

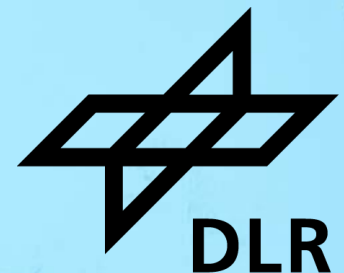
Insights on Modelling Practices and Tool Preferences

Results of a Public Survey in the Energy Domain

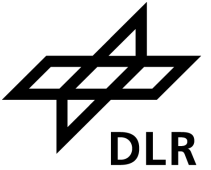
Christoph Schimeczek¹, Felix Nitsch², Daniel Zapf¹

¹German Aerospace Center (DLR), Institute of Networked Energy Systems, Stuttgart

²BOKU University, Institute of Sustainable Economic Development, Vienna



Motivation



- Hundreds of (open source) energy modelling tools exist
 - 214 listed on [Open Energy Modelling Tool Tracker](#)
 - Which programming languages are used?
 - Which software practices are employed?
 - What to recommend early career colleagues?
- Status quo assessment of models and practices

Survey Design

Overview



Participant Background

- Role
- Experience level

Modelling Experience

- With programming languages
- With energy modelling tools

Model Selection Criteria

- Importance of factors
- Encountered barriers

Software Development Practices

- Employed techniques
- Collaboration

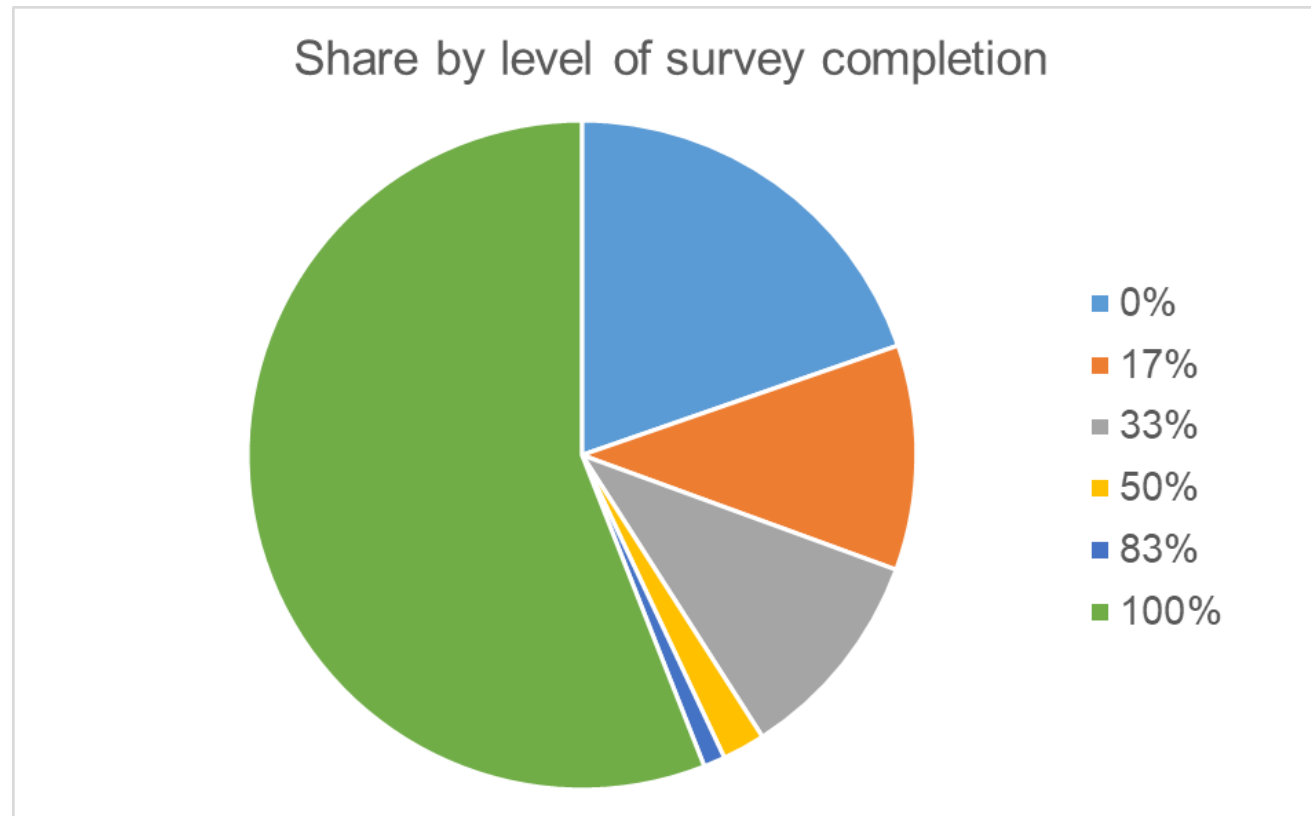
Survey Design

Implementation



- Implemented with [LimeSurvey](#)
- Open from October 13th 2025 to November 10th 2025
- Publicly available, disseminated at
 - [openmod forum](#)
 - [Strommarkttreffen](#) & Newsletters
 - NFDI4Energy Newsletter
 - LinkedIn
- Of 193 participants that started...
 - 155 submitted at least 1 answer
 - 108 completed the survey
 - All provided answers used

Results are not representative!



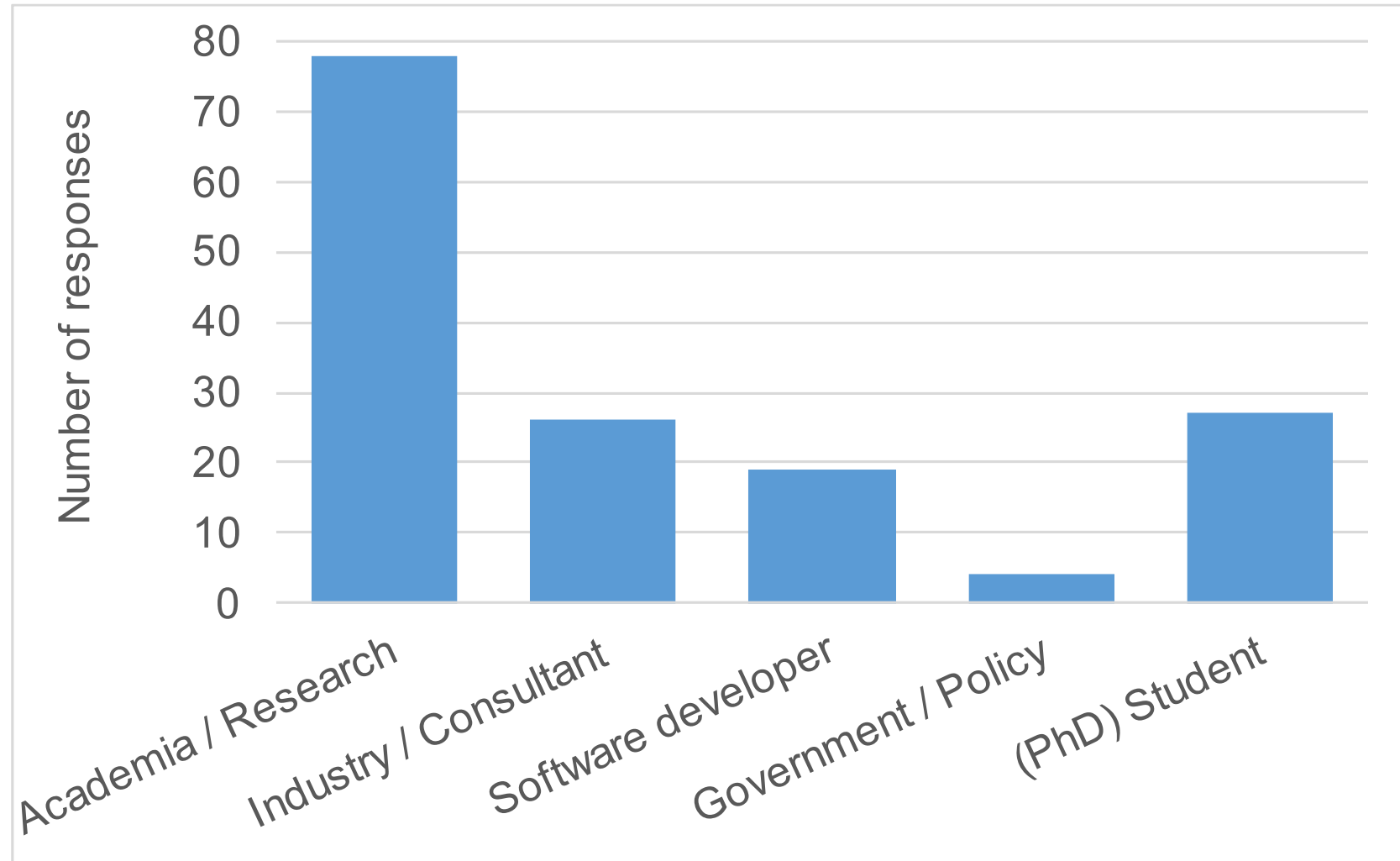
Participants

Participants

What is your *primary role*?



Participants
are mostly from academia



Participants

What is your *primary role*?



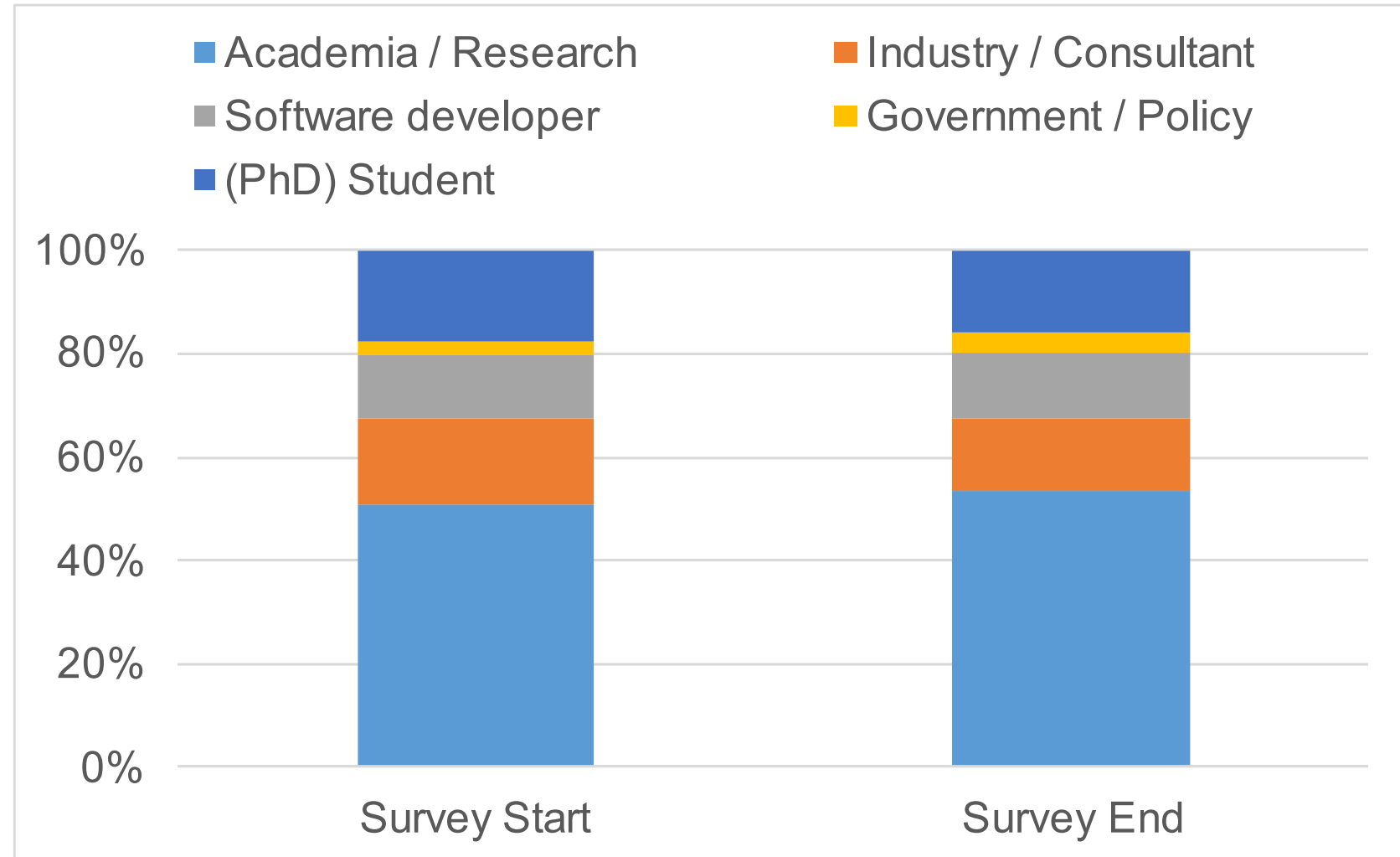
Participants

are mostly from academia

Survey discipline

is about equal across roles

→ Low bias towards later questions

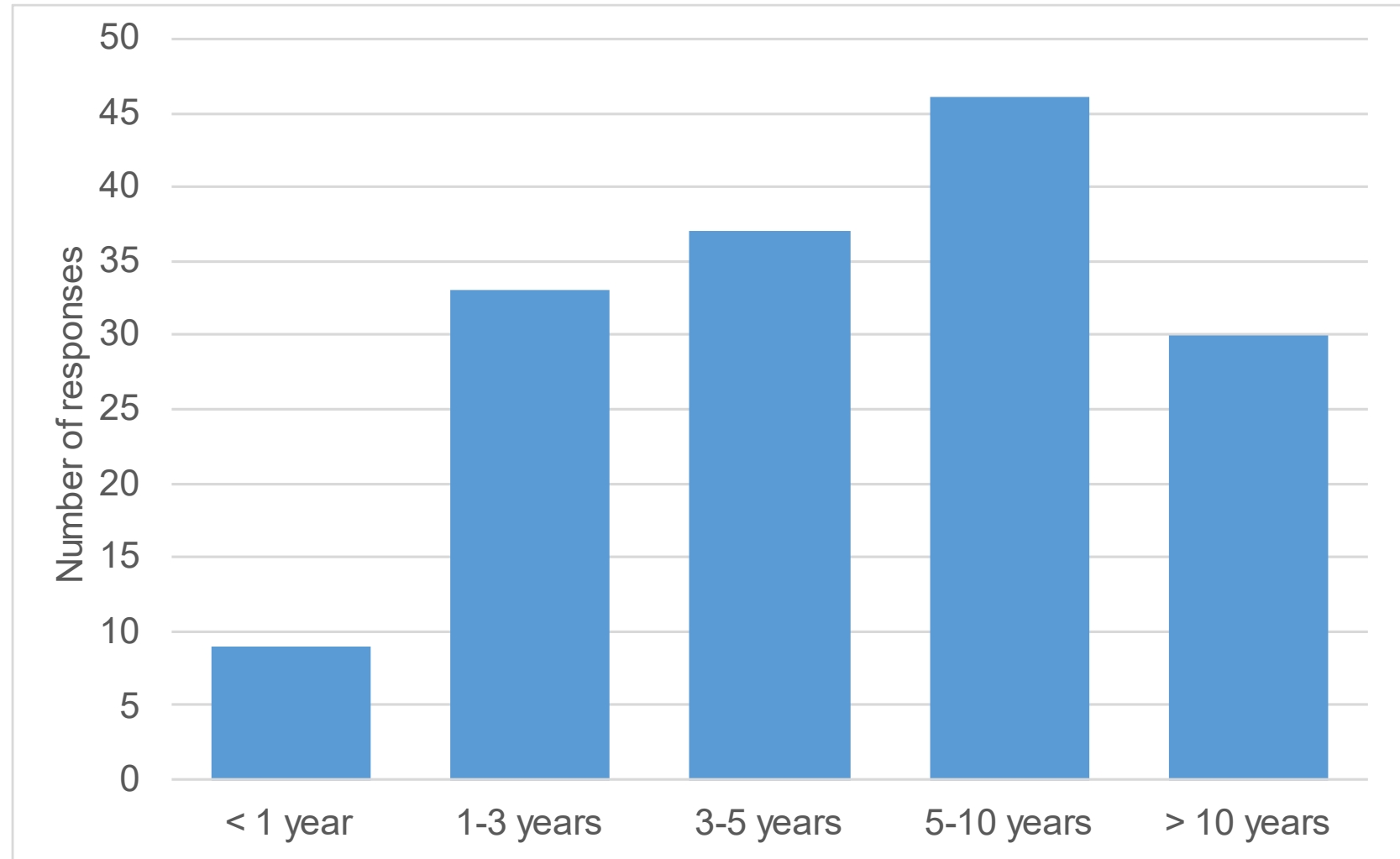


Participants

How many years of *experience* do you have in *energy systems analysis*?



Participants
are quite experienced



Participants

How many years of *experience* do you have in *energy systems analysis*?



Participants

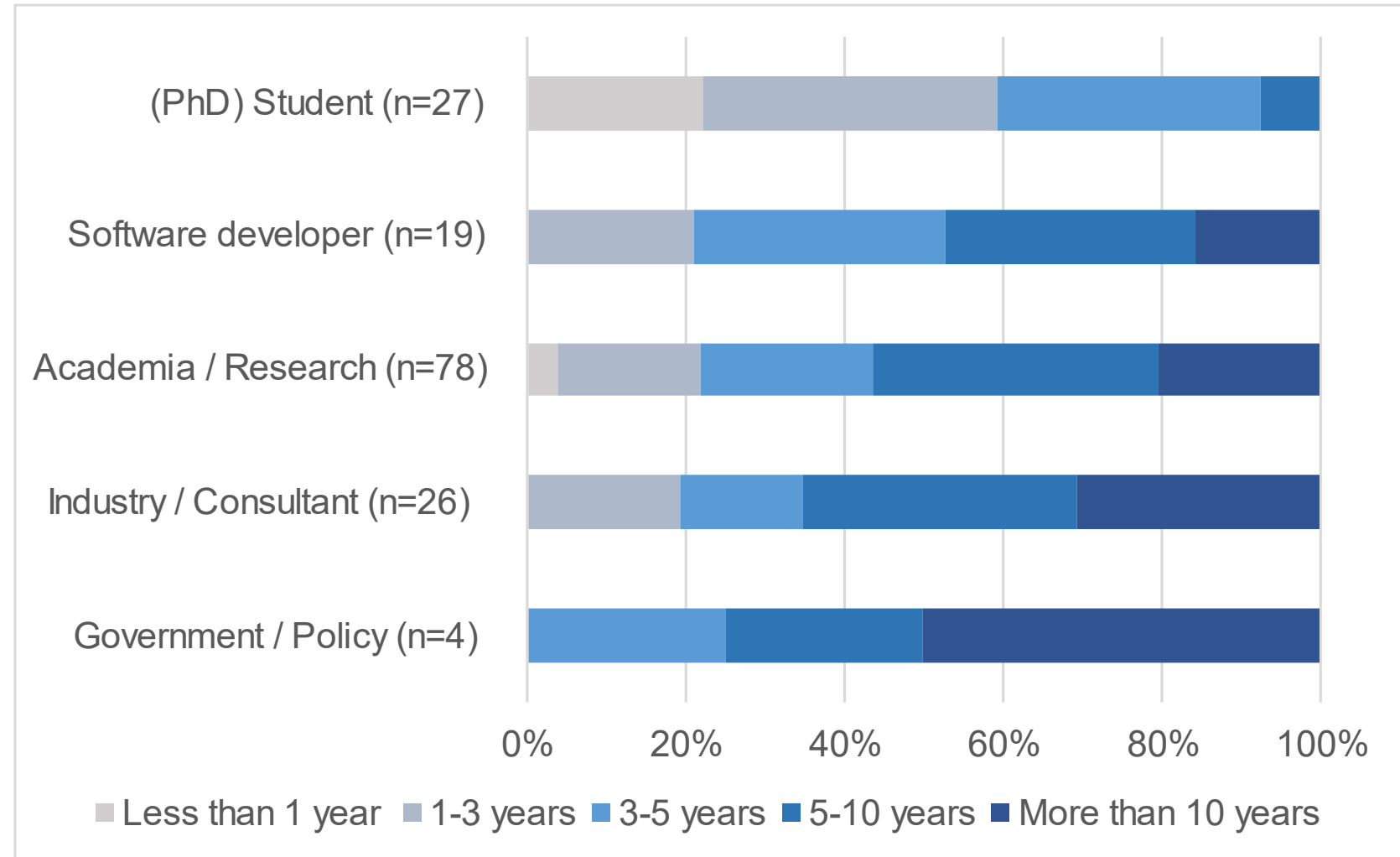
are quite experienced

Least experience

Students (average < 3 years)

Most experience

Analysts from industry / policy
(average > 7 years)

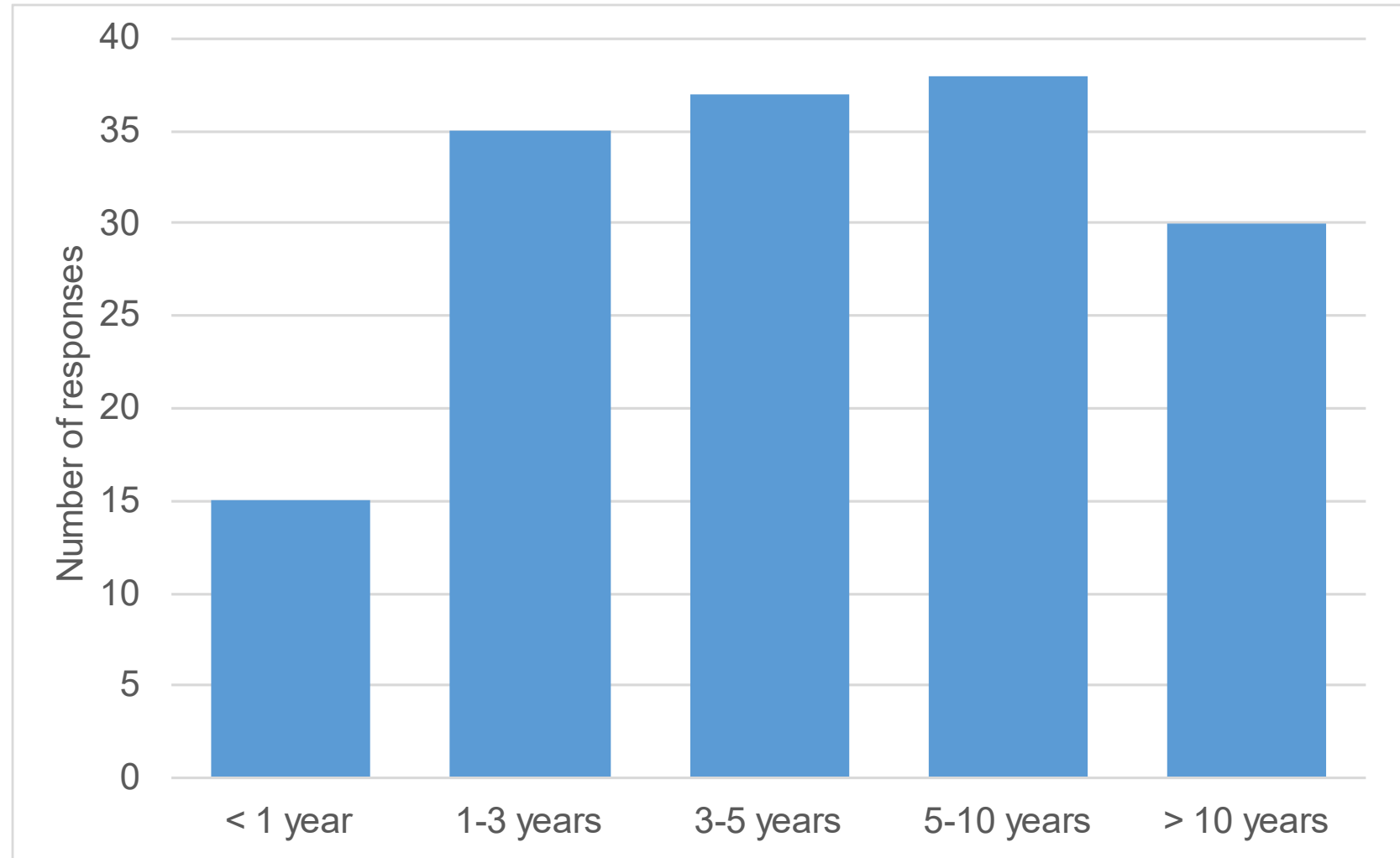


Participants

How many years of *experience* do you have in *software engineering*?



Most participants
have 3+ years experience



Participants

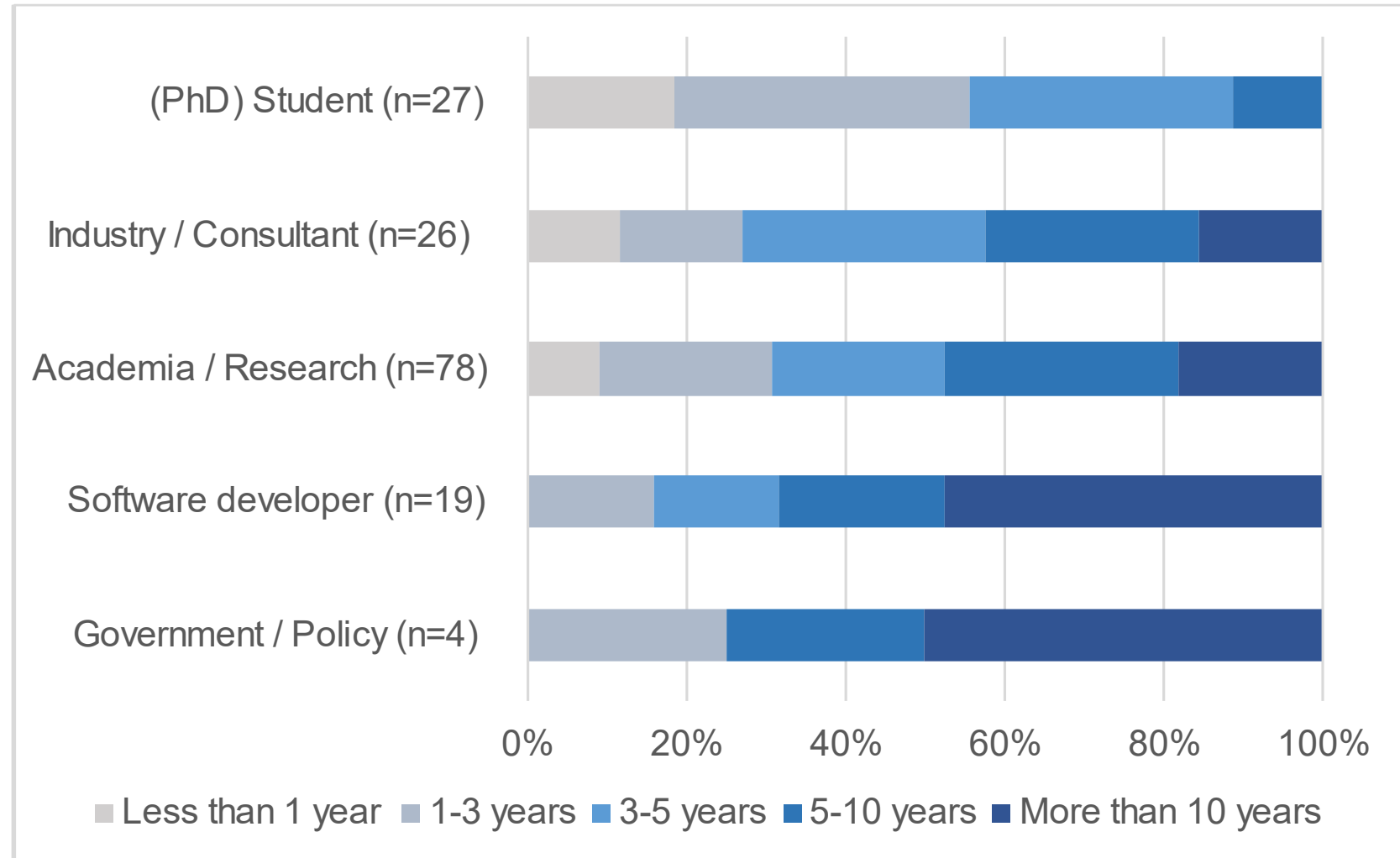
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Most participants
have 3+ years experience

Least experience
Students (average < 3 years)

Most experience
Software devs & policy
analysts (average > 7 years)



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Modelling Languages

Modelling Languages

Which *programming languages* do you currently use for modelling energy systems?



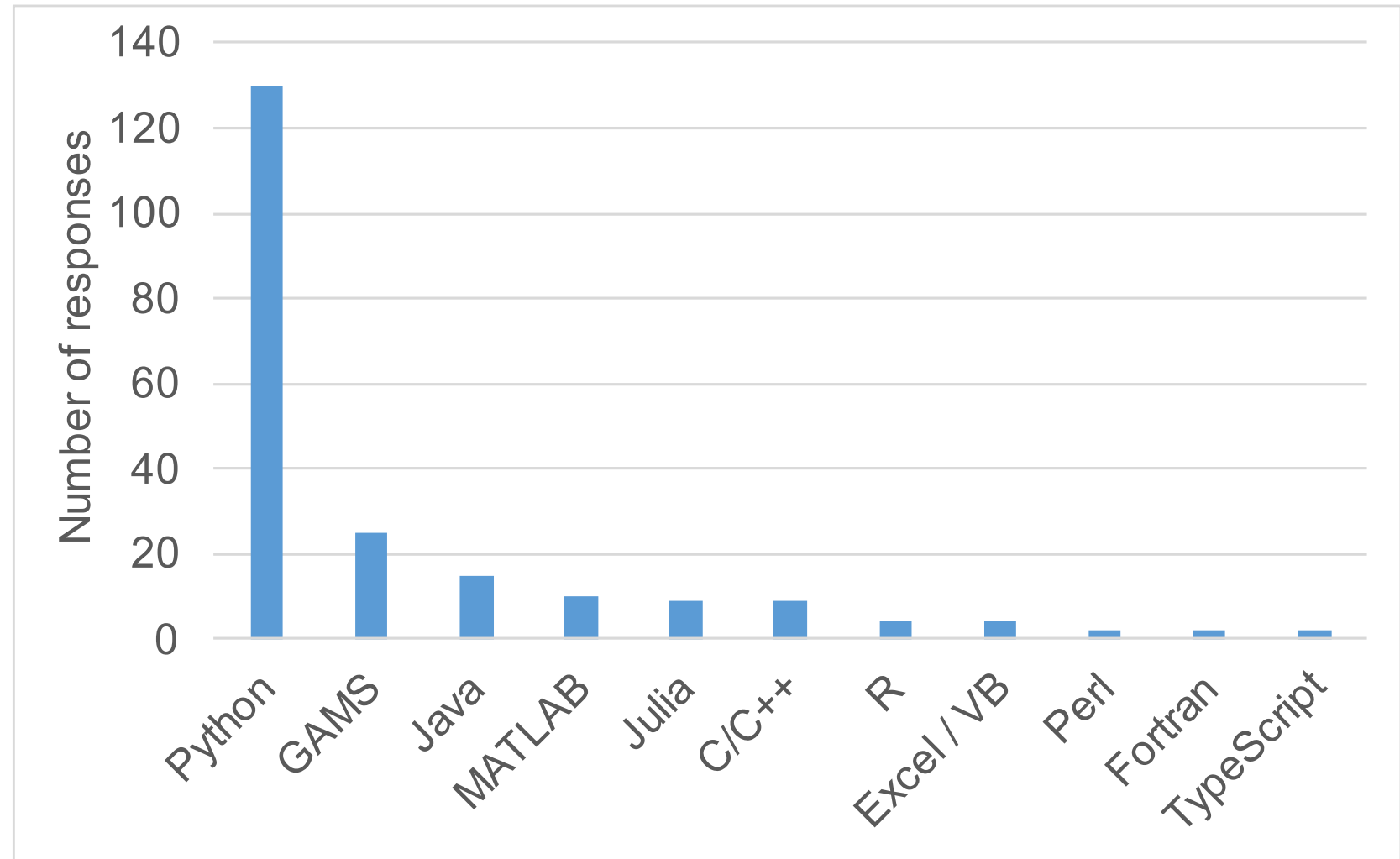
Multiple choice + Free text

By far most used

Python

Not shown: 1 mention

Scala, Rust, Go, Modelica, csh, Gurobi, GIS, F#, ...



Modelling Languages

Which *programming languages* do you *currently use* for modelling energy systems?



Multiple choice + Free text

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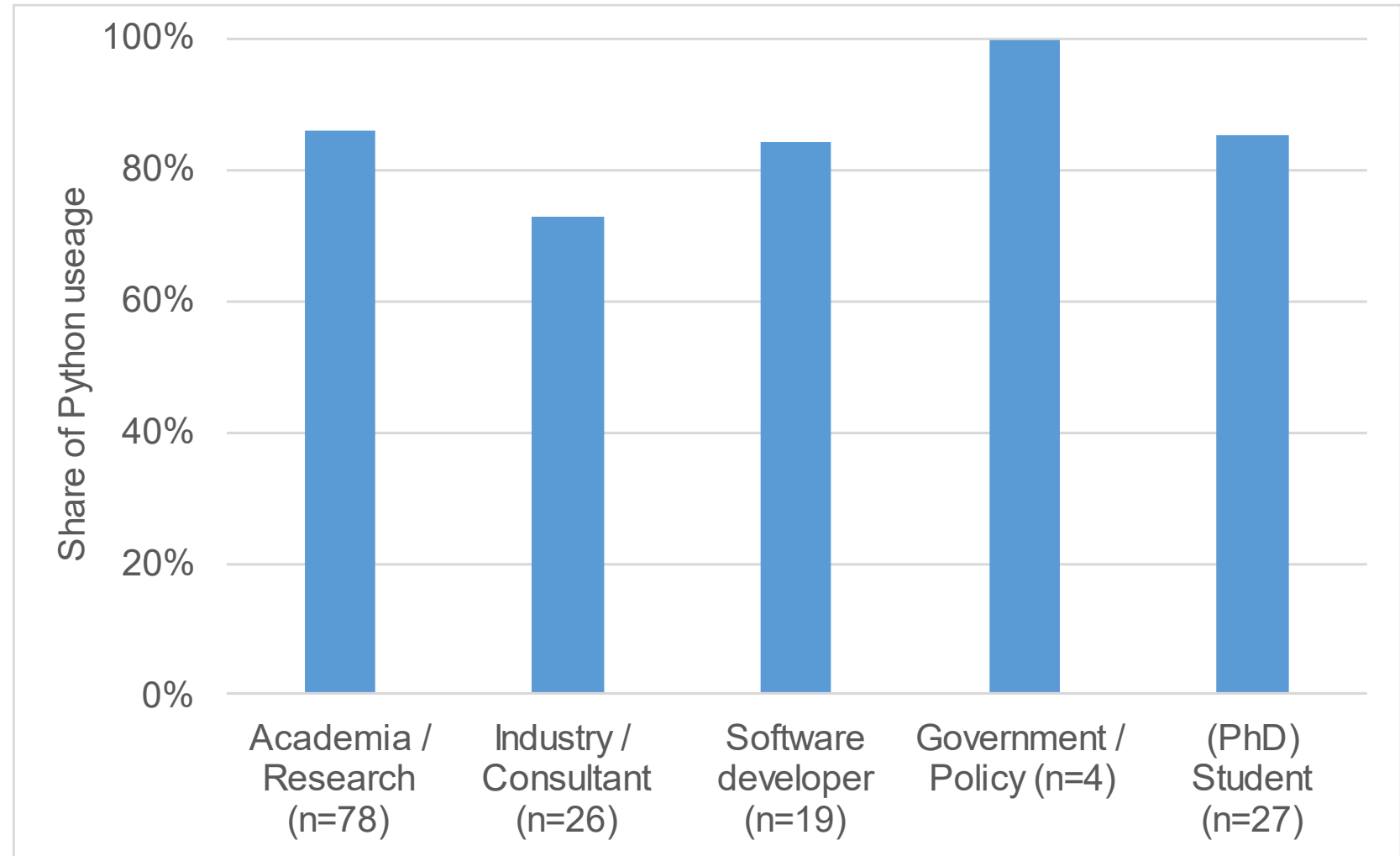
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Python popularity

High across the board,
Slightly less in industry



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Multiple choice + Free text

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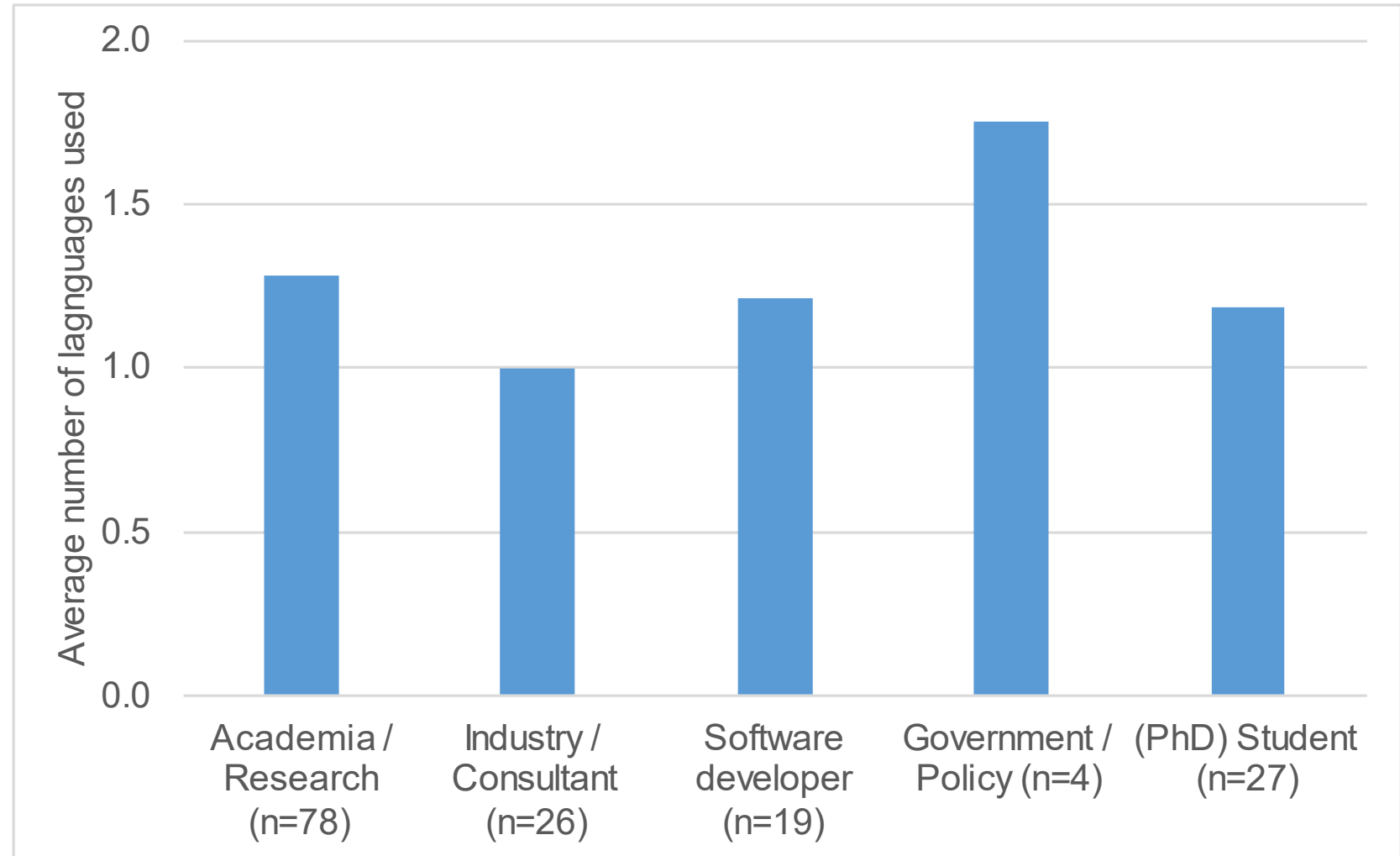
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High across the board,
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Number of languages

On average 1.2 actively used



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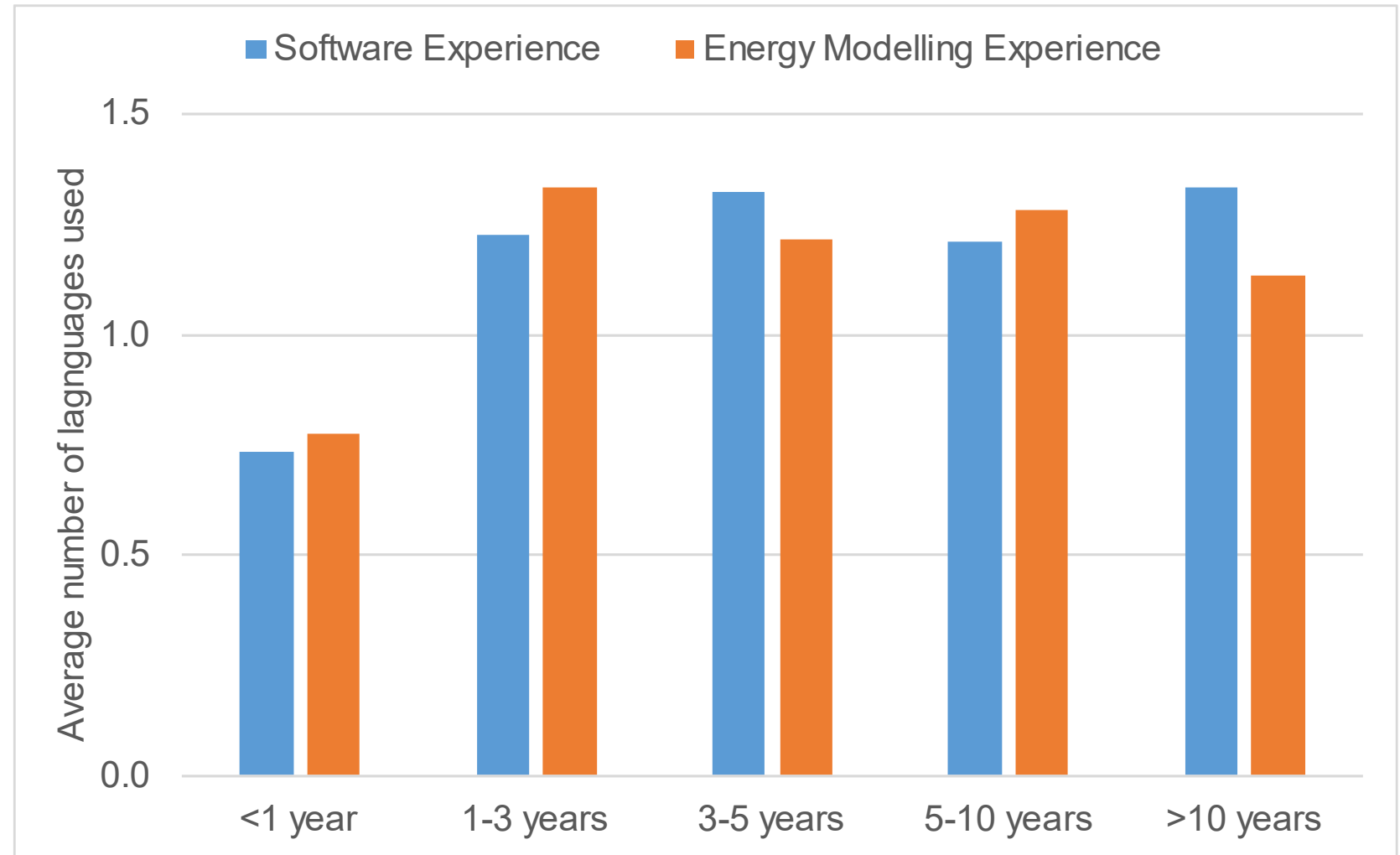
Scala, Rust, Go, Modelica,
csh, Gurobi, GIS, F#, ...

Python popularity

High across the board,
Slightly less in industry

Number of languages

On average 1.2 actively used
(except beginners)



Modelling Languages

What is your *PRIMARY* programming language for modelling energy systems?

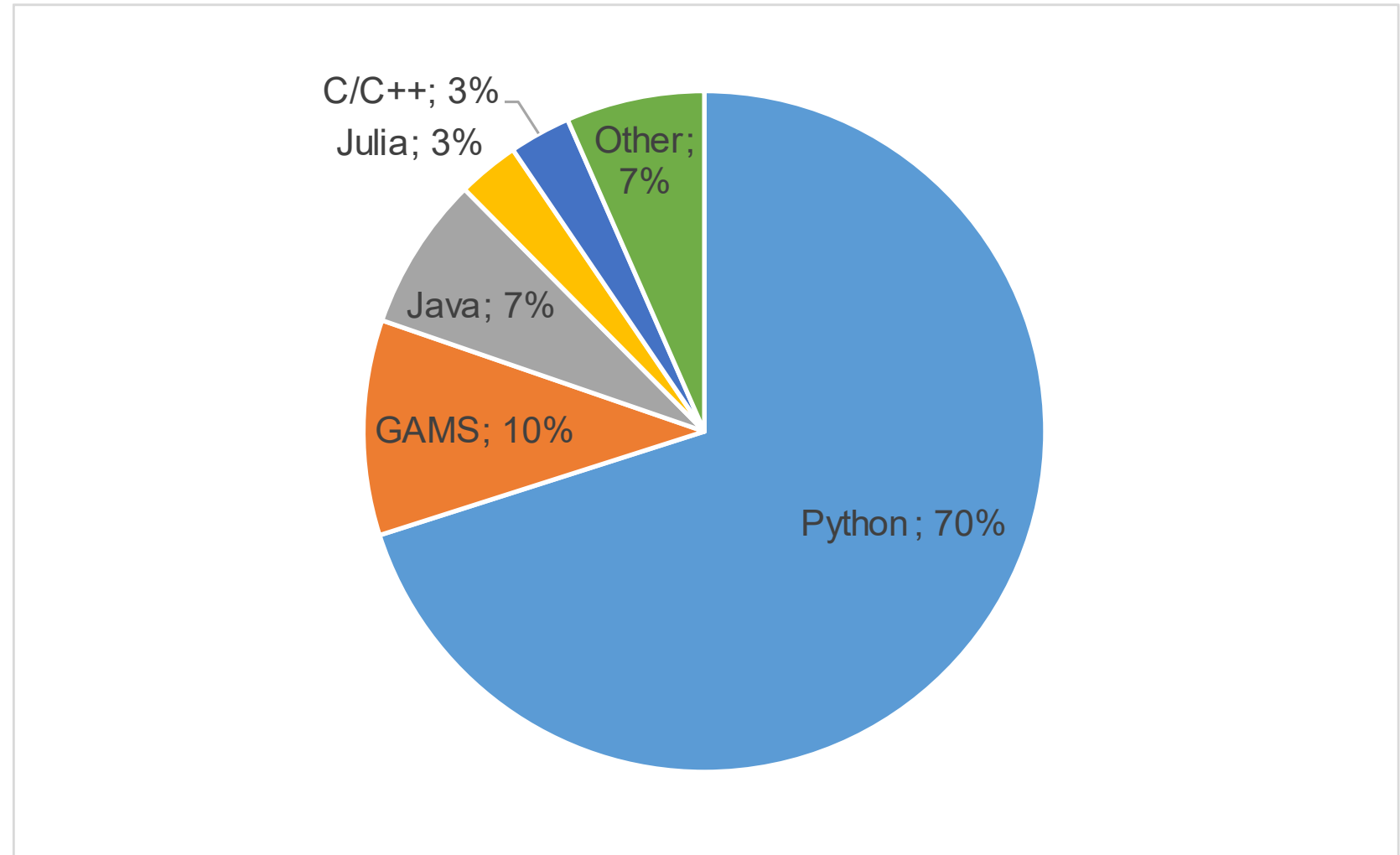


By far most used

Python

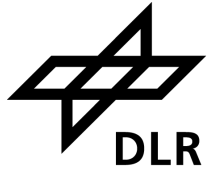
Honourable mentions

GAMS, Java



Modelling Languages

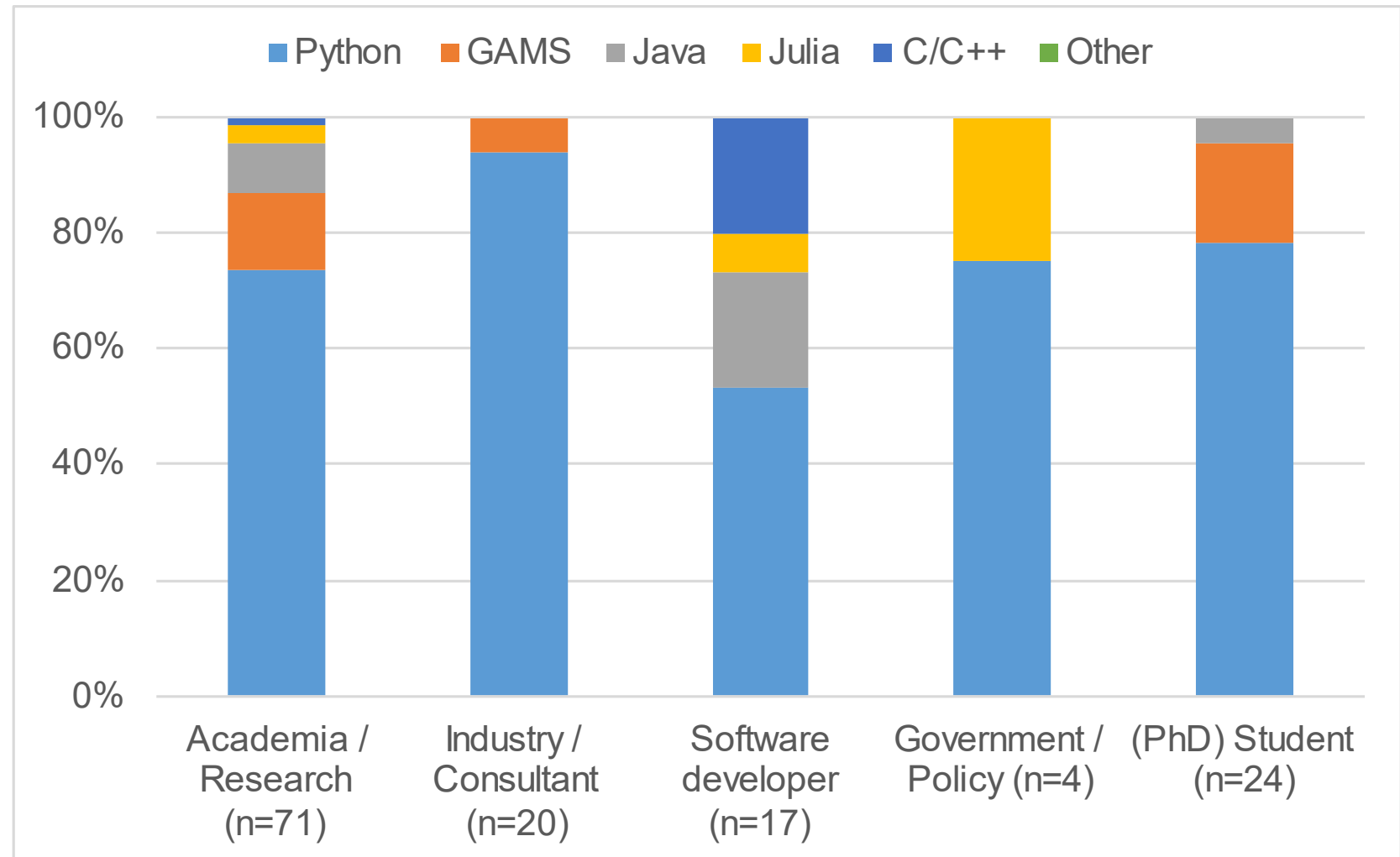
What is your *PRIMARY* programming language for modelling energy systems?



By far most used
Python

Honourable mentions
GAMS, Java

Most deviant group
Software developers



Modelling Languages

How many *years of experience* do you have in...?



Python

By far most experience,
4.5 years on average

MATLAB

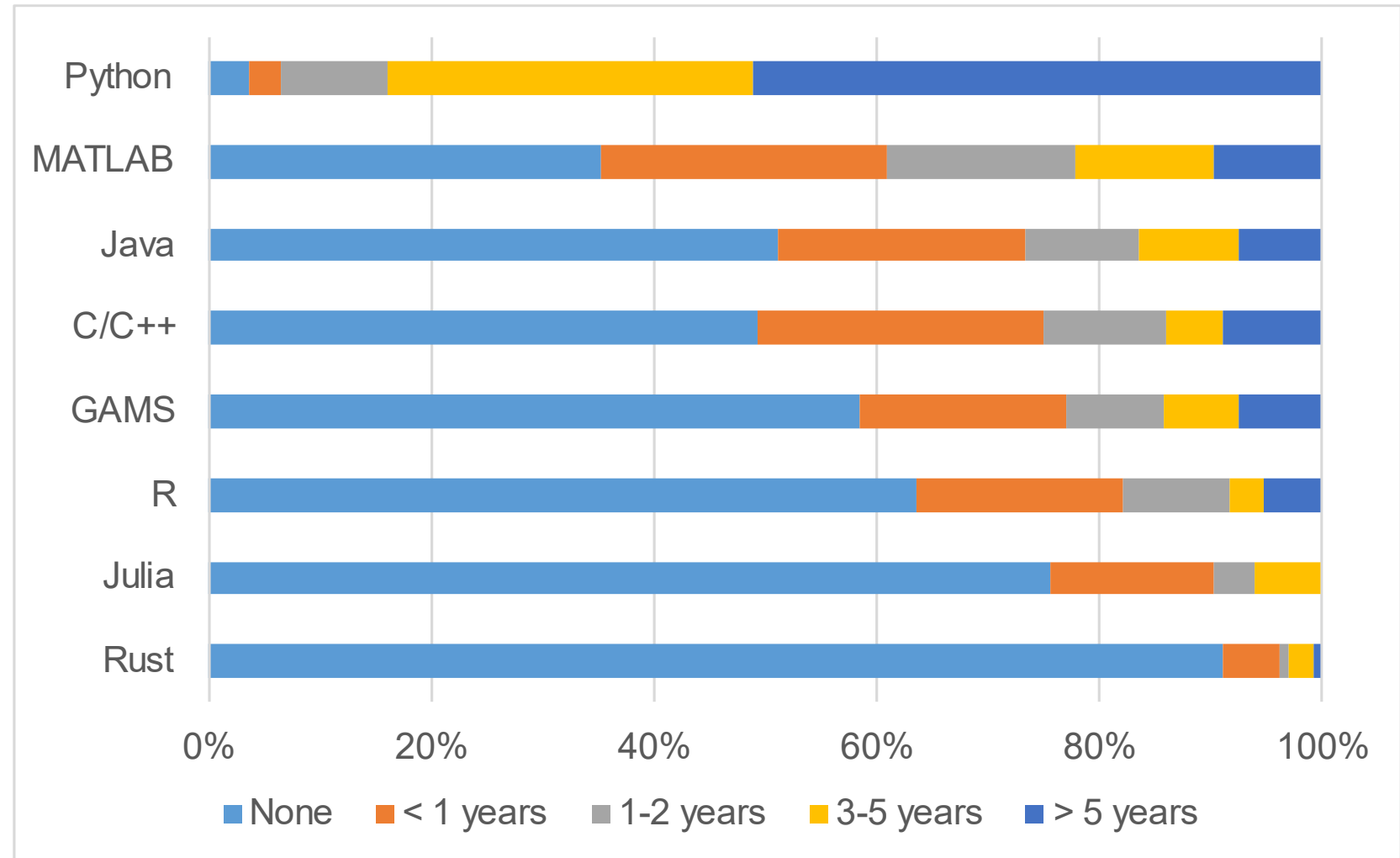
2nd place, 1.5 years on
average, *but rarely used*

Java, C/C++, GAMS

≈1 year on average

Julia, Rust

Very few respondents with
>1 year of experience



Cross Check

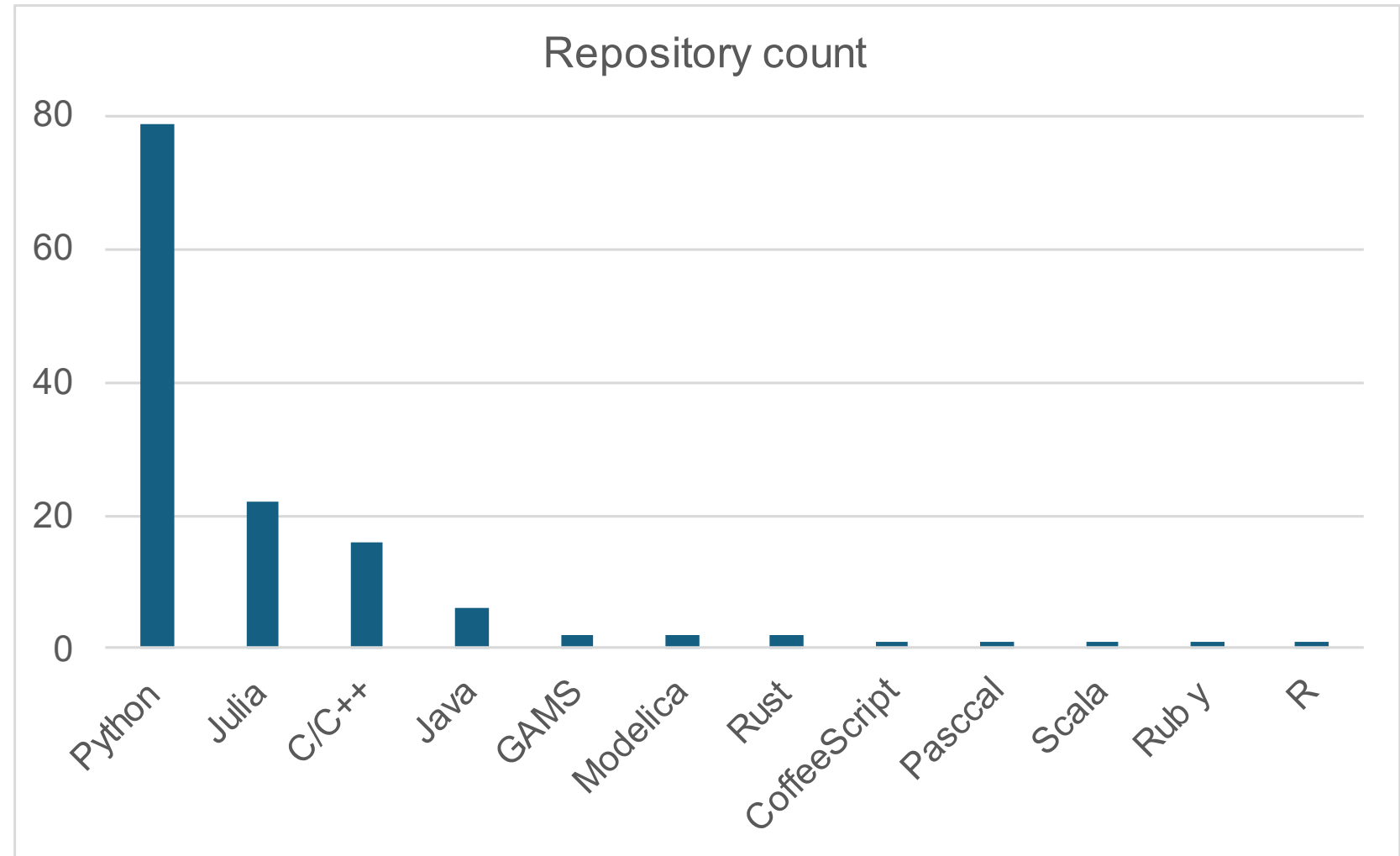
Does language popularity in survey match popularity of open repositories?



Repository main language

Python \approx 59%, Julia \approx 16%

C/C++ \approx 12%, Java \approx 4%



data from <https://openmod-tracker.org>

Cross Check

Does language popularity in survey match popularity of open repositories?

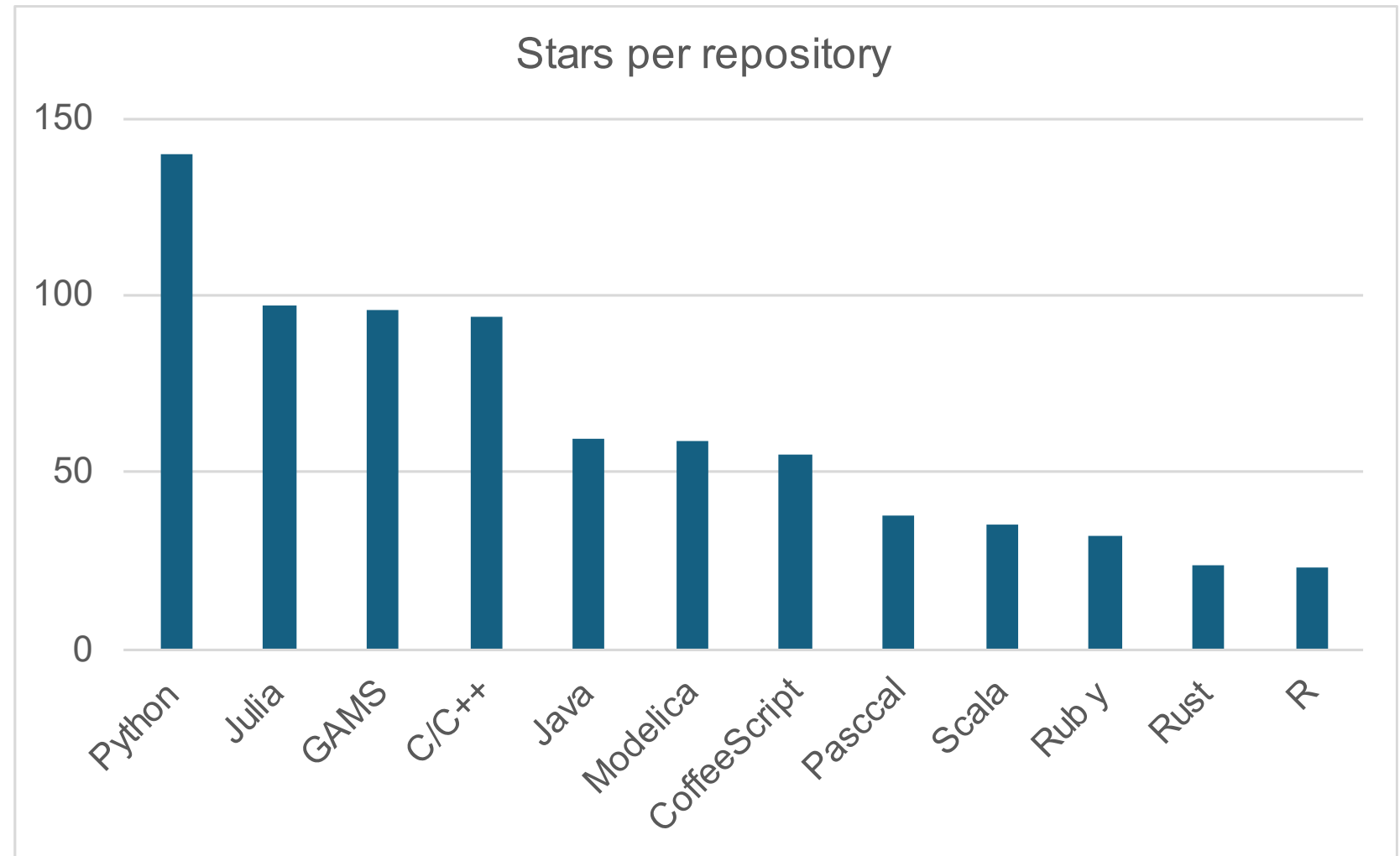


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Stars per repository

Python ahead
GAMS: few but valued



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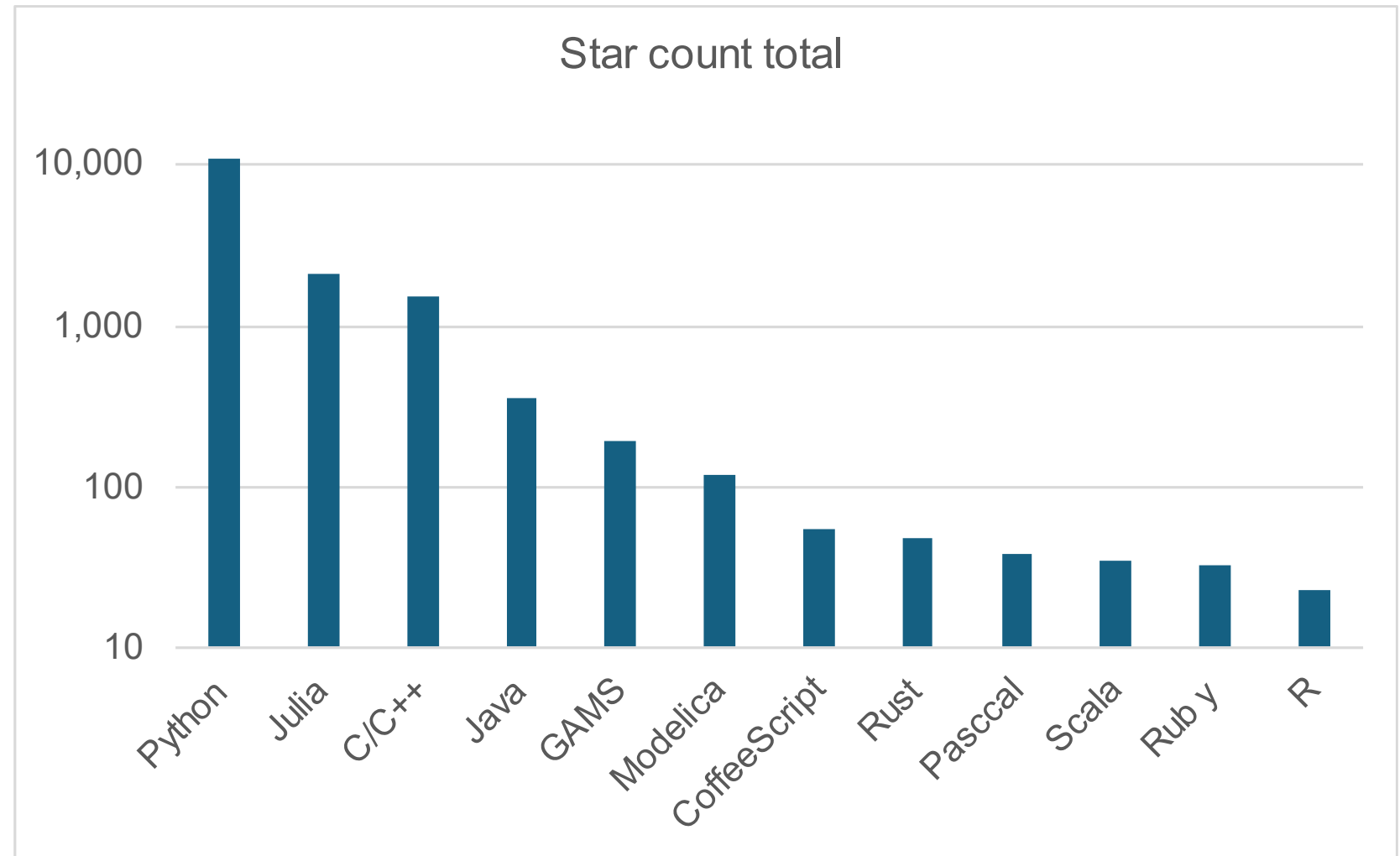
Stars per repository

Python ahead
GAMS: few but valued

Total star count

Behold: Logarithmic scale
71% of stars @ Python,
14% @ Julia, 10% @ C/C++

*Most-regarded Julia
repositories from USA*

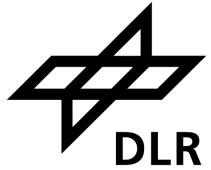


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Energy Models

Energy Models

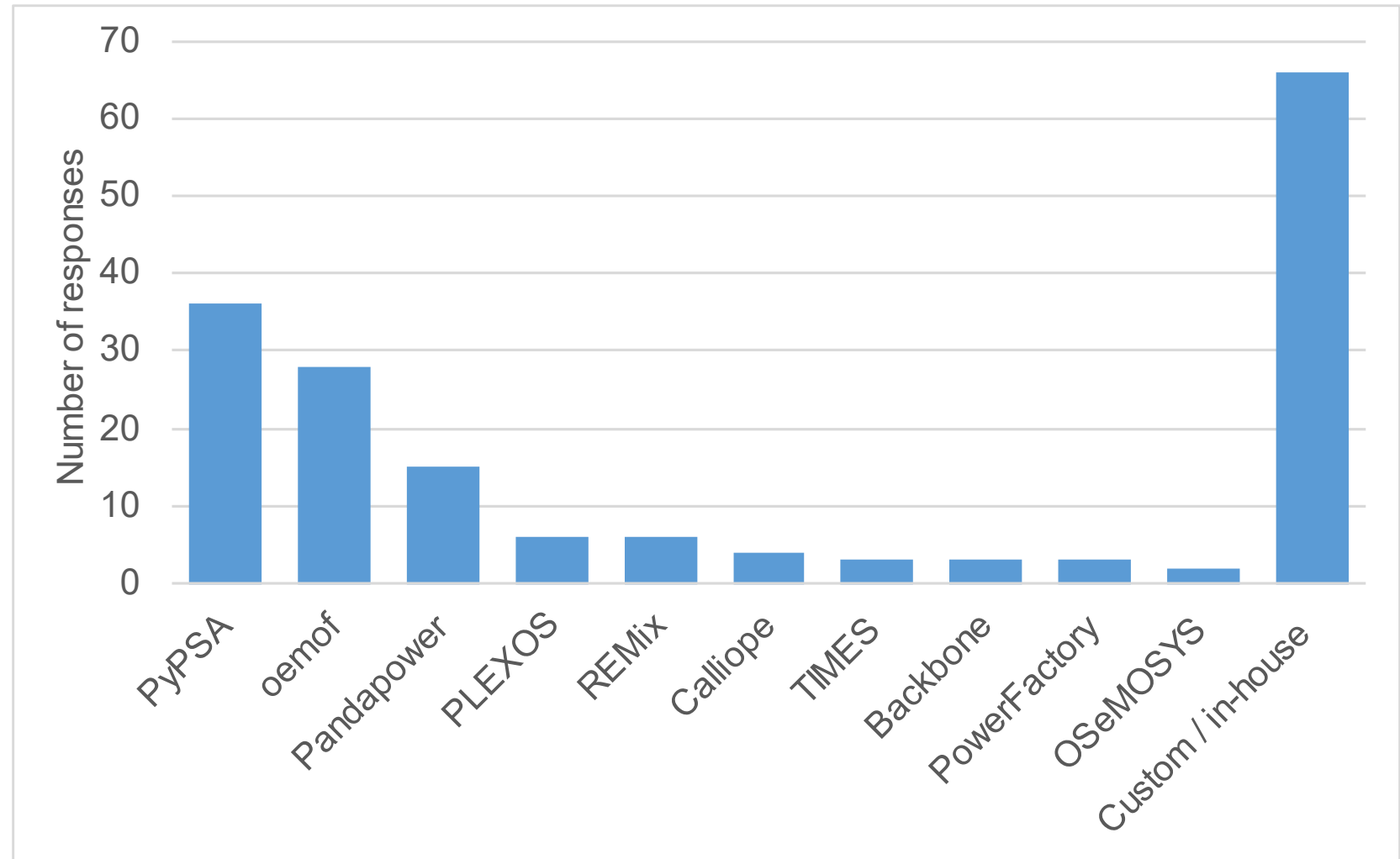
Which energy systems modelling *frameworks / tools* do you *currently use*?



Multiple choice + Free text

Most popular

PyPSA, oemof, Pandapower



Energy Models

Which energy systems modelling *frameworks / tools* do you currently use?



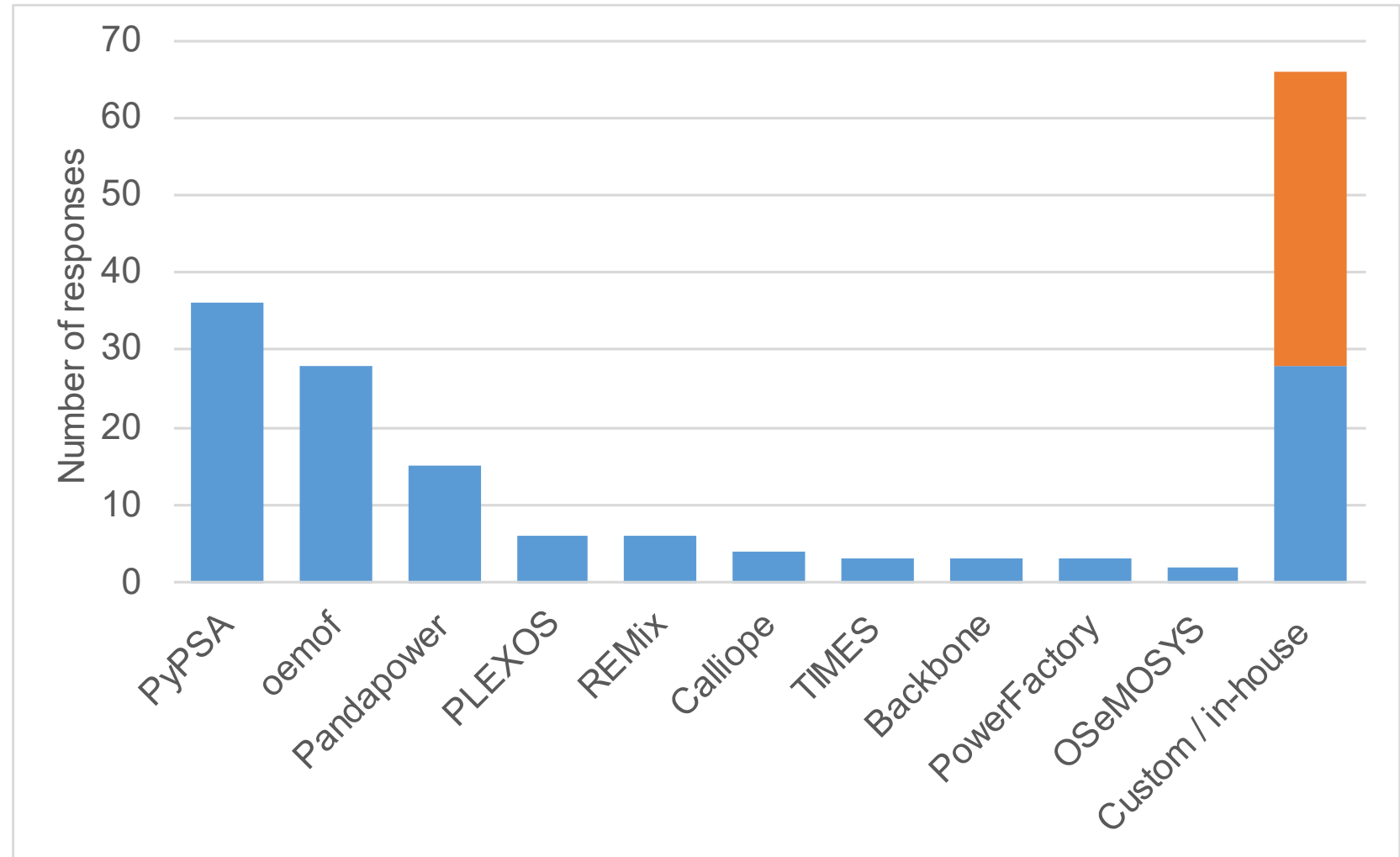
Multiple choice + Free text

Most popular

PyPSA, oemof, Pandapower

Custom / in-house

≈55% of those use in-house software only



Energy Models

Which energy systems modelling *frameworks / tools* do you *currently use*?



Multiple choice + Free text

Most popular

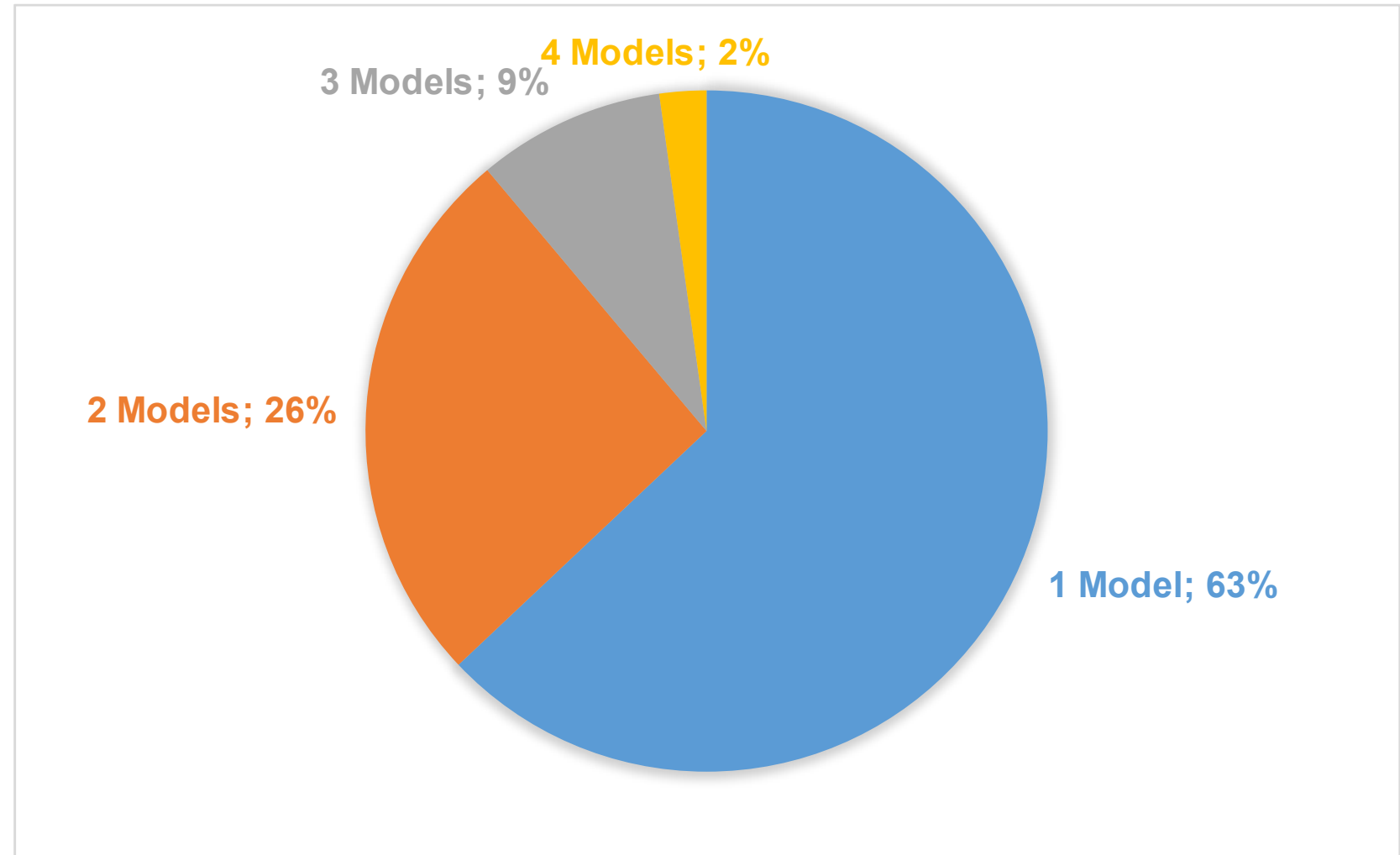
PyPSA, oemof, Pandapower

Custom / in-house

≈55% of those use in-house software only

Number of models

Majority uses 1-2 models



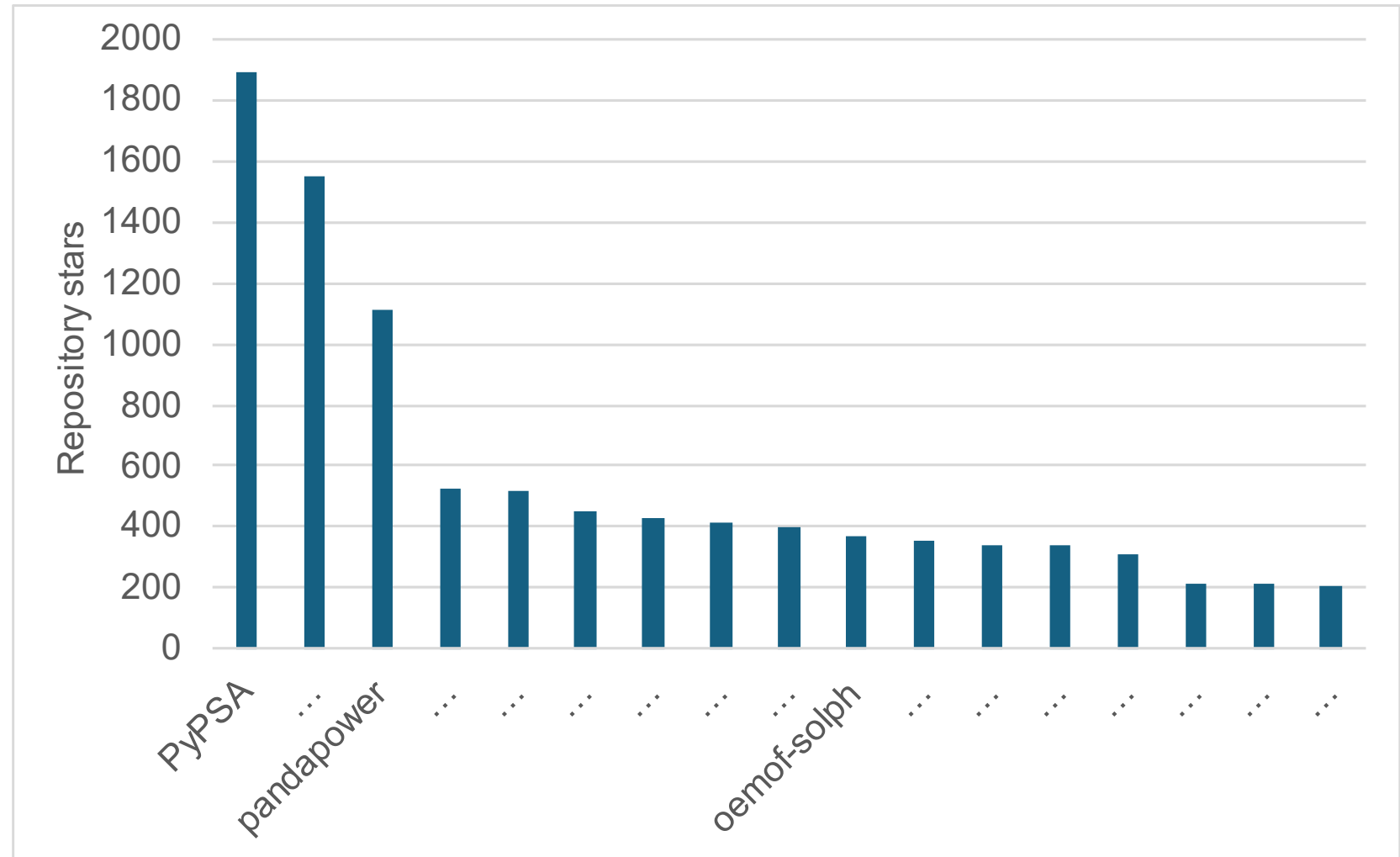
Model Popularity

Does model popularity in survey match repository stars of open models?



Popularity

Rough rank correspondence in rank only



data from <https://openmod-tracker.org>

Model Popularity

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Popularity

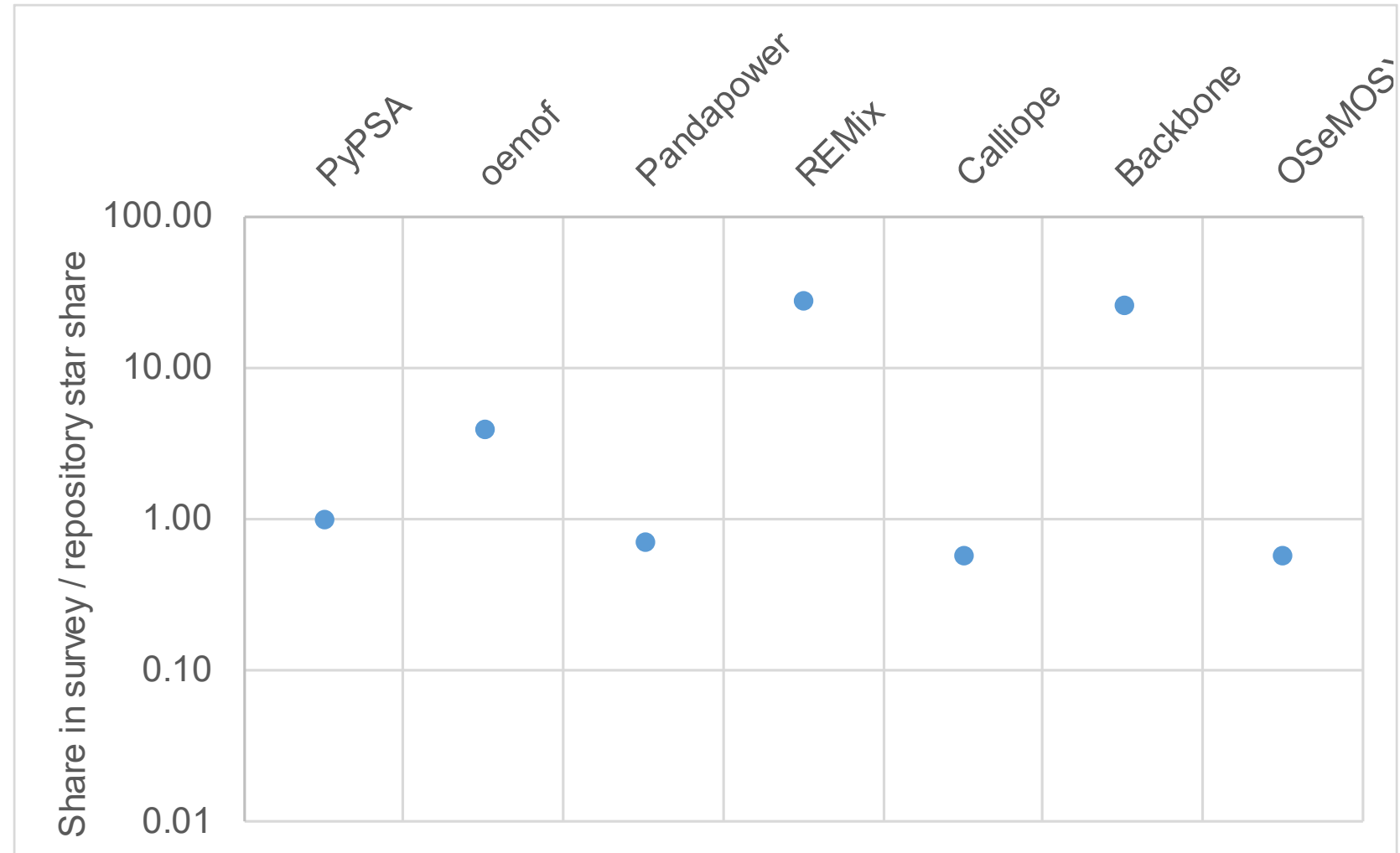
Rough rank correspondence in rank only

Major discrepancies

Between popularity of model in survey and repository stars

Probable causes

- Open ↔ closed models
- Germany ↔ international
- Non-representativeness



data from <https://openmod-tracker.org>

Energy Models

When *choosing a modelling tool*, how important is to you ... ?



Most important

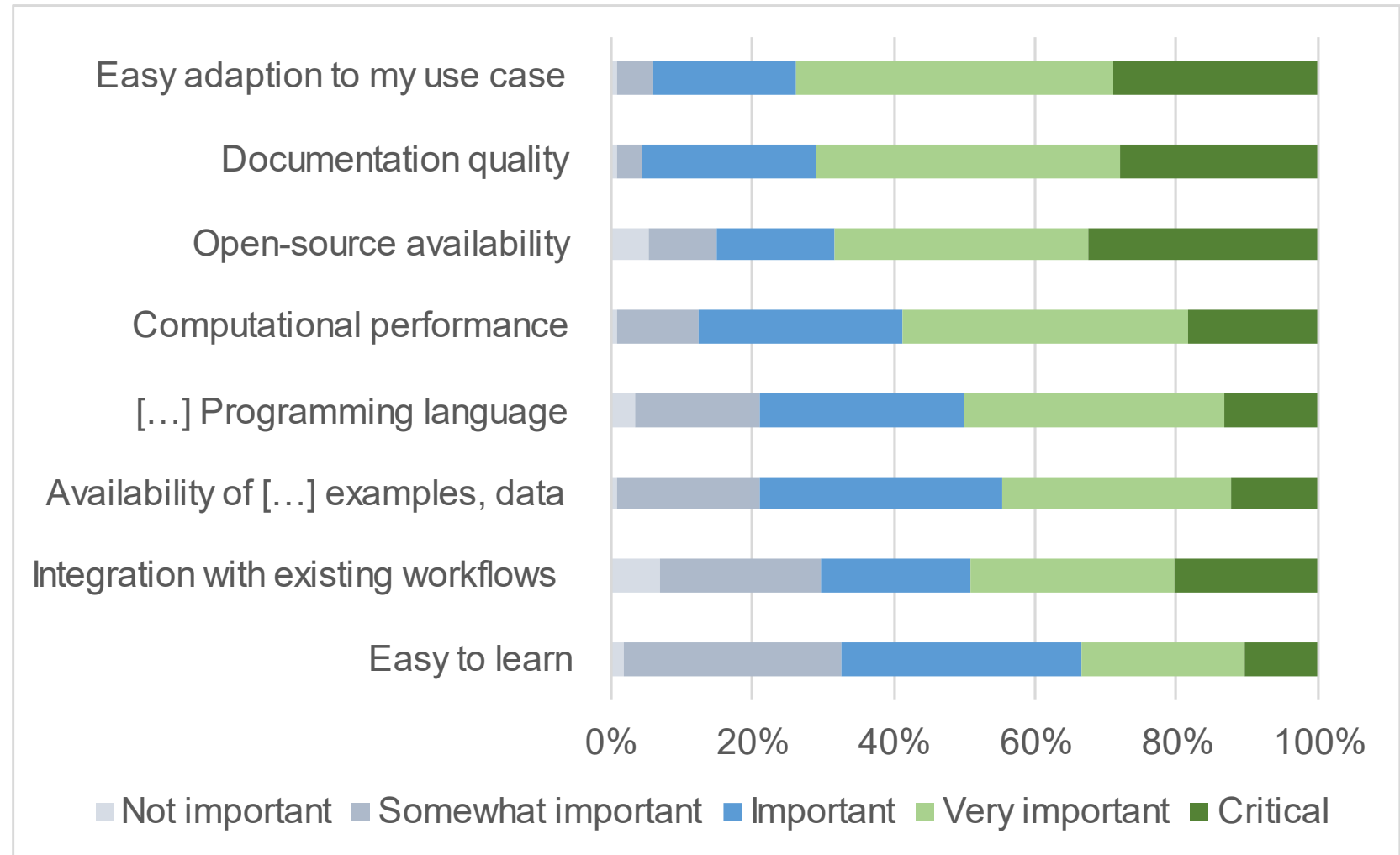
Own use case, documentation,
OS-availability

Least important

Interfaces to existing
workflows, ease of learning

Overall ratings similar

From best to worst < 1 level



Energy Models

What are the *three main barriers* you face when adopting a *new modelling tool*?



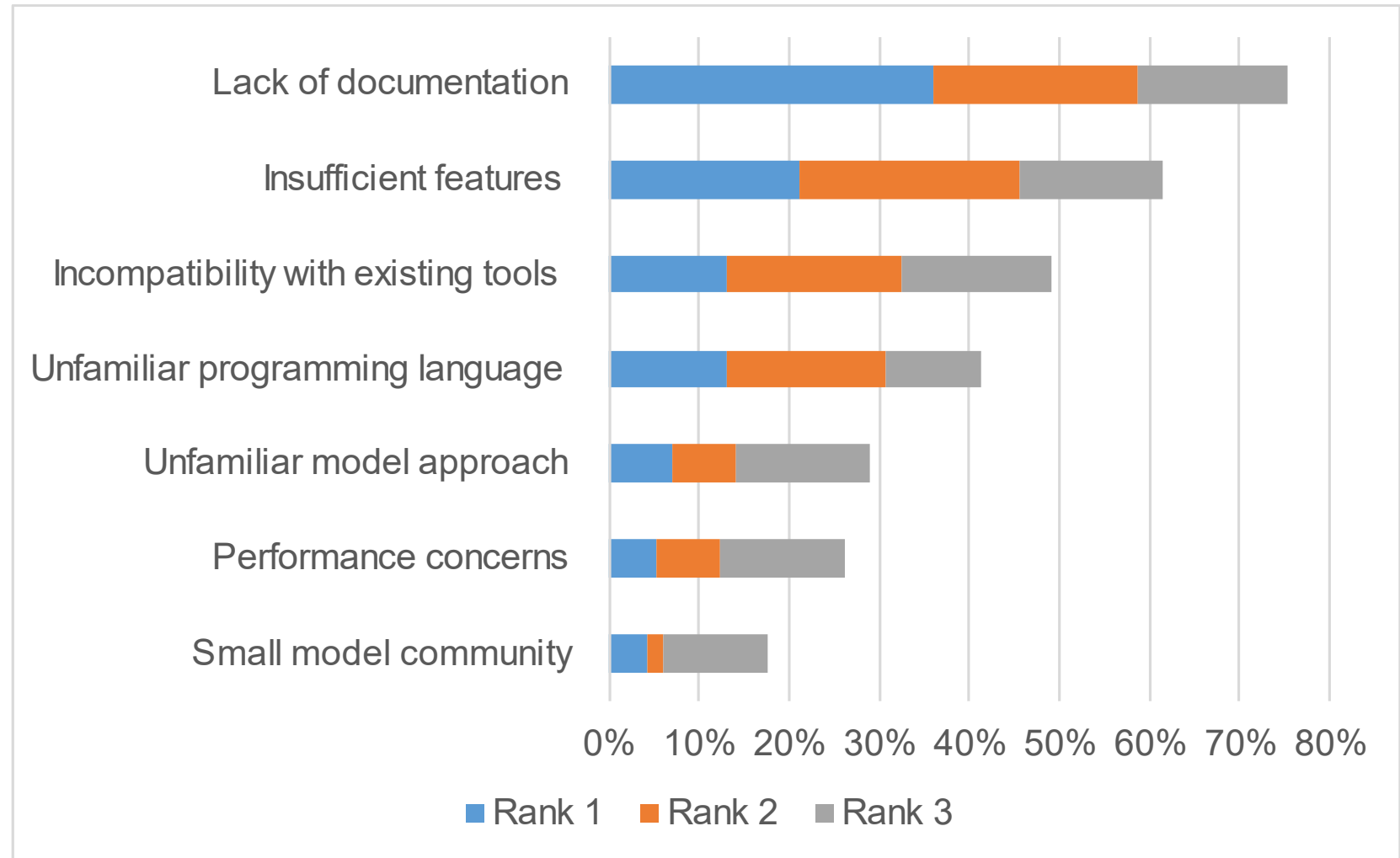
Rank 3 out of 7

Main barriers

Bad documentation, missing features

Minor barriers

Size of community, performance



The background of the slide is a photograph of a solar farm. Numerous large, rectangular solar panels are mounted on metal poles in a grassy field. The panels are tilted at an angle and reflect the bright blue sky and white clouds. The perspective is from a low angle, looking across the rows of panels towards the horizon.

Software Development Practices

Software Development

Do you use the following *practices* in your modelling work?



Version control

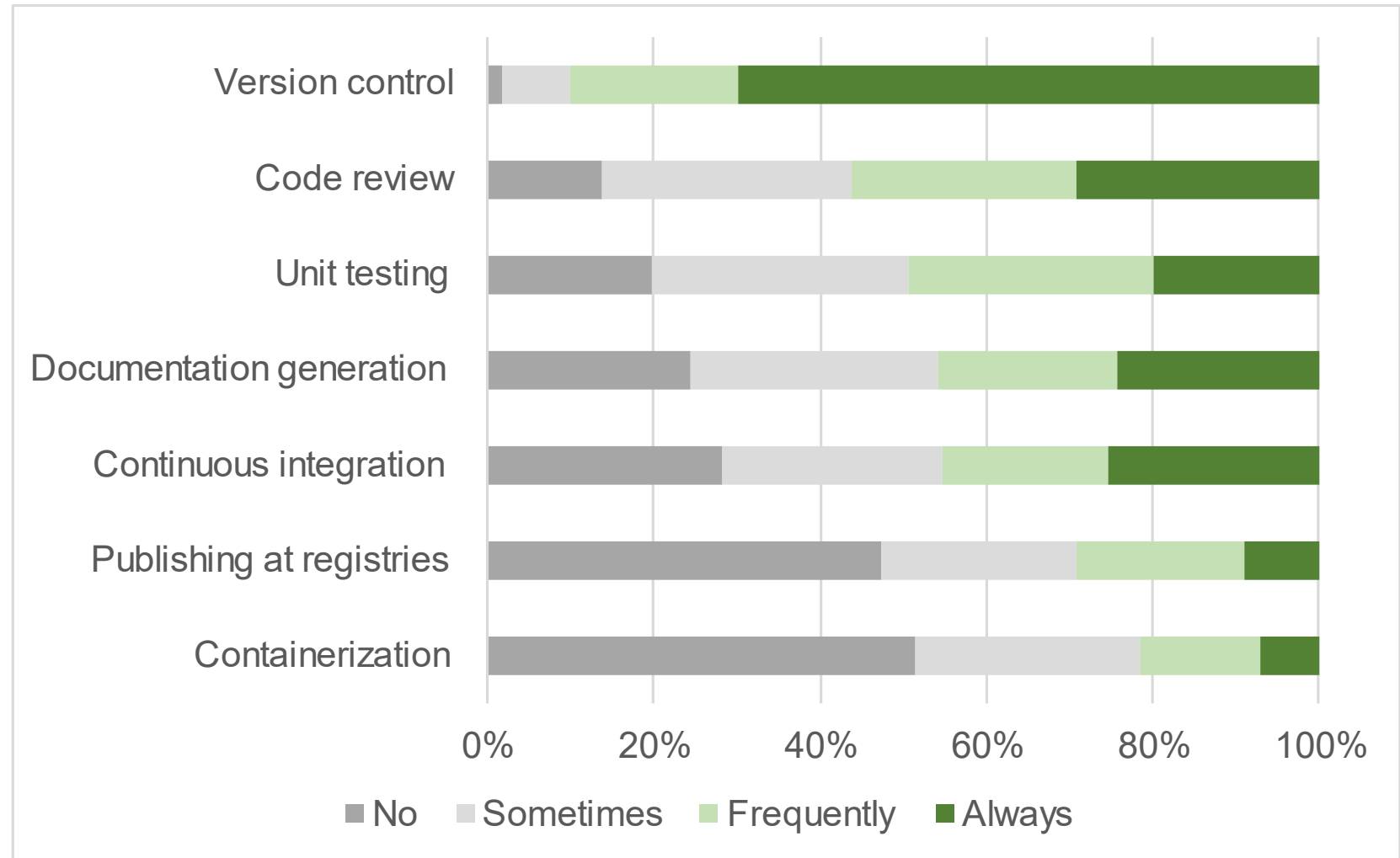
Frequently or always used by 90% of respondents

Frequent use

by \approx 50% of respondents:
Core reviews, unit testing,
documentation generators, CI

Rather uncommon

Publishing at registries,
containerization



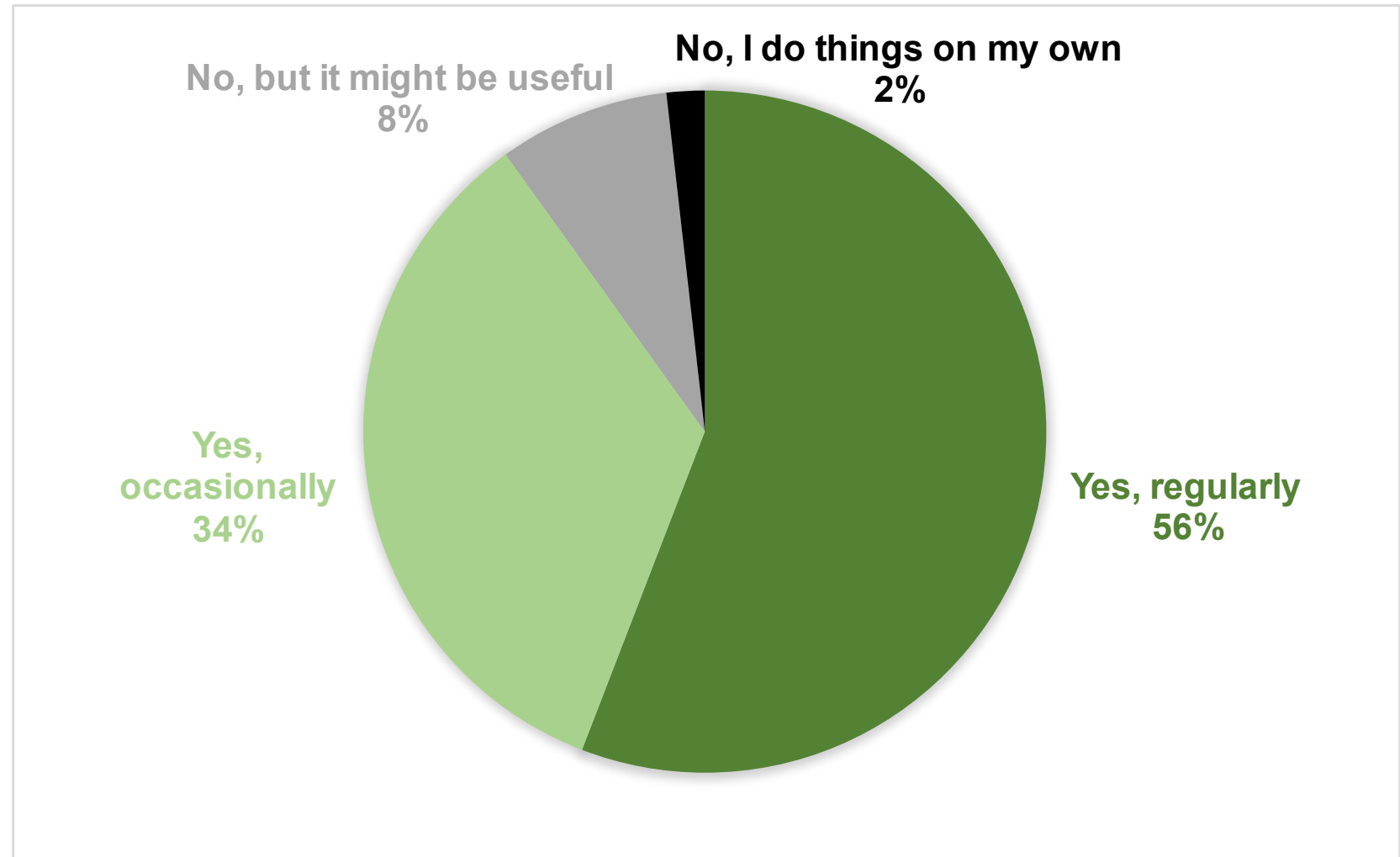
Software Development

Do you *collaborate* with others for coding / scripting?



Collaboration

90% collaborate on coding, at least occasionally



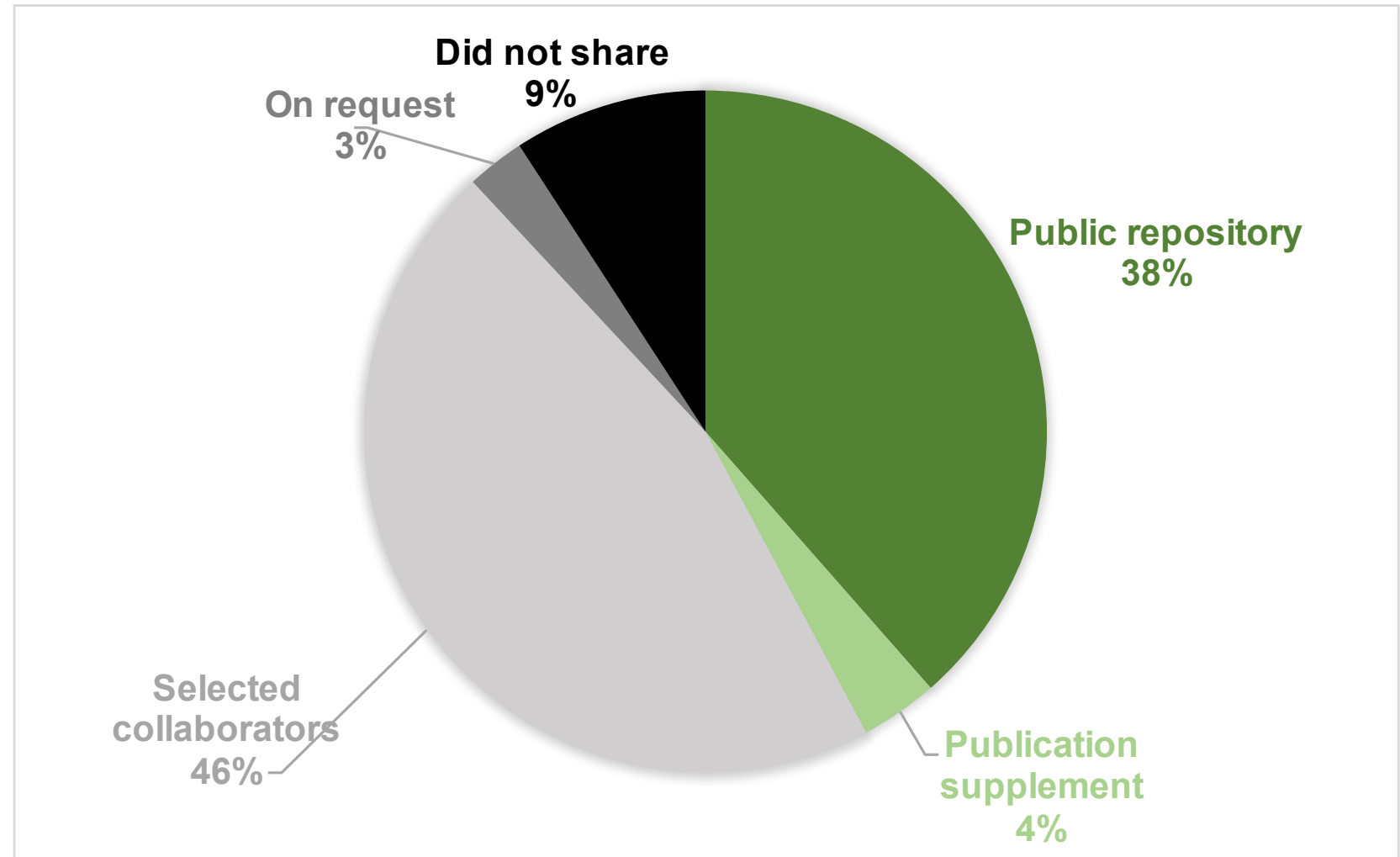
Software Development

How do you typically *share* your models / code?



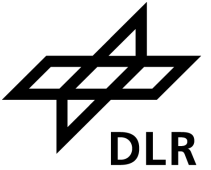
But sharing typically
with a selected group only

In case of public access
Mostly repositories



Conclusions

Conclusions



- Python is **the** most used language in the energy domain
 - across all types of users
 - average experience level Python >> other language
- Most respondents actively use one (to two) models and programming languages
- Applicability & documentation quality are most valued on choosing / switching tools
- Most software development practices not consistently used (except version control)
- Most modellers collaborate on coding – but primarily with selected partners

Non-representativeness of participants

- Spatial bias: Central-Europe, esp. Germany
- Academia focused, other groups may be under-represented

Missing

- Control questions
- Impact of AI on software development & domain modelling

Topic	Insights on Modelling Practices and Tool Preferences - Results of a Public Survey in the Energy Domain
Date	2026-03-25
Authors	Christoph Schimeczek, Felix Nitsch, Daniel Zapf
Contact	Christoph.Schimeczek@dlr.de
Institute	Institute of Networked Energy Systems German Aerospace Center (DLR)
License	DLR (CC BY 4.0), except DLR Logo, title image, and chapter images © DLR

Appendix

Energy Models

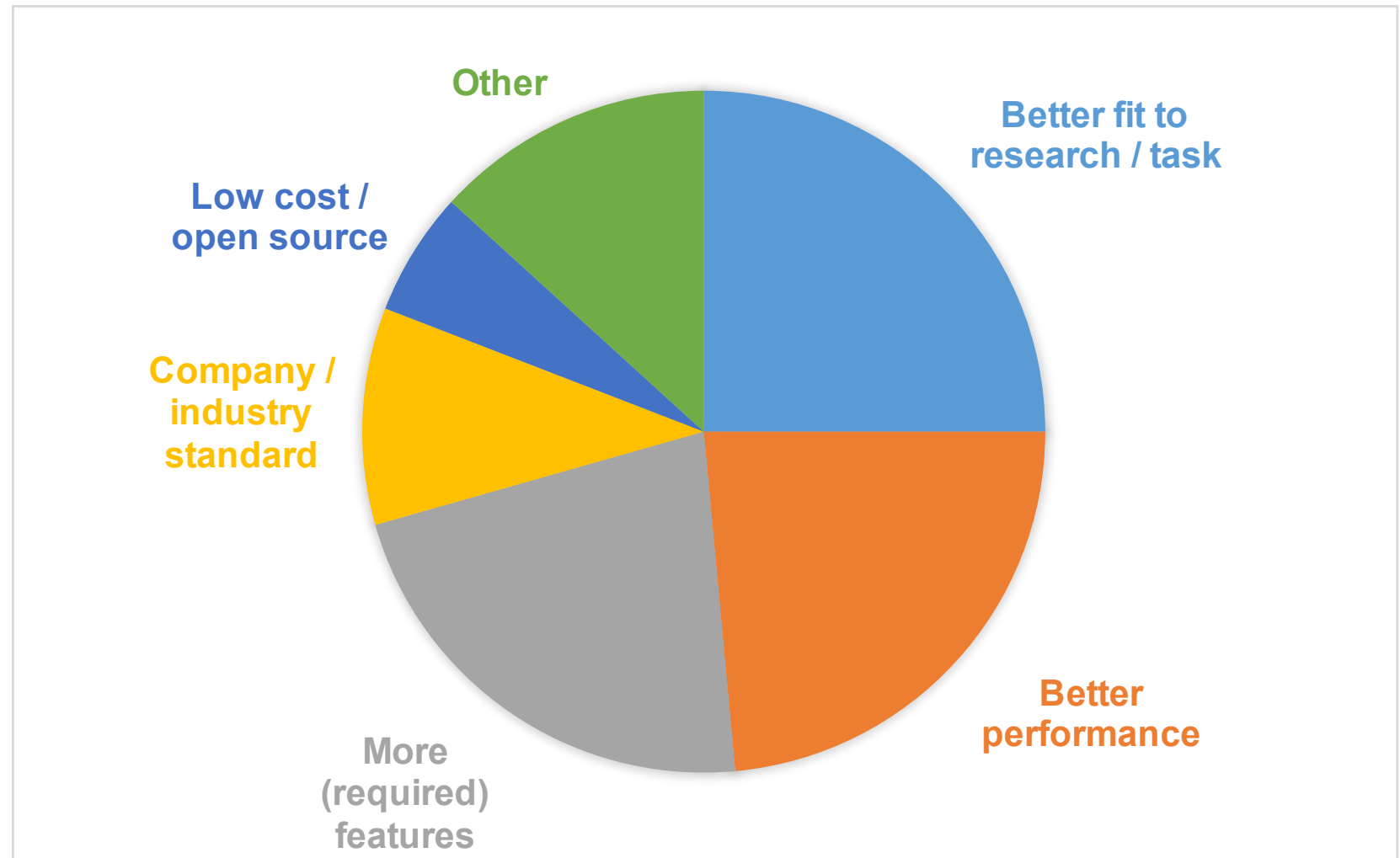
What would make you *switch* from your current modelling tool *to a new one*?



Free text, concepts extracted

Main reasons

Better fit to task,
better performance



Energy Models

What would make you *switch* from your current modelling tool *to a new one*?



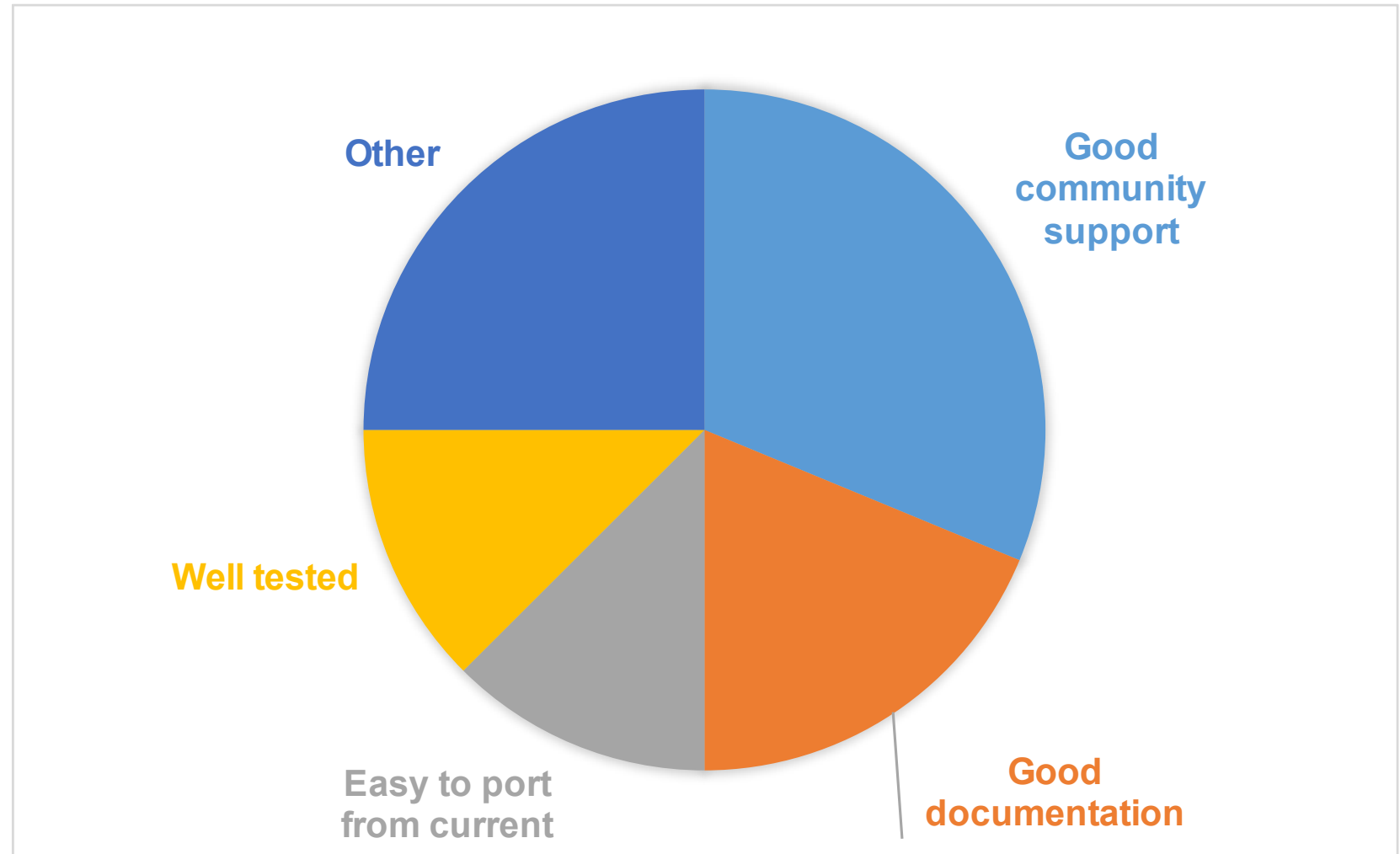
Free text, concepts extracted

Main reasons

Better fit to task,
better performance

But also requirements

Good support,
good documentation

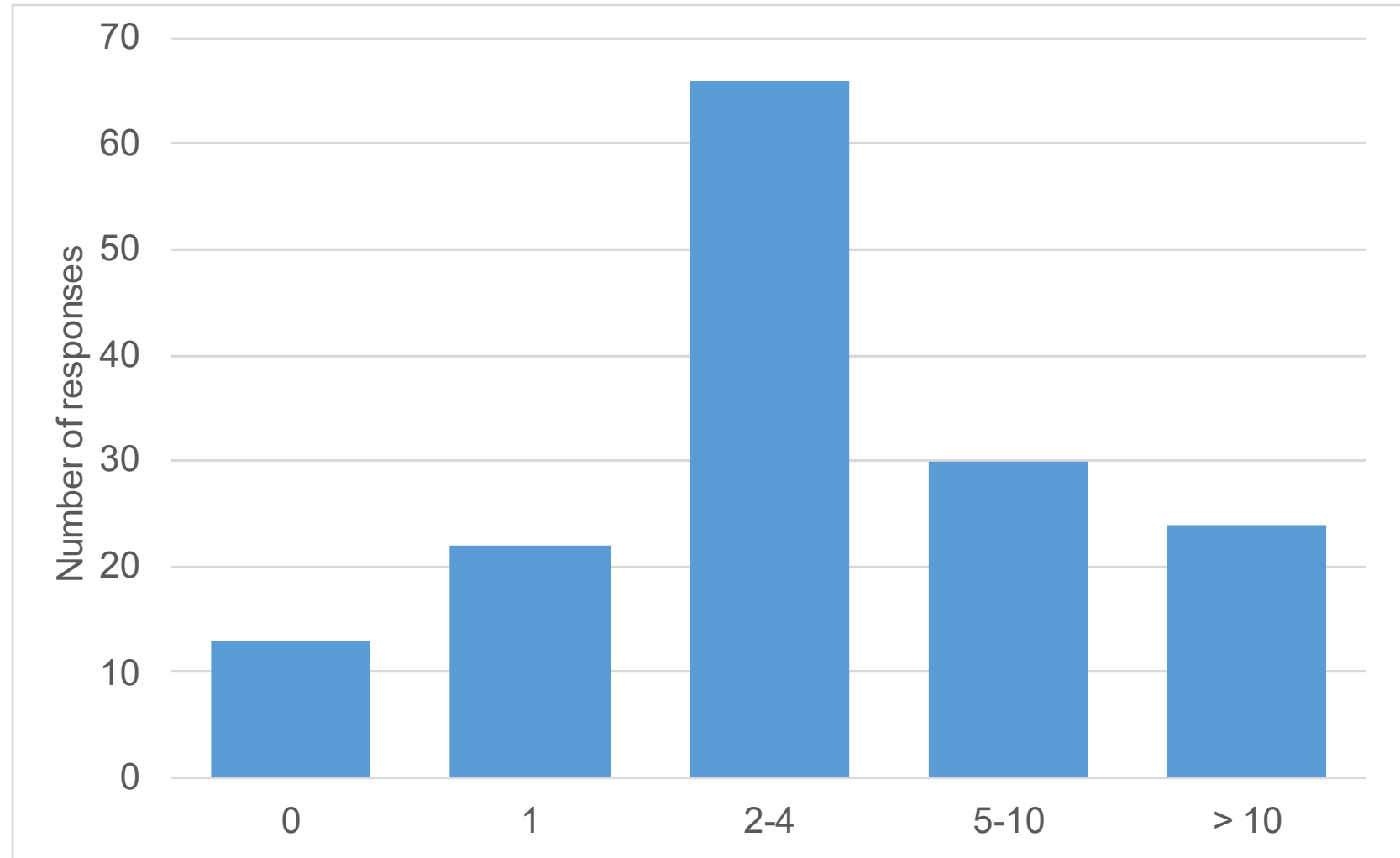


Software Development

How many applications, models, or repositories in the energy systems domain have you contributed code to?

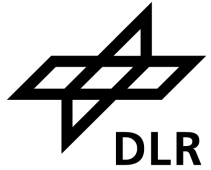


Most participants
contributed to 1+ tools



Software Development

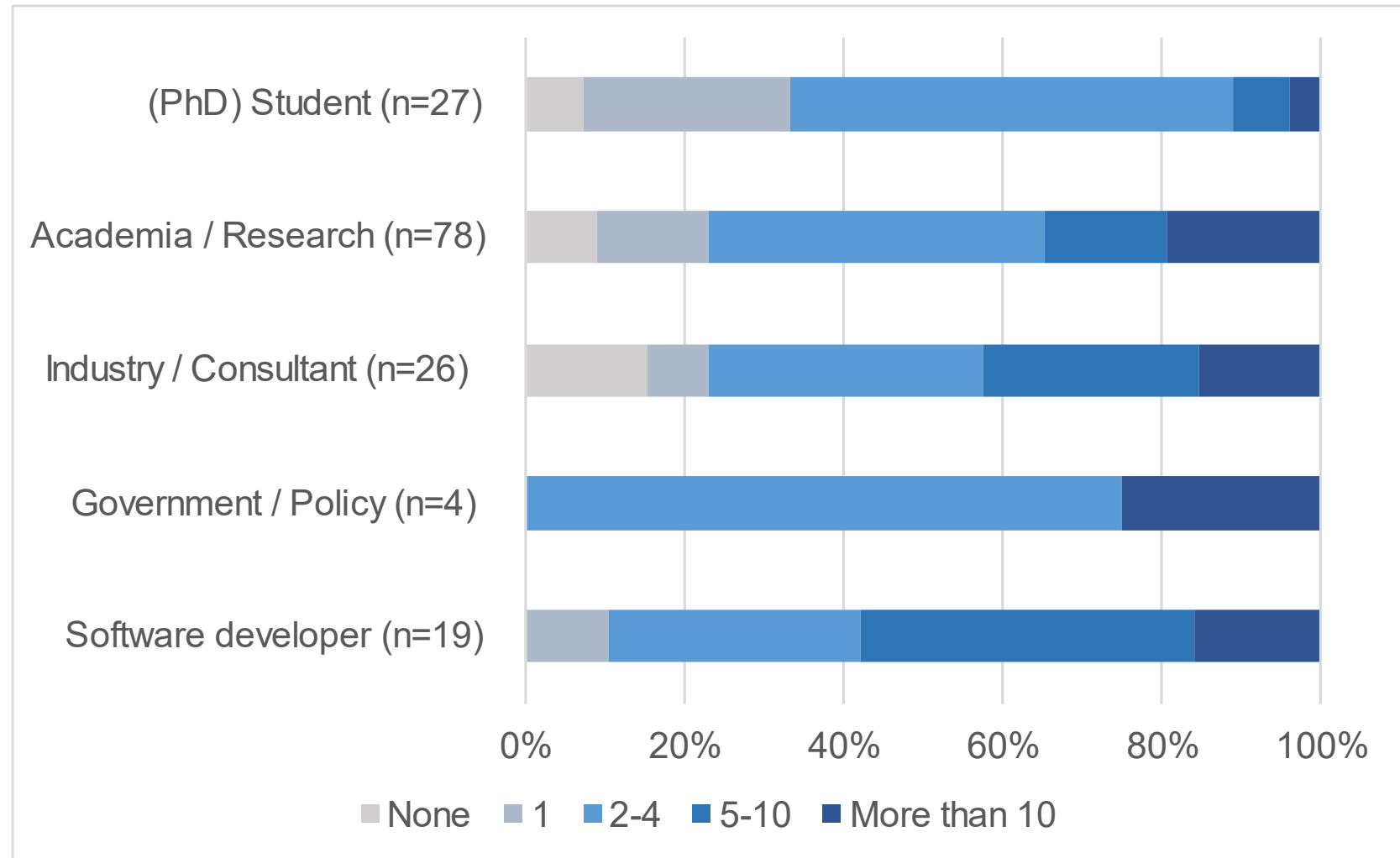
How many applications, models, or repositories in the energy systems domain have you contributed code to?



Most participants
contributed to 1+ tools

Least contributions
Students (average < 3)

Most contributions
Software devs (average > 5)

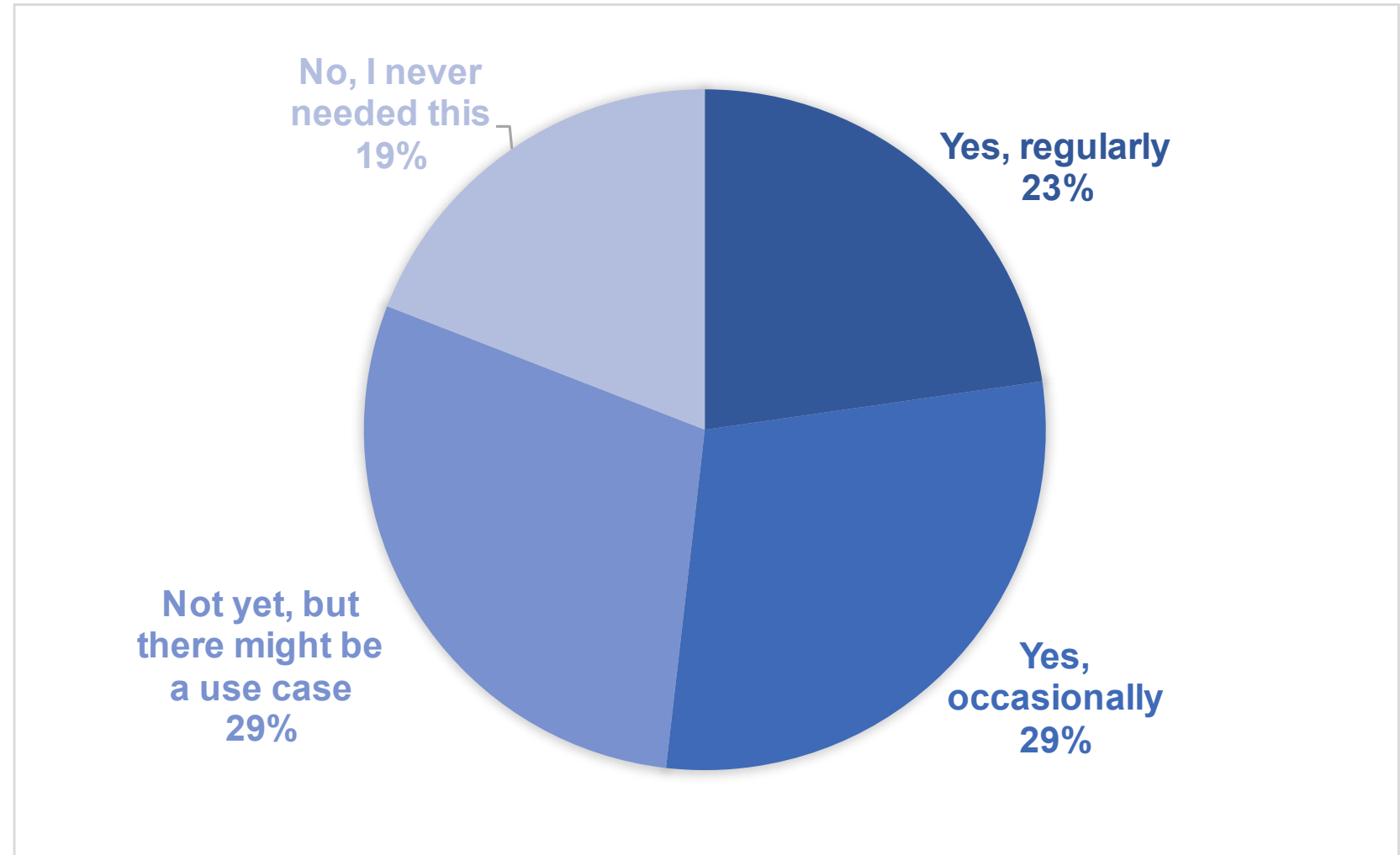


Model Interoperation

Do you *combine models / scripts* that use *different programming languages*?



Model interoperation
≈ 50% of respondents
experienced it



Model Interoperation

If you ever combined models / scripts [...], which languages were involved?

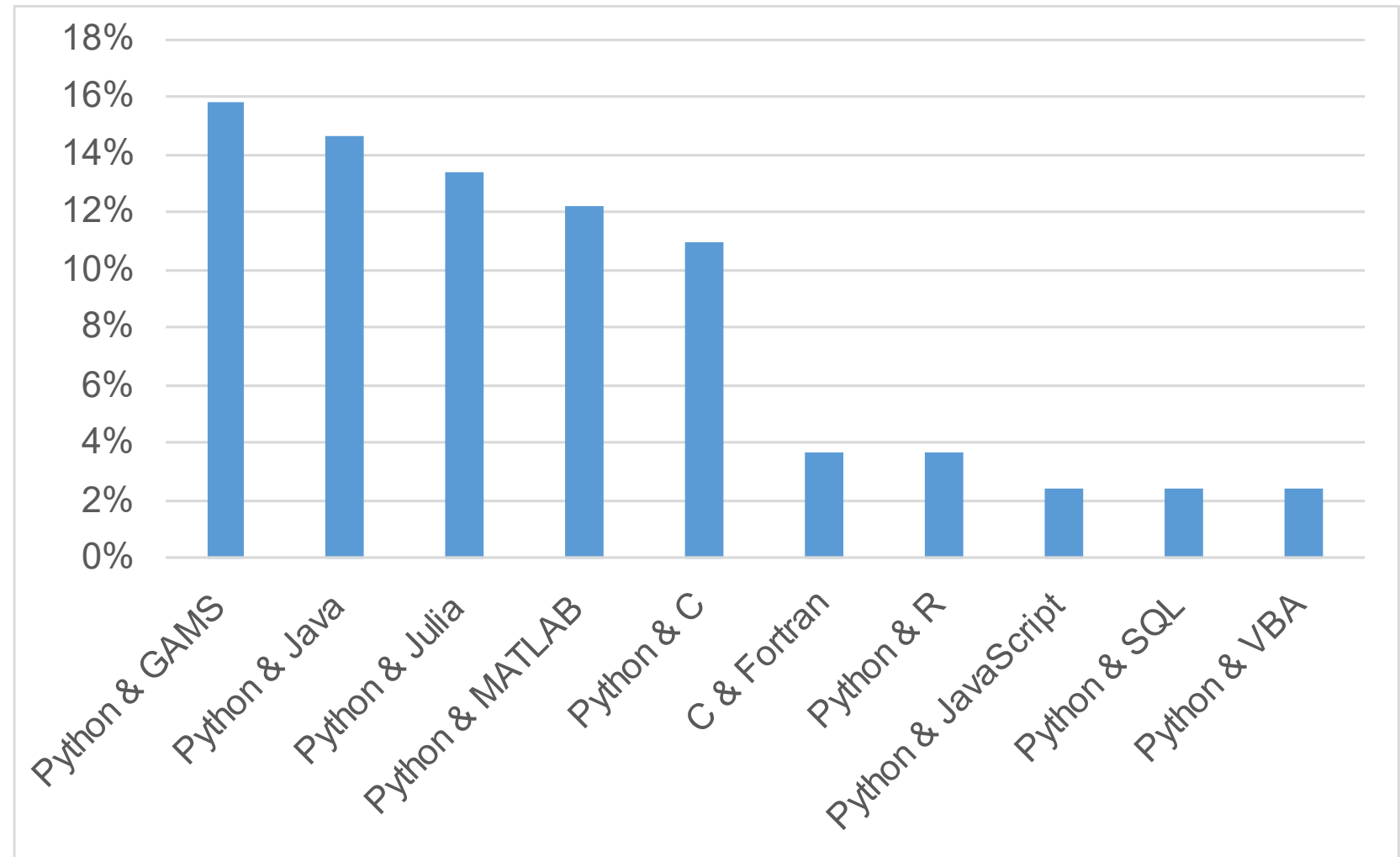


Python

Involved in $\approx 85\%$ of model / script couplings

Combinations

Mostly with either optimisation tools (GAMS, Julia) or more performant languages (Julia, Java, C)



Model Interoperation

If you ever combined models / scripts [...], which languages were involved?



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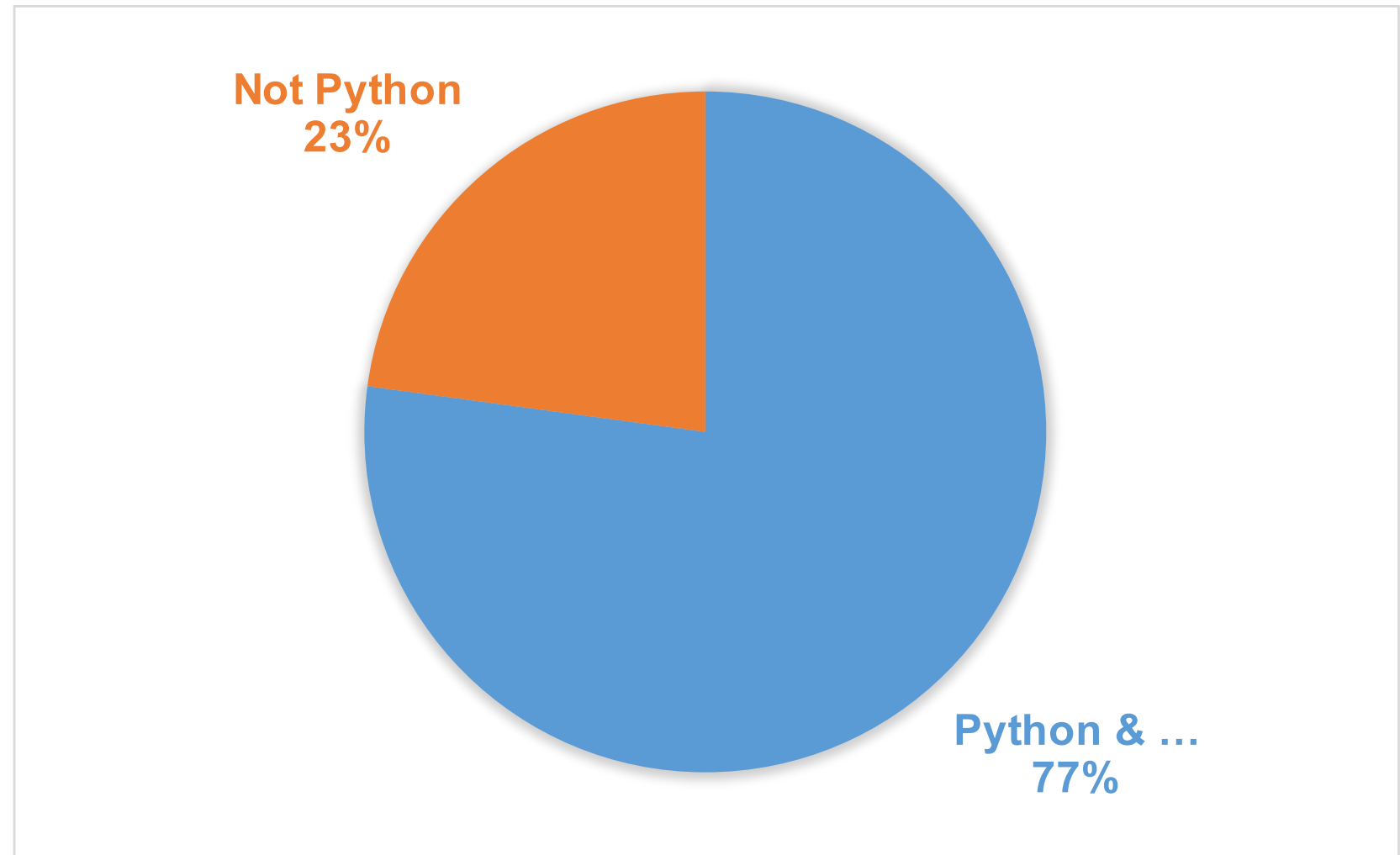
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Second language

Python also dominant for interoperation when not primary language



Model Interoperation

What approaches have you used for language interfacing?



Methods of interoperation
Mostly file-based

