and prevent tampering

POST /v3/shapeshifter/messages

<SignedMessage SenderDomain="dso.nl" SenderRole="DSO"
Body="SwGOfsa4bZ9ghmuQmm71vTkg..."/>
Example FlexRequest

```xml
<FlexRequest SenderDomain="dso.nl" RecipientDomain="agr.nl"
  TimeStamp="2021-10-29T06:54:26.861Z"
  ISP-Duration="PT15M"
  TimeZone="Europe/Amsterdam"
  Period="2021-10-30"
  ContractID="A-AA-A-12345"
  CongestionPoint="ean.265987182507322951">
  <ISP Disposition="Requested" MinPower="0" MaxPower="50000000" Start="48"
        Duration="1"/>
  <ISP Disposition="Requested" MinPower="0" MaxPower="60000000" Start="49"
        Duration="3"/>
</FlexRequest>
```

Meaning: “Please limit your power consumption to:
- 50 MW between 12:00 and 12:15 o’clock and
- 60 MW between 12:15 and 13:00 o’clock.”
<FlexOffer SenderDomain="agr.nl" RecipientDomain="dso.nl"
  TimeStamp="2021-10-29T06:54:36.8868538Z"
  MessageID="338ed243-5517-4400-962e-2b7b812c468c"
  ConversationID="48cdc3d2-56c0-436c-8d5a-6f6cc3dc538d"
  FlexRequestMessageID="d3ae4836-55b1-4084-b54e-34107b22648c"
  <OfferOption OptionReference="ba40a5f8-849b-4fe6-958f-e628a1653558"
    Price="20.00">
    <ISP Power="50000000" Start="48"/>
    <ISP Power="60000000" Start="49"/>
    <ISP Power="60000000" Start="50"/>
    <ISP Power="60000000" Start="51"/>
  </OfferOption>
</FlexOffer>

Some attributes omitted for clarity.
Example FlexOrder

<FlexOrder SenderDomain="dso.nl" RecipientDomain="agr.nl"
ConversationID="48cdc3d2-56c0-436c-8d5a-6f6cc3dc538d"
FlexOfferMessageID="338ed243-5517-4400-962e-2b7b812c468c"
  <ISP Power="50000000" Start="48" Duration="1"/>
  <ISP Power="60000000" Start="49" Duration="3"/>
</FlexOrder>

Some attributes omitted for clarity.
What’s next

• Current challenges

• How you can contribute:
  • Report issues (bugs or feature requests)
  • Review or improve the specification
  • Contribute or review code in the Java or Python library
  • Create a new library for your programming language
Want to know more?

• Subscribe to the mailing list or join a TSC meeting at https://lfenergy.org/projects/shapeshifter/
• See Shapeshifter (github.com) or the Shapeshifter specification at https://shapeshifter.github.io/shapeshifter-specification/

Or talk to us today!