



Update on ARPA-E ALPHA Program

Will Regan, ARPA-E Fellow
Program Director: Patrick McGrath

Fusion Power Associates
35th Annual Meeting and Symposium
Washington, DC
December 17, 2014

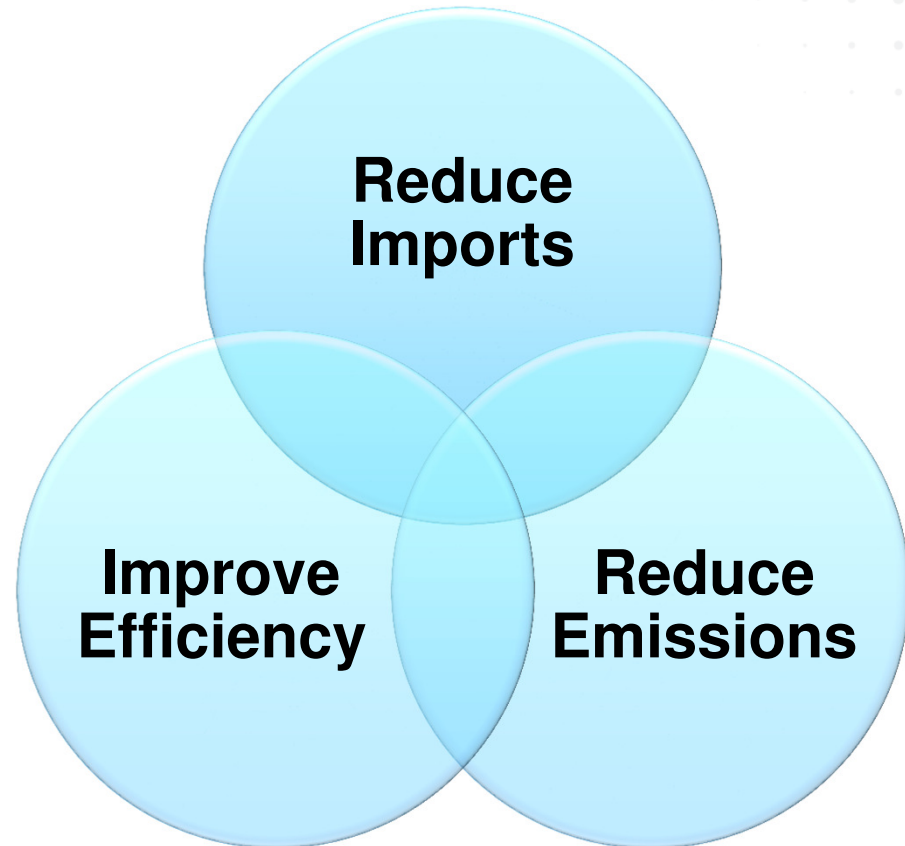


ARPA-E's mission

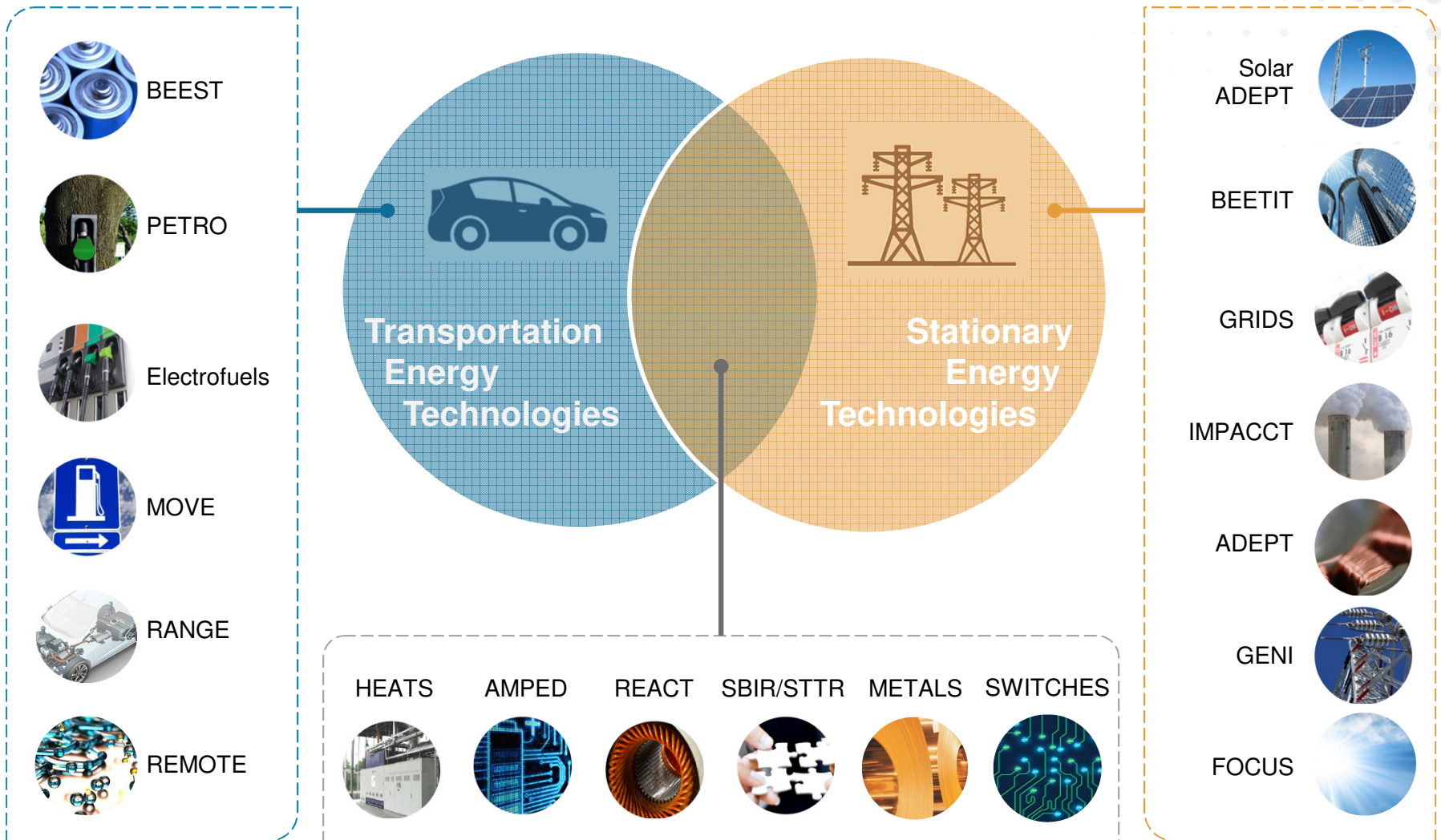
Catalyze and support the development of transformational, high-impact energy technologies

Ensure America's

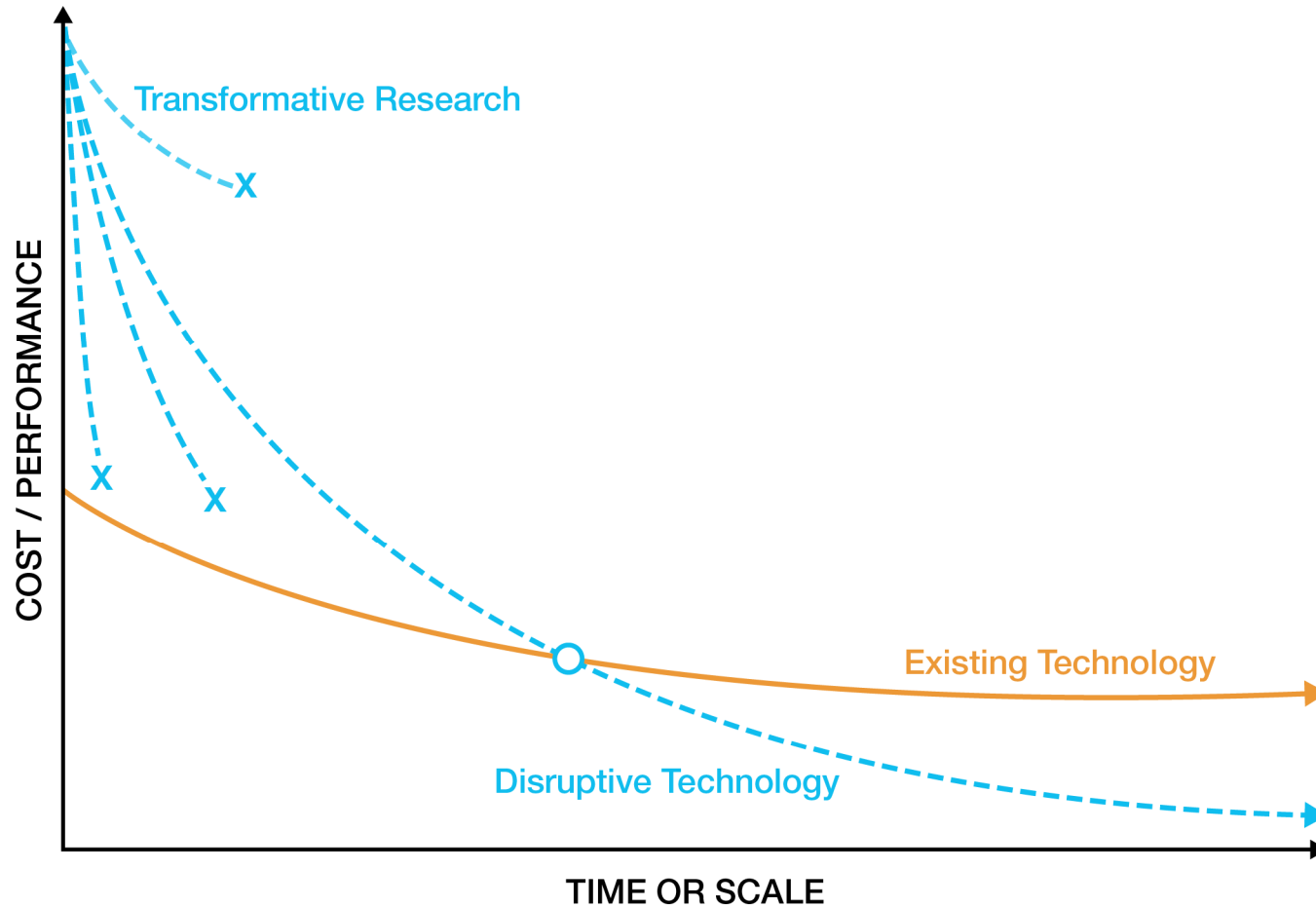
- National security
- Economic security
- Energy security
- Technological lead



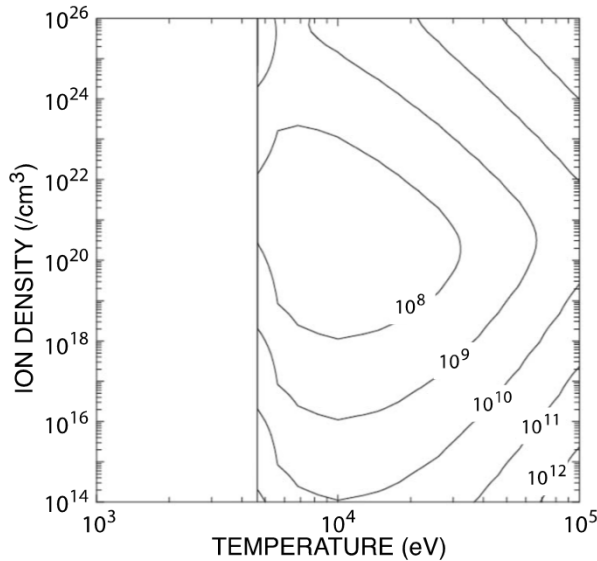
Focused programs



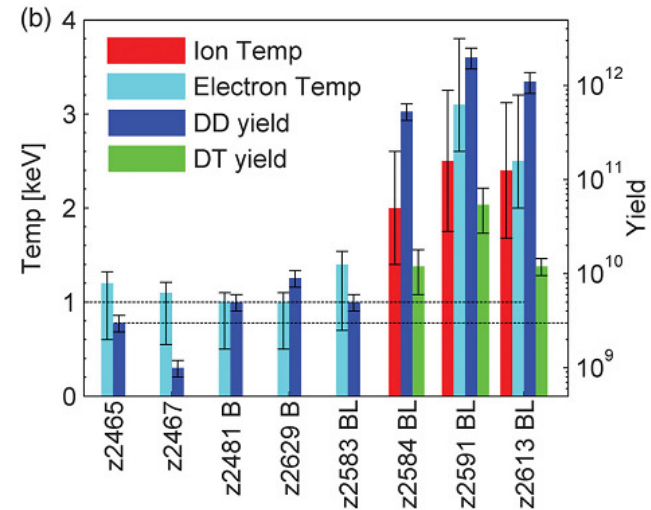
Creating new learning curves



Why intermediate density fusion?



Minimum fusion facility cost vs. n and T
Lindemuth and Siemon, *Am. J. Phys.* 2009





Temperature and yield from MagLIF shots
Gomez et al, *PRL* 2014

- ▶ Recent analyses suggest a potential sweet spot between MCF and ICF
- ▶ Recent promising work lends support to some of the many possible paths
- ▶ Advances in codes, computation, diagnostics, pulsed power in past decade(s)
- ▶ Research tool development appears compatible with our funding/time constraints

ALPHA FOA released August 2014

FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

ADVANCED RESEARCH PROJECTS AGENCY – ENERGY (ARPA-E)
U.S. DEPARTMENT OF ENERGY

**ACCELERATING LOW-COST PLASMA HEATING AND ASSEMBLY
(ALPHA)**

Announcement Type: **Initial Announcement-Modification 01**
Funding Opportunity No. DE-FOA-0001184
CFDA Number 81.135

FOA Issue Date:	August 28, 2014
First Deadline for Questions to ARPA-E-CO@hq.doe.gov :	5 PM ET, October 7, 2014
Submission Deadline for Concept Papers:	5 PM ET, October 14, 2014
Second Deadline for Questions to ARPA-E-CO@hq.doe.gov :	5 PM ET, TBD
Submission Deadline for Full Applications:	5 PM ET, TBD
Submission Deadline for Replies to Reviewer Comments:	5 PM ET, TBD
Expected Date for Selection Notifications:	TBD
Total Amount to Be Awarded	Approximately \$30 million, subject to the availability of appropriated funds.
Anticipated Awards	ARPA-E may issue one, multiple, or no awards under this FOA. Awards may vary between \$250,000 and \$10 million.

- For eligibility criteria, see Section III.A of the FOA.
- For cost share requirements under this FOA, see Section III.B of the FOA.
- To apply to this FOA, Applicants must register with and submit application materials through ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/Registration.aspx>). For detailed guidance on using ARPA-E eXCHANGE, see Section IV.H.1 of the FOA.
- Applicants are responsible for meeting each submission deadline. Applicants are strongly encouraged to submit their applications at least 48 hours in advance of the submission deadline.
- ARPA-E will not review or consider noncompliant or nonresponsive applications. For detailed guidance on compliance and responsiveness criteria, see Sections III.C.1 and III.C.2 of the FOA.

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A. Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

- ▶ Driver/target tools to enable rapid experimentation/learning and low cost development
 - high shot rate
 - low cost per shot

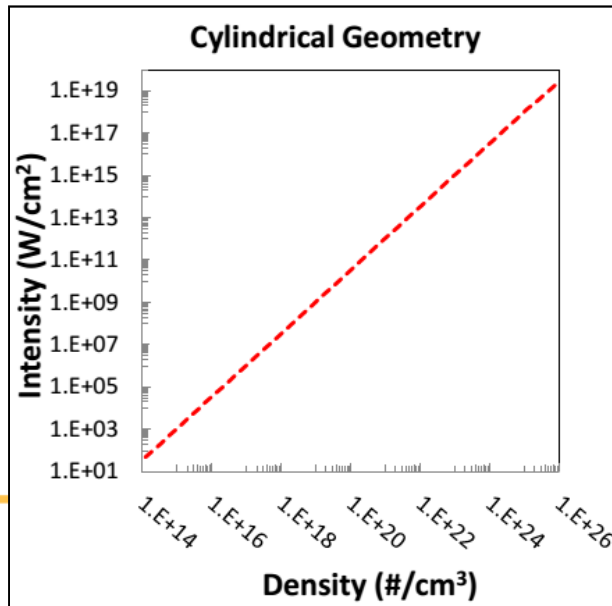
- ▶ Long-term envisioned goals:
 - 10^{18} - 10^{23} /cc at Lawson
 - $\eta_d G_d > 5$, rep rate ≥ 1 Hz
 - driver $< \$0.05/\text{MJ}$ (delivered)
 - target $< 0.05\text{¢}/\text{MJ}$ (fuel)

- ▶ ~\$30M, 3 years, ~12-15 awards

Metrics for prototype tools

Category 1: Drivers

Parameter	Requirement
η_d (driver efficiency, wall-plug to useful energy)	>20%
successful shots*	>100 shots
total shots in program	>500 shots
power or intensity	defined by applicant
precision, jitter, symmetry	defined by applicant



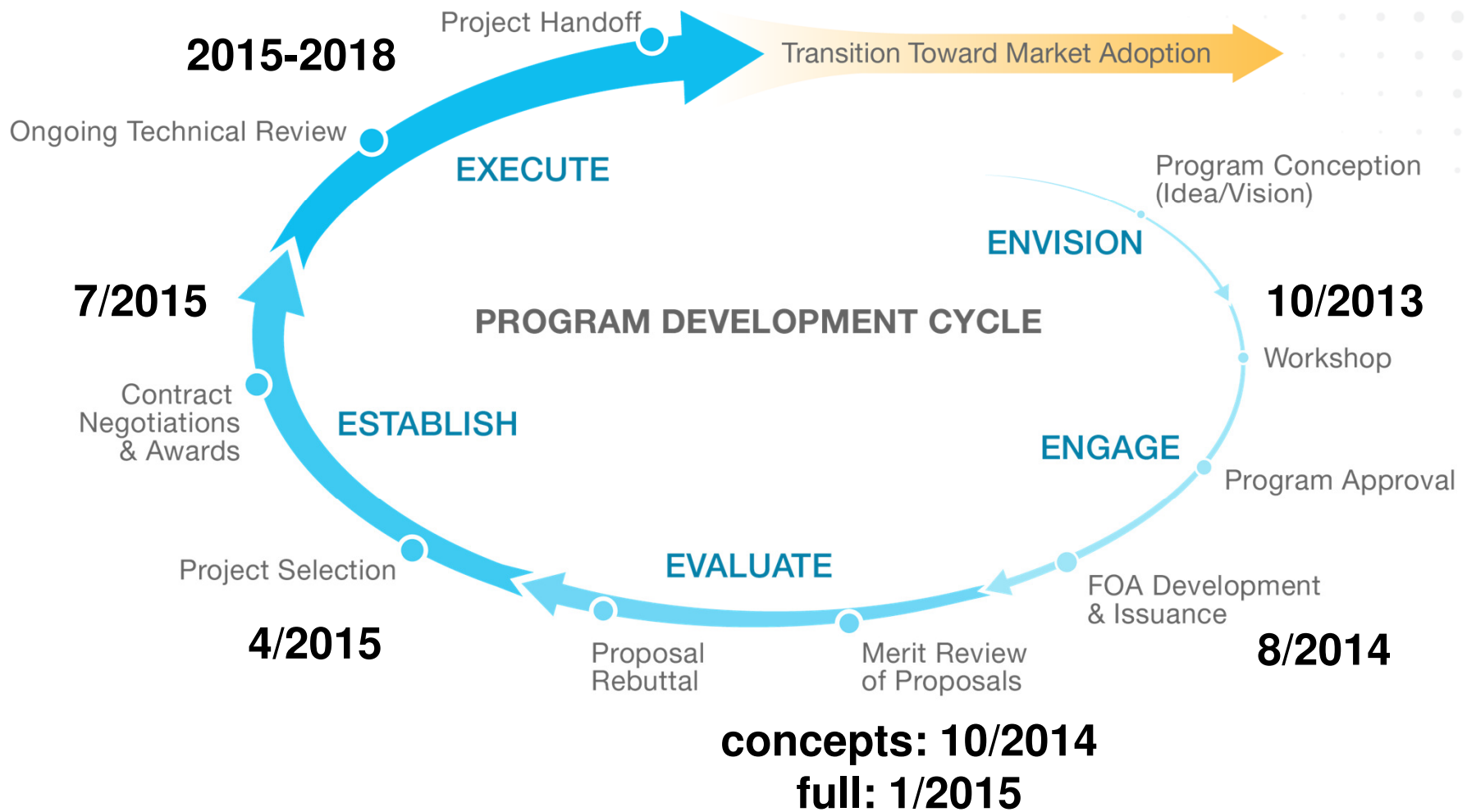
Minimum intensity for cylindrical (Fig 2b)

Category 2: Targets

Parameter	Requirement
successful shots	>50 shots
total shots in program (include development, testing, and demo)	>500 shots
plasma lifetime	$\max(\tau_{\text{Lawson}}, \tau_{\text{driver}}) < \min(\tau_{\text{thermal losses}}, \tau_{\text{lifetime}})$
plasma parameters	n, T, τ, r, B defined by applicant and measured within $\pm 20\%$ for each shot
modeling	codes defined by applicant

*A successful shot is one that meets all the required plasma parameters (within diagnostic error) to demonstrate and validate physics of tools for scale up and integration beyond the ARPA-E program.

ALPHA calendar





U.S. DEPARTMENT OF
ENERGY

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